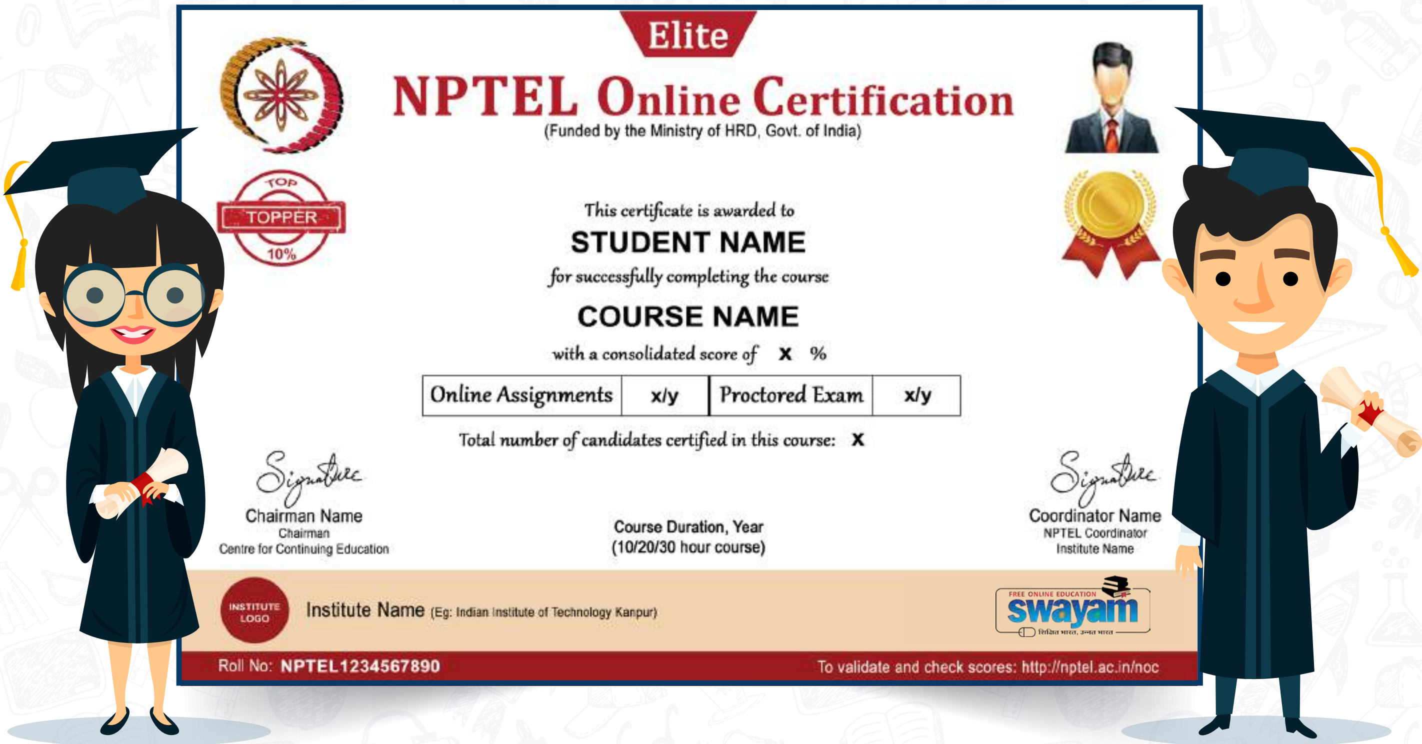
NPTEL

NATIONAL PROGRAMME ON TECHNOLOGY ENHANCED LEARNING

FREE ONLINE EDUCATION
swayam
शिक्षित भारत, उन्नत भारत

CERTIFICATES FROM THE
IITs & IISc
are just a click away



Jan - Apr 2019

IIT BOMBAY | IIT DELHI | IIT GUWAHATI | IIT KANPUR | IIT KHARAGPUR | IIT MADRAS | IIT ROORKEE | IISc BANGALORE

NPTEL IS OFFERING
ONLINE CERTIFICATION COURSES
https://onlinecourses.nptel.ac.in

FREE ONLINE EDUCATION
swayam
शिक्षित भारत, उन्नत भारत

290 COURSES ARE OPEN FOR ENROLLMENT

ABOUT NPTEL

National Programme on Technology Enhanced Learning (NPTEL) is a project of MHRD created to provide quality education to anyone interested in learning from the IITs. NPTEL was initiated by seven Indian Institutes of Technology (Bombay, Delhi, Kanpur, Kharagpur, Madras, Guwahati and Roorkee) along with the Indian Institute of Science, Bangalore in 2003. Five core disciplines were identified namely, Civil Engineering, Computer Science and Engineering, Electrical Engineering, Electronics and Communication Engineering and Mechanical Engineering. 290 courses in web/video format were developed in this phase.

The main goal of NPTEL Phase II (2009-14) was to build on the engineering and core science courses launched previously in NPTEL Phase I. An additional 600 web and video courses were created in all major branches of engineering, physical sciences at the undergraduate and postgraduate levels and management courses at the postgraduate level. Several improvements such as indexing of all video and web courses and keyword search were implemented.

NPTEL ONLINE CERTIFICATION

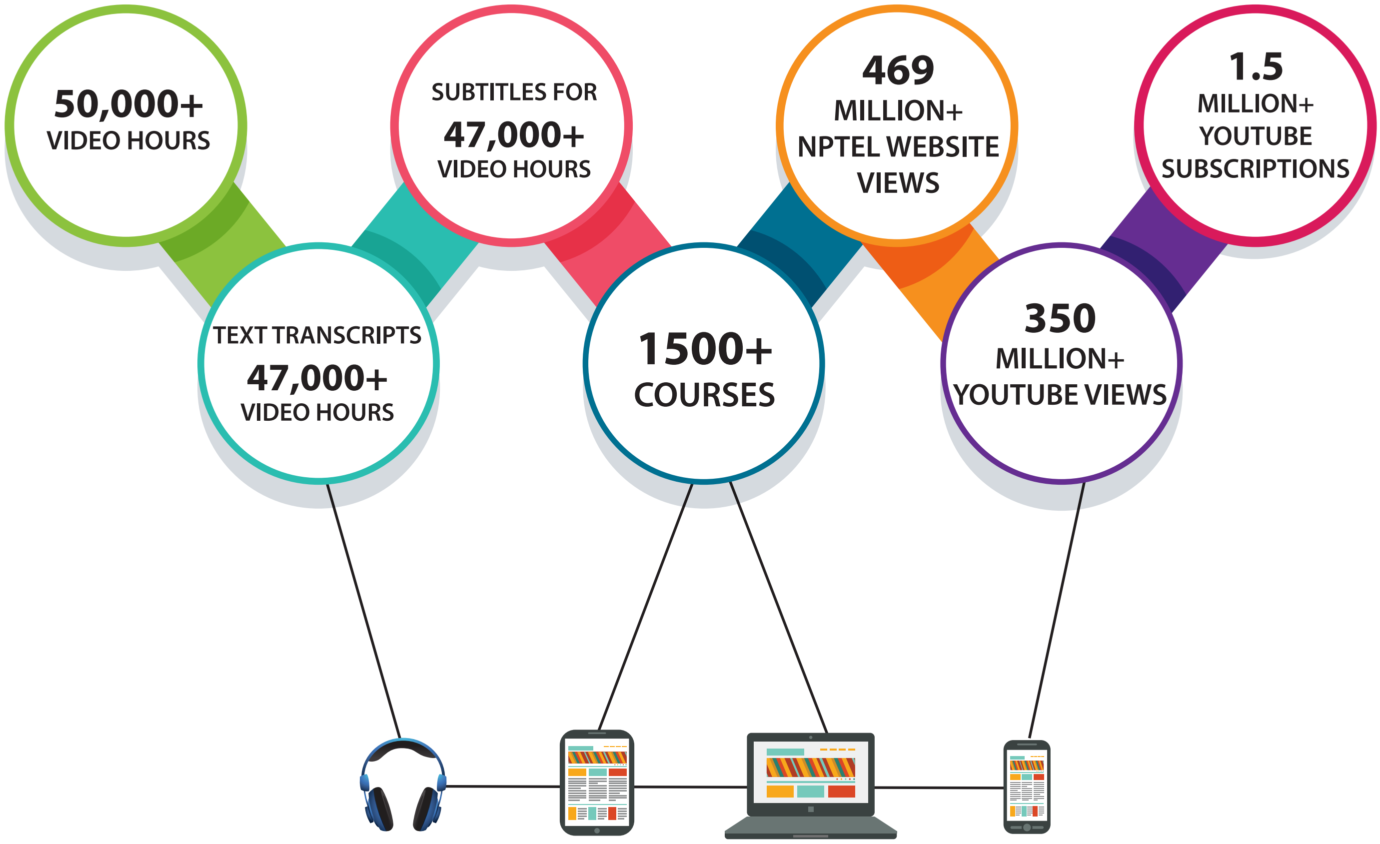
From March 2014 onward, NPTEL started offering online certification courses. Every January and July, anywhere between 250-300 courses are offered online - free of cost - for anyone to enroll and learn from. The certification involves writing an exam that is proctored and conducted in 120+ cities across India. 1010 online certification courses have been completed as on date with 288+ courses currently open for enrollment at onlinecourses.nptel.ac.in. Through an online portal, 4, 8, or 12 week online courses, typically on topics relevant to students in all years of higher education along with basic core courses in sciences and humanities with exposure to relevant tools and technologies, are being offered.

NPTEL online courses for certification
onlinecourses.nptel.ac.in

Open Online Courses
Learn for free
Anyone
Anytime
Anywhere

In person proctored certification exam.
Choose your exam city from 120+ locations across India.

Get Certified from the IITs & IISc



STATISTICS ON OPEN ONLINE COURSES FROM MARCH 2014 TILL OCTOBER 2018

1009
COMPLETED COURSES

5.0 MILLION+
ENROLLMENTS ACROSS COURSES

4.3 LAKH+
NUMBER OF EXAM REGISTRATIONS

TRANSCRIPTION OF VIDEOS AND TRANSLATION OF THE TEXTS

All videos are being transcribed in English and are also subtitled. As a pilot project, Translation of text transcripts into regional Indian languages is also being carried out so that language barrier does not stop any interested learner in participating in the e-learning process.

NPTEL-SWAYAM LOCAL CHAPTERS (NPTEL.AC.IN/LOCALCHAPTER)

NPTEL partners with 2000 + colleges (Engineering / Management / Arts and Science / Polytechnic colleges) in the form of SWAYAM-NPTEL Local chapters. Each college has a coordinator with whom NPTEL works closely to encourage maximum participation of students as well as faculty. Local Chapters are rated in each semester based on performance, further motivating the colleges to participate in full rigour.

NPTEL-SWAYAM LOCAL CHAPTER COLLEGES

ANDAMAN & NICOBAR ISLANDS	01	MAHARASHTRA	382
ANDHRA PRADESH	156	MANIPUR	01
ARUNACHAL PRADESH	01	MEGHALAYA	02
ASSAM	07	MIZORAM	01
BIHAR	07	ODISHA	20
CHHATTISGARH	24	PONDICHERRY	13
DELHI	12	PUNJAB	32
GOA	09	RAJASTHAN	40
GUJARAT	72	SIKKIM	02
HARYANA	33	TAMILNADU	362
HIMACHAL PRADESH	05	TELANGANA	93
JAMMU AND KASHMIR	07	TRIPURA	06
JHARKHAND	20	UTTAR PRADESH	353
KARNATAKA	108	UTTARAKHAND	29
KERALA	114	WEST BENGAL	109
LAKSHADWEEP	01	KABUL(01), ETHIOPIA(02)	03
MADHYA PRADESH	58	GRAND TOTAL	2072

NPTEL ONLINE CERTIFICATION COURSES FOR CREDIT TRANSFER

UGC and AICTE have approved that colleges can take these MOOC courses for credit in their Gazette notification of August 2016. These courses are being used by students to avail internship opportunities and prepare for the GATE exam too. About 15-20% of the total exam certified participants are faculty members from various colleges and hence these programmes are helping in faculty development and improvement. The advanced courses are recognized by AICTE as FDP.

To encourage more students across colleges to participate in NPTEL online certification courses, we motivate colleges to set up NPTEL-SWAYAM Local Chapter which also serves as a way for NPTEL to partner with them.

Growing at the rate of 5-8 LCs every week.

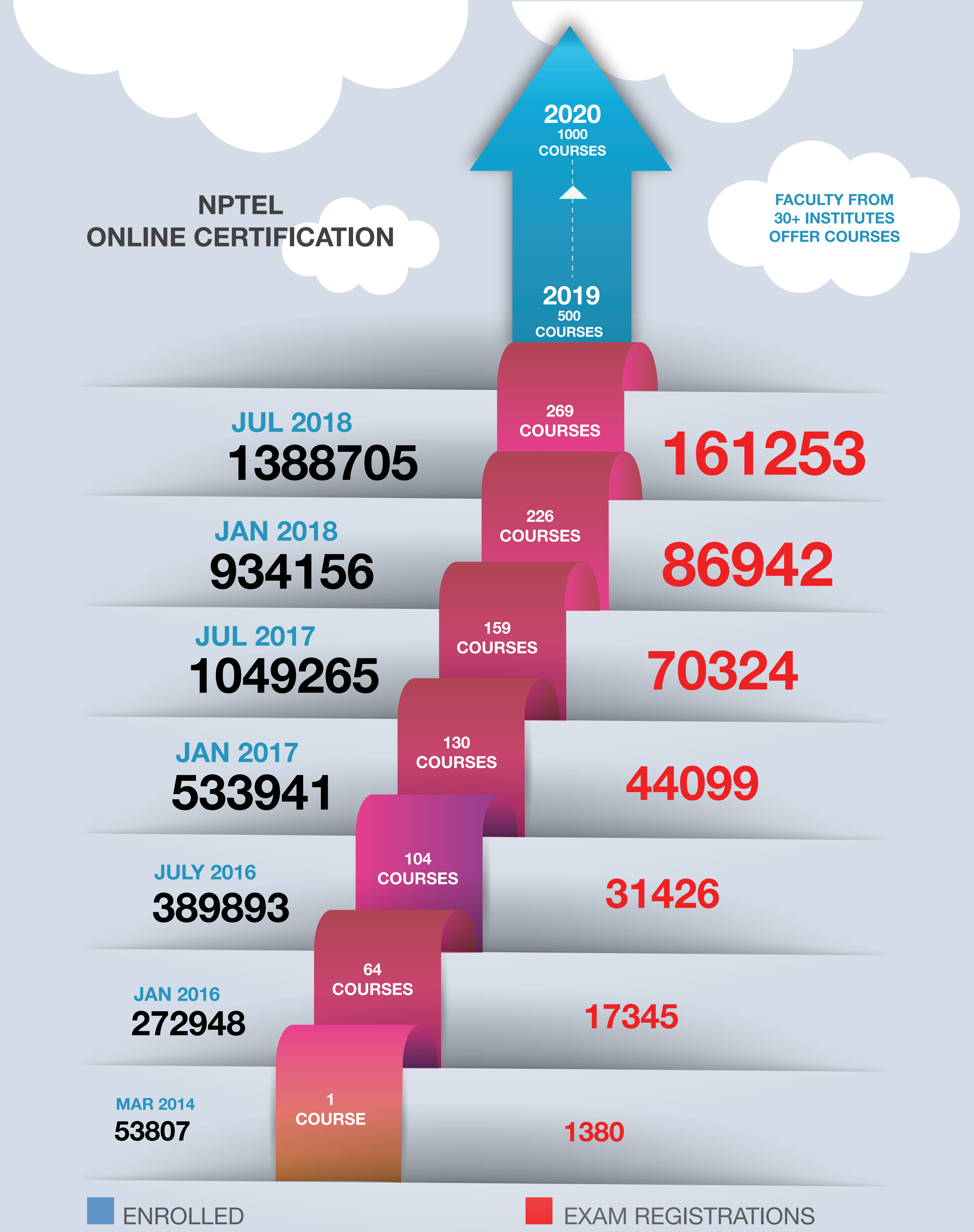
NPTEL INDUSTRY ASSOCIATE

NPTEL wishes to bring in an industry perspective to its technically rich courses. This led to the inception of NPTEL INDUSTRY ASSOCIATE (NIA). NPTEL aims to partner with organisations in a mutually beneficial manner by offering courses to train the freshers and to cross-skill and up-skill the existing workforce. NPTEL would act as a liaison between the Industries and Academia and expose learners to the current market trends, while connecting the Industries to the best skillset. CSR initiatives are also welcomed as part of this association.

INTERNSHIP

From 2018 summer onward, NPTEL has started offering internships to NOC exam toppers with the respective course instructors. Such internships will be offered twice a year.

HTTPS://NPTEL.AC.IN/INDUSTRYASSOCIATE/


NPTEL
ONLINE CERTIFICATION
2020
1000
COURSES
2019
500
COURSES
FACULTY FROM
30+ INSTITUTES
OFFER COURSES
JUL 2018
1388705
269
COURSES
161253
JAN 2018
934156
226
COURSES
86942
JUL 2017
1049265
159
COURSES
70324
JAN 2017
533941
130
COURSES
44099
JULY 2016
389893
104
COURSES
31426
JAN 2016
272948
64
COURSES
17345
MAR 2014
53807
1
COURSE
1380
ENROLLED
EXAM REGISTRATIONS

AEROSPACE ENGINEERING

AGRICULTURAL ENGINEERING

ARCHITECTURE

BIOTECHNOLOGY & BIOSCIENCES

CHEMICAL ENGINEERING

CHEMISTRY AND BIOCHEMISTRY

CIVIL ENGINEERING

COMPUTER SCIENCE & ENGINEERING

12 weeks

ELECTRICAL ENGINEERING

04 weeks

08 weeks

12 weeks

HUMANITIES & SOCIAL SCIENCES

04 weeks

08 weeks

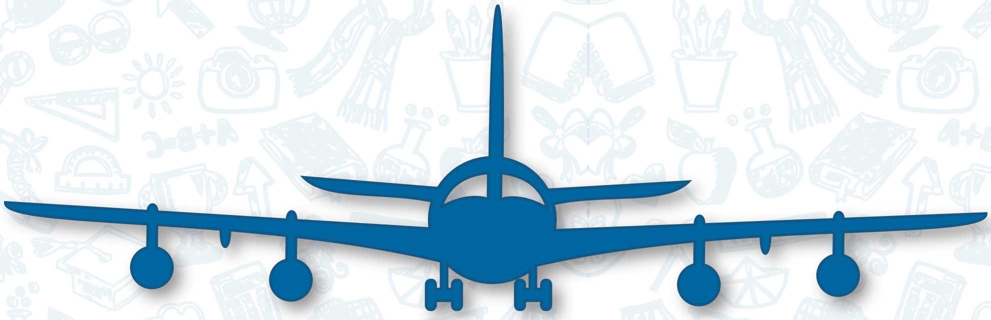
12 weeks

MANAGEMENT

04 weeks

08 weeks

12 weeks



AEROSPACE ENGINEERING

AEROSPACE ENGINEERING

8 weeks

01. Introduction to Airplane Performance
02. Advance Aircraft Maintenance
03. Introduction to Finite Volume Methods II

12 weeks

01. Satellite Attitude Dynamics and Control

INTRODUCTION TO AIRPLANE PERFORMANCE

AEROSPACE ENGINEERING

PROF. A.K. GHOSH
Department of Aerospace Engineering
IIT Kanpur

TYPE OF COURSE : Rerun | Core | UG
INTENDED AUDIENCE : B.E/B.Tech
COURSE DURATION : 8 weeks (28 Jan'19 - 22 Mar'19)
EXAM DATE : 31 Mar 2019

COURSE OUTLINE :

This course is designed to provide an integrated introductory treatment of airplane performance with flavor of aircraft design and flight testing.

ABOUT INSTRUCTOR :

Prof. A.K. Ghosh is a faculty of Aerospace Engg. Department of IIT Kanpur. He is also in-charge of the flight laboratory and unmanned aerial vehicle of IIT Kanpur. His research areas include system identification through flight tests using conventional and neural network based methods, design of aircrafts and airborne projectiles, supercavitation, unmanned aerial systems. Before joining IIT Kanpur, he worked as a scientist with Defense Research Development Organization (DRDO). He has published many peer reviewed journal papers and conference papers, guided 13 doctoral students, and 38 masters students. He is also a mentor of multiple aerospace start-up companies, and also been associated with major industry contributions of high speed low drag aircraft bomb, Pinaka Mk-I, 105mm sabot round for tracked vehicles, etc.

COURSE PLAN :

Week 01 : General Introduction: Airplane Performance Characteristics | George Cayley: Concept of Lift and Drag | Introduction to airplane and its components | Hansa 3 Aircraft and its Primary Systems - Concept of Lift: Aerofoil, Wing, and Complete Aircraft | Drag Polar

Week 02 : Standard Atmosphere: Description and Modelling | Measuring Instruments: Altimeter, Airspeed Indicator | Equations of Motion: Static Performance | Thrust Required, Power Required: Cruise| Excess Thrust and Power: Climb Angle and Rate of Climb.

Week 03 : Thrust Required: A Closer Look | Modelling of CL: Dimensional Analysis | A Closer Look: Point Mass Model, Dimensional Analysis | Estimation of Drag Polar Through Flight Test - Estimation of Rate of Climb.

Week 04 : Range and Endurance | Gliding Flight | Accelerated Flight | V-n Diagram.

Week 05 : V stall: Cruise and Manoeuvre | Flaps: High Lift Devices to Reduce Take off / Landing Distance | Take off: Warm-up Lecture | Take off Performance.

Week 06 : Landing Performance | Challenges in Take-off and Landing: Single and Twin Engines | Introduction to Static Stability | Positioning of Centre of Pressure for Static Stability.

Week 07 : Stability and Control: Designer's Perspective | Longitudinal Control: Elevator | Stability: Wing and Tail Contribution.

Week 08 : Control: Elevator | Control: del_E Required | Design Basics: Wing Loading & Thrust Loading | Design Basics: Sweep & Dihedral.

AEROSPACE ENGINEERING

ADVANCE AIRCRAFT MAINTENANCE

PROF. A.K. GHOSH
Department of Aerospace Engineering
IIT Kanpur

MR. VIPUL MATHUR
Department of Aerospace Engineering
IIT Kanpur

TYPE OF COURSE : New | Core | UG/PG
INTENDED AUDIENCE : B.Tech, M.Tech, Ph.D
PRE-REQUISITES : Aircraft maintenance
COURSE DURATION : 8 weeks (25 Feb'19 - 19 Apr'19)
EXAM DATE : 27 Apr 2019

INDUSTRIES APPLICABLE TO : DRDO, HAL,Boeing, Airbus, Bell, McDonnell Douglas, UAV Factory, Lockheed Martin, Cessna.

COURSE OUTLINE :

This course will cover Aircraft maintenance like overhaul, repair, inspection or modification of an aircraft or aircraft component. Maintenance includes such tasks as ensuring compliance with Airworthiness Directives.

ABOUT INSTRUCTOR :

Prof. A.K. Ghosh is a faculty of Aerospace Engg. Department of IIT Kanpur. He is also in-charge of the flight laboratory and unmanned aerial vehicle of IIT Kanpur. His research areas include system identification through flight tests using conventional and neural network based methods, design of aircrafts and airborne projectiles, supercavitation, unmanned aerial systems. Before joining IIT Kanpur, he worked as a scientist with Defense Research Development Organization (DRDO). He has published many peer reviewed journal papers and conference papers, guided 13 doctoral students, and 38 masters students. He is also a mentor of multiple aerospace start-up companies, and also been associated with major industry contributions of high speed low drag aircraft bomb, Pinaka Mk-I, 105mm sabot round for tracked vehicles, etc.

Mr. Vipul Mathur works as a Chief Engineer at Flight laboratory, Department of Aerospace Engineering, IIT-Kanpur.

COURSE PLAN :

Week 01 : Introduction, Construction
Week 02 : Performance, Lubrication system, Induction system
Week 03 : Fuel system, Ignition System, Starting System
Week 04 : Propeller, Maintenance
Week 05 : Introduction, Inlet, Compressor
Week 06 : Combustion, Turbine, Exhaust
Week 07 : Fuel system, Lubrication system, Ignition System
Week 08 : Starting, Thrust Augmentation, Material, Maintenance

AEROSPACE ENGINEERING

INTRODUCTION TO FINITE VOLUME METHODS - II

PROF. ASHOKE DE
Department of Aerospace Engineering
IIT Kanpur

TYPE OF COURSE : New | Elective | UG/PG
COURSE DURATION : 8 weeks (28 Jan'19 - 22 Mar'19)
INTENDED AUDIENCE : Senior undergraduate students and postgraduate students of Mechanical, Aerospace and Chemical Engineering
EXAM DATE : 31 Mar 2019
PRE-REQUISITES : Fluid Mechanics, Basic Programming, Linear Algebra, PDEs, FVM-I (MOOC)
INDUSTRIES APPLICABLE TO : Aerospace, Automobile, Chemical and Power Generation and Defense Industries

COURSE OUTLINE :

The Finite Volume Method (FVM) is one of the widely used numerical techniques in the scientific community and in industry as well. In this approach, the partial differential equations that represent the conservation laws to simulate fluid flow, heat transfer, and other related physical phenomena, are transformed over differential volumes into discrete algebraic equations over finite volumes (or elements or cells). Thereafter, the system of algebraic equations is solved to compute the values of the dependent variable for each of the elements to represent the physical processes.

ABOUT INSTRUCTOR :

Dr. Ashoke De is currently working as Associate Professor in the Department of Aerospace Engineering at Indian Institute of Technology Kanpur. He leads large scale initiatives in the modeling of turbulent reacting and non-reacting flows at IIT Kanpur. So far, he has authored more than 90 peer reviewed articles in journals and conferences. His primary research focus is the emerging field of computational mechanics with particular interest in combustion and turbulent flows.

COURSE PLAN :

Week 01 : Linear Solvers

Week 02 : Linear Solvers (contd.)+ Discretization of Convection Equations

Week 03 : Discretization of Convection Equations (contd.)

Week 04 : Higher order discretization

Week 05 : Higher order discretization (contd.)

Week 06 : Unsteady discretization + Source term discretization

Week 07 : Fluid flow problem-Incompressible

Week 08 : Fluid flow problem-Compressible + Turbulence model

AEROSPACE ENGINEERING

SATELLITE ATTITUDE DYNAMICS AND CONTROL

PROF. MANORANJAN SINHA
Department of Aerospace Engineering
IIT Kharagpur

TYPE OF COURSE : New | Elective | UG/PG/Ph.D.
COURSE DURATION : 12 weeks (28 Jan'19-19 Apr'19)
INTENDED AUDIENCE : Aerospace, Mechanical, Electrical
EXAM DATE : 27 April 2019
PRE-REQUISITES : Linear Control Systems/ Basic Mechanics
INDUSTRIES APPLICABLE TO : ISRO/DRDO

COURSE OUTLINE :

This course is designed to introduce the participants the rotational kinematics first. Then it introduces the subject matter of satellite/rigid body rotational dynamics comprehensibly. Finally, the attitude control of satellite using reaction wheels, control moment gyros, magnetic/Lorentz force actuators, and thrusters are introduced.

ABOUT INSTRUCTOR :

Dr. Sinha is a Professor in the Department of Aerospace Engineering and involved in research on satellite dynamics and control, Aircraft Dynamics and Control. He has contributed by solving some more than five decades old problems related to magnetically actuated satellite control. He also contributed to the fighter aircraft development by our defence agencies.

COURSE PLAN :

Week 01-02 : Attitude Kinematics
Week 03-04 : Attitude Dynamics
Week 05 : Stability of Torque Free Rotation
Week 06 : Gravity Gradient Modeling and Stabilization
Week 07 : Spin Stabilized Satellite
Week 08-09 : Satellite Attitude Control using Reaction wheels and Control Moment Gyros
Week 10-11 : Attitude Stabilization using Magnetic Torquer and Lorentz Force
Week 12 : Attitude Cotrol using Thrusters

AGRICULTURAL ENGINEERING

AGRICULTURAL ENGINEERING

12 weeks

01. Novel Technologies and Food Processing and Shelf Life Extension
02. Soil Science and Technology

AGRICULTURAL ENGINEERING

NOVEL TECHNOLOGIES AND FOOD PROCESSING AND SHELF LIFE EXTENSION

PROF. HARI NIWAS MISHRA
Department of Agricultural and Food Engineering
IIT Kharagpur

TYPE OF COURSE : New | Core | UG/PG
COURSE DURATION : 12 weeks (28 Jan'19-19 Apr'19)
EXAM DATE : 27 April 2019
INTENDED AUDIENCE : Food Processing and Engineering, Food Science and Technology, Agricultural Engineering, Biochemical Engineering, Chemical Engineering, and related disciplines.

INDUSTRIES APPLICABLE TO : Food industries such as Britannia Industries Ltd, Nestle, Hindustan Unilever Ltd, PepsiCo Frito Lay, General Mills, Glaxo, ITC, Jubilant foods, Coca cola, Keventers, Marico, Cargilletc.

COURSE OUTLINE :

Food processing which includes both fresh and packaged food involves handling of foods, preparation and storage through the subsequent stages so that the pathogens and toxic components present in food are destroyed and deactivated making the food safer and hygienic. It is the capability of the food processing sector to develop novel food processing and preservation technologies to manufacture and preserve food in an effective manner with a view to enhance their shelf life, improve quality as well as make them functionally more useful.

ABOUT INSTRUCTOR :

Professor H N Mishra has over thirty years of experience in teaching and research. A Professor of Food Technology in the Agricultural and Food Engineering Department, and a former President of the Association of Food Scientists & Technologists (India), Dr. Mishra Chairman of the Post-Harvest Technology Centre, IIT Kharagpur. Prof. Mishra teaches Food Science& Technology, Food Product & Process Technology, Non Thermal Processing of Food, Industrial Processing of Foods & Beverages, and Food Chemistry. His research interests include RTE Health foods & Nutraceuticals, Novel Food Products & Process Development and Extension of Shelf Life of Perishable Foods.

COURSE PLAN :

Week 01 : Introduction to food processing, preservation and quality. Basic principles & methods, water activity vs. food stability, structure-function relationship.
Week 02 : Chemical changes in food during processing. Browning reactions (enzymatic and non-enzymatic), protein interactions, carbohydrate interactions, Rancidity & reversion.
Week 03 : High pressure processing and Membrane technologies in food processing.
Week 04 : Food irradiation, RF & microwave heating; Super critical fluid extraction and ultrasonication.
Week 05 : Food extrusion technology, RTE snack foods, Textured vegetable protein, Rice and dal analogues.
Week 06 : Hurdle technology concept, Natural antimicrobials & bacteriocin; Freeze drying.
Week 07 : Controlled atmosphere storage of food grains; ozone, microwave treatment for disinfestation of grains. Detection of spoilage in grains.
Week 08 : Modified atmosphere packaging, Active packaging and Edible coating of fruits & vegetables
Week 09 : Extraction and processing of oil, Mechanical expellers, solvent extraction, refining, hydrogenation, winterization
Week 10 : Shelf life extension of oils using natural antioxidants. Concept and, measurement of rancidity.
Week 11 : Microencapsulation of bioactive and Technology of oil powder.
Week 12 : Functional foods and Nutraceuticals. Ready to eat therapeutic food, micronutrient fortified high energy bar, gluten free bread, lactose free milk, carbonated cereal beverage.

AGRICULTURAL ENGINEERING

SOIL SCIENCE AND TECHNOLOGY

PROF. SOMSUBHRA CHAKRABORTY
Department of Agricultural and Food Engineering
IIT Kharagpur

TYPE OF COURSE : New | Core | UG
INTENDED AUDIENCE : Agriculture, Environmental science Agricultural engineering
COURSE DURATION : 12 weeks (28 Jan'19-19 Apr'19)
EXAM DATE : 27 April 2019
INDUSTRIES APPLICABLE TO : 1. Fertilizer companies 2. Soil testing services 3. Soil and environmental pollution consulting companies 4. Soil remote sensing solution services

COURSE OUTLINE :

This core course is aimed to provide a basic understanding of various aspects of soil science along with some state-of-the-art technologies. The objective is to provide knowledge of different physical and chemical properties of soil. Most importantly this course will impart different preparatory and exploratory data analysis approaches for unconventional digital soil mapping, modeling and mapping of continuous and categorical soil attributes, hyperspectral and proximal soil sensors and their applications for modeling of soil properties, soil pollution and remediation which are not covered in the traditional courses of soil science.

ABOUT INSTRUCTOR :

He is currently serving as an Assistant Professor (Soil Science) at the Agricultural and Food Engineering Department, Indian Institute of Technology Kharagpur. He was awarded various prestigious fellowships including the Australia Awards Fellowship from the Australian Department of Foreign Affairs and Trade. He did his undergraduate and M.Sc degrees from BCKV and PAU in India and PhD degree in Agronomy (Soil Science emphasis) from Louisiana State University, USA. He started his career as a post-doctoral researcher at West Virginia University, USA. He joined IITKgp as faculty in 2016. He is passionate about the use of proximal and non-invasive sensors for soil management.

COURSE PLAN :

Week 01 : Basic Overview Of Soil, Ecosystem Services Of Soils, Weathering , Soil Formation, Soil Profile

Week 02 : Soil Taxonomy, Soil Orders-1, Soil Orders-2, Soil Colour And Soil Texture, Soil Structure

Week 03 : Soil Tillage And Soil Density, Soil Porosity And Consistency, Soil Water Energy Concepts, : Measurement Of Soil Water, Tutorial

Week 04 : The Flow Of Liquid Water Into Soil, : Qualitative Description Of Soil Wetness, Soil Air, Soil Temprature, Tutorial

Week 05 : Silicate Clays-1, Silicate Clays -2, Sources Of Charges On Soil Colloids, Cation Exchange Capacity, Sorption Of Pesticides In Soil

Week 06 : Diffuse Double Layer Theories , Adsorption Isotherms, Soil Acidity, : Soil Alkalinity And Salinit, Submerged Soils

Week 07 : Essential Plant Nutrients, Soil Nitrogen, Biological Nitrogen Fixation, Soil Phosphorus And Potassium, Fertilizers

Week 08 : Soil Testing-1, Soil Testing-2, Soil Organic Matter And Climate Change, Soil Organisms,Compost

Week 09 : Soil Erosion And Land Degradation, The Universal Soil-Loss Equation, Conservation Tillage, Wind And Tillage Erosion, Toxic Organic Chemicals In Soils

Week 10 : Remediation Of Soil Organic Pollution, Soil Contamination With Toxic Inorganic Substances, Remediation Of Soil Inorganic Pollution, Soil Survey, Remote Sensing In Soil Survey

Week 11 : Gis And Gps, Geostatistics, Basics Of Diffuse Reflectance Spectroscopy, : Diffuse Reflectance Spectroscopy For Soils, Pxrf Soil Applications

Week 12 : Overview Of Digital Soil Mapping, Modeling And Mapping Of Continuouos Variables, Modeling And Mapping Of Categorical Variables, : Pedotrasnfer Functions, Accuracy and Uncertainity Of Dsm

ARCHITECTURE AND PLANNING

ARCHITECTURE

04 weeks

01. Principles and Applications of Building Science
02. Introduction to History of Architecture in India
03. Visual Communication Design for Digital Media
04. User Interface Design

08 weeks

01. Housing Policy & Planning
02. Landscape Architecture and Site Planning - Basic Fundamentals
03. Architectural Conservation And Historic Preservation

12 weeks

01. Urban governance and Development Management (UGDM)

ARCHITECTURE AND PLANNING

PRINCIPLES AND APPLICATIONS OF BUILDING SCIENCE

PROF. E. RAJASEKAR
Department of Architecture and Planning
IIT Roorkee

TYPE OF COURSE : Rerun | Elective | UG

COURSE DURATION : 4 weeks (25 Feb'19 - 22 Mar'19)

INTENDED AUDIENCE : BE - Civil, Architecture; Design and Construction industry professionals

EXAM DATE : 27 Apr 2019

INDUSTRIES APPLICABLE TO : Design and Construction Firms, Architecture Firms, Construction companies. It can be used as a part of induction course for recruits in design and construction firms.

COURSE OUTLINE :

Design and construction professionals require a command on fundamental principles of building physics in order to ensure functional efficiency in the built environments. The course provides a one-stop solution to design/construction industry professionals, students of architecture and engineering disciplines to understand these principles and learn their practical applications. The course comprises of 10 modules which cover climate responsive design of buildings, thermal comfort and energy efficiency, building acoustics and noise control and visual quality and day lighting. The participants will engage in a series of experiential learning modules - involving basic tutorials, animated examples, applied case studies and do-it-yourself exercises.

ABOUT INSTRUCTOR :

Dr. E. Rajasekar is an Assistant Professor at the Department of Architecture and Planning ,IIT Roorkee, India. He is an Architect with post-graduation in Building Technology and Construction Management and PhD on Thermal comfort and building performance from IIT Madras. He is a Shastri Indo - Canadian Institute Doctoral Fellow.He specializes in the field of building performance assessment focused on the thermal,acoustics and lighting parameters.He carries a rich research and industry experience in this field and has published more than 20 technical papers in peer-reviewed journals and conferences. He is a USGBC LEED accredited professional and a GRIHA certified professional.

COURSE PLAN :

Week 01 : Solar geometry, climate responsive building design, thermal comfort

Week 02 : Bio climatic design, building envelop, glazing systems, energy efficiency

Week 03 : Fundamentals of building acoustics, Quality indicators, Acoustic materials, Noise control

Week 04 : Visual quality in built environment, Effective day lighting design, Integrated design.

ARCHITECTURE AND PLANNING

INTRODUCTION TO HISTORY OF ARCHITECTURE IN INDIA

PROF. PUSHKAR SOHONI
Department of Humanities and Social Sciences
IISER Pune

TYPE OF COURSE : New | Elective | UG
INTENDED AUDIENCE : Anyone can do the course
PRE-REQUISITES : Any student who is interested in architecture or cultural history.
COURSE DURATION : 4 weeks (28 Jan'19 - 22 Feb'19)
EXAM DATE : 31 Mar 2019

COURSE OUTLINE :

The history of architecture in India is a material narrative of aspirations, polities, and societies in the region. From the Indus Valley Civilization to the modernism of B.V. Doshi, architecture has defined periods, peoples, and regions across India. This course is a brief introduction to a history of five thousand years of architecture in India, and provides a broad perspective on one aspect of material expression.

ABOUT INSTRUCTOR :

Pushkar Sohoni trained as a professional architect from the University of Pune, after which he received an MS in Historic Preservation from the University of Pennsylvania. His doctoral research was on late medieval and early modern architecture, and he received his PhD from the University of Pennsylvania, followed by a post-doctoral position at the University of British Columbia. He has authored many articles and books on architectural history and other aspects of material culture.

COURSE PLAN :

Week 01 : Introduction to History of Architecture, Indus Valley Civilisation, Early Historic Period - Wooden and Cave Architecture

Week 02 : Beginnings of the Temple, Medieval Temples, Islamic Architecture

Week 03 : Sultanate Architecture, Mughals and Rajputs, Princely States

Week 04 : Neo-Classical, Indo-Saracenic, Revivial Gothic, Art Deco, Modern, International and Contemporary

VISUAL COMMUNICATION DESIGN FOR DIGITAL MEDIA

ARCHITECTURE AND PLANNING

PROF. SAPTARSHI KOLAY
Department of Architecture and Planning
IIT Roorkee

TYPE OF COURSE : Rerun | Elective | UG/PG

COURSE DURATION : 4 weeks (28 Jan'19 - 22 Feb'19)

EXAM DATE : 31 Mar 2019

INDUSTRIES APPLICABLE TO : Any User Experience design, Interaction design and Visual design companies.

INTENDED AUDIENCE : Students and professional from the discipline of Visual Communication design, User experience design or equivalent domain. It is a Elective Course for UG and PG of design and architecture domain, including B.Des, M.Des, B.Arch, M.Arch, B.FA, M.FA etc.

COURSE OUTLINE :

The course will impart knowledge on the different aspects of visual communication design, emphasizing on virtual media platform. In contemporary visual design pedagogy, virtual media technology is an emerging paradigm. The course will emphasize on understanding of visual cognition, which is the key factor to achieve user-friendly design. Usage of contemporary technology like, eye tracking will also be introduced as user testing tool. The course will enable the students to learn visual design in virtual media through a methodological approach.

ABOUT INSTRUCTOR :

Prof. Saptarshi Kolay is presently an Assistant Professor at Architecture and Planning department of Indian Institute of Technology Roorkee. After completing his under graduation in Architecture form Jadavpur University, he went on to explore User Centric design at Design Programme of Indian Institute of Technology Kanpur. He was selected in student-exchange programme for Aalto University, Finland and Escola De Arte and Desino, Spain. He has received Rafiq Azam Travel Bursary, Yuva-Ratna award and has participated in Design workshop by MIT, Media lab. His current research interest includes gerontology and socio-cultural sustainability, way-finding design, visual narratives, etc.

COURSE PLAN

Week 1 : Introduction to Visual Design
Introduction to Virtual Media Technology

Week 2 : Applications of Visual Design in Virtual Media Paradigm
Design Thinking and Visual Cognition

Week 3 : Contemporary Trends in Virtual-Media
Visual Design Methodology (continues to week 4)

Week 4 : Visual Design Methodology
Case Studies of Visual Design in Virtual Media Technology

USER INTERFACE DESIGN

ARCHITECTURE AND PLANNING

PROF. SAPTARSHI KOLAY
Department of Architecture and Planning
IIT Roorkee

TYPE OF COURSE : New | Elective | UG/PG

INTENDED AUDIENCE : M.Des. / B.Des. M.Arch/ B.Arch. students, design professionals

COURSE DURATION : 4 weeks (25 Feb'19 - 22 Mar'19)

EXAM DATE : 28 April 2019

INDUSTRIES APPLICABLE TO : Industrial Design Companies, User experience Design Companies, Visual Design Companies

COURSE OUTLINE :

The course will impart knowledge on the different aspects of User-Inteface Design, emphasizing on virtual media platform. In contemporary Industrial design pedagogy, human-machine interaction is an emerging paradigm. The course will emphasize on understanding of user experience and cognition, which are the key factor to achieve user-friendly Interface Design. Usage of contemporary technology like, eye tracking will also be introduced as user testing tool. The course will enable the students to learn to design User-Interface through a methodological approach.

ABOUT INSTRUCTOR :

Saptarshi Kolay is presently an Assistant Professor at Architecture and Planning department of Indian Institute of Technology Roorkee. After completing his under graduation in Architecture form Jadavpur University, he went on to explore User Centric design at Design Programme of Indian Institute of Technology Kanpur. Along with teaching he is pursuing his PhD from the Department of Architecture and Planning, IIT-Roorkee. He was selected in student-exchange programme for Aalto University, Finland and Escola De Arte and Desino, Spain. He has received Rafiq Azam Travel Bursary, Yuva-Ratna award and has participated in Design workshop by MIT, Media lab. His current research interest includes gerontology and socio-cultural sustainability, way-finding design, visual narratives, etc. on which he has international Journal and Conference papers. He has floated NPTEL courses like "Contemporary Architecture and Design" and "Visual Communication Design on Digital Media".

COURSE PLAN :

Week 01 : Introduction to User Interface Design (UI), Brief History of UI Design

Week 02 : UI Design Methodology

Week 03 : User Experience design component in Interface Design, Visual Communication design component in Interface Design

Week 04 : Case Studies and Best Practices

ARCHITECTURE AND PLANNING

HOUSING POLICY & PLANNING

PROF. UTTAM K. ROY
Department of Architecture and Planning
IIT Roorkee

COURSE DURATION : 8 weeks (28 Jan'19 - 22 Mar'19)
EXAM DATE : 31 Mar 2019

TYPE OF COURSE : Rerun | Core | UG/PG

INDUSTRIES APPLICABLE TO : Ministry of Housing and Poverty Alleviation and, Department of Housing at each state government, Development Authorities and Housing boards, Joint venture companies in housing, Private developers of social housing.

INTENDED AUDIENCE : Students, academicians and professionals working in the field of housing & real estate development. It is a core course for PG.

COURSE OUTLINE :

'Housing for All' is a primary aim of Government of India for long. It has formulated Housing for All mission with a Sub-mission focused on 'technology' to enhance the social housing delivery. Government has also been creating an enabling environment for private players through bringing reforms in land and financial sectors to increase overall housing supply. As a result, housing market is facing a constant change. Under this changed circumstances it is challenging for professionals and academicians to deliver in the field of housing development without the sound knowledge of the fast changing housing policy dynamics and planning practice. The present course covers contemporary housing policy, reforms (land and finance), planning and strategy intervention at the city and sub-regional level. The course is highly interactive and full of relevant cases and best practices, course materials which are highly useful for students at bachelor's, master's & PhD degree, academicians, consultants/professionals as well as policy makers at various levels.

ABOUT INSTRUCTOR :

Prof. Uttam K. Roy is an Architect and City Planner (with specialization in Housing) with more than sixteen years of academic, research and professional experience in the field of housing and urban planning and currently serving as Assistant Professor at the Department of Architecture and Planning, IIT Roorkee. He has served as HUDCO chair faculty in Kolkata and has been instrumental in planning of New Town, Kolkata and many municipal towns prior to the present responsibility. His broad interest area is housing and city planning. He is a 'Recognized Trainer' (RT) of Design of Training (D.O.T) by DOPT, Government of India and delivered more than fifty short term courses including Training of Trainers (TOT) courses. He is having a keen interest in teaching pedagogy/ andragogy and uses innovative methods of teaching.

COURSE PLAN

Week 1 : Introduction, Learning Objective
Week 2 : Legal, Policy Framework and Land for Housing
Week 3 : Affordability, Delivery Systems and Housing finance
Week 4 : Planning Framework for Housing & Infrastructure
Week 5 : Planning for Social Infrastructure & Housing Strategy for Cities
Week 6 : Planning for Major Formal Housing typologies
Week 7 : Planning for Informal and Special Housing Typologies
Week 8 : Housing Development and Management

LANDSCAPE ARCHITECTURE AND SITE PLANNING - BASIC FUNDAMENTALS

ARCHITECTURE AND PLANNING

PROF. UTTAM KUMAR BANERJEE
Department of Architecture and Regional Planning
IIT Kharagpur

COURSE DURATION : 8 weeks (25 Feb'19 - 19 Apr'19)
EXAM DATE : 27 Apr 2019

TYPE OF COURSE : Rerun | Core | PG
INTENDED AUDIENCE : Architecture, Agriculture Engineering, Urban Planning, Landscape Planning, Botany

INDUSTRIES APPLICABLE TO : This course would be very useful for the Govt. or Private Horticulture and Gardening departments, Plant Nurseries, any individual Landscape connoisseurs.

COURSE OUTLINE :

In the event of rapid urbanization there is a trend of fast depletion of natural resources, especially the vegetation. Depletion of natural ground-cover and Landscape is one of the major sources of natural hazards, such as Landslide, Flood, Heat Island, Soil erosion etc. There is growing interest in this field of knowledge. This course is tailored very effectively to introduce all aspects of Plant sciences, Planting design techniques, Garden maintenance and management. This course would be very useful for the students as well as practicing architects, planners, engineers and common people. The lectures would be supported with real-time illustrations through sketches and analysis, in addition to the digital illustrations time to time. These would result in easy comprehension by the students of different level of ability and exposure. Multiple illustrations with case studies would be the strength of this course disseminated with lucid lectures.

ABOUT INSTRUCTOR :

Prof. Uttam Kumar Banerjee is currently a Senior Professor in the Department of Architecture & Regional Planning, as well as Joint-Faculty in the RCG School of Infrastructure Design and Management at the Indian Institute of Technology Kharagpur, where he has served as the Head in both the departments from 2004 to 2007 and 2011 to 2014 respectively. He has graduated with Bachelor of Architecture (B.Arch), post-graduated with Master of City Planning (MCP) and Ph.D. in Transportation system evaluation from Indian Institute of Technology Kharagpur. He has a wide spectrum of knowledge with academic, research and professional experience in the multiple domains associated with Architecture, Planning, Infrastructure, Landscape, Environment and Computer Applications.

COURSE PLAN :

Week 01 : Introduction to Landscape Design
Week 02 : History of Landscape
Week 03 : Landscape Elements
Week 04 : Site Analysis
Week 05 : User Analysis
Week 06 : Landform Design
Week 07 : Drainage Design
Week 08 : Plant Sciences and Plant Maintenance

ARCHITECTURAL CONSERVATION AND HISTORIC PRESERVATION

PROF. SANGHAMITRA BASU
Department of Architecture and Regional Planning
IIT Kharagpur

TYPE OF COURSE : Rerun | Elective | UG/PG
COURSE DURATION : 8 weeks (25 Feb'19 - 19 Apr'19)
INTENDED AUDIENCE : Architecture, Civil Engineering Archeology, Fine Arts Museology, History, Tourism Management /Administration
EXAM DATE : 28 Apr 2019

INDUSTRIES APPLICABLE TO : PWD, CPWD, Archeological Survey & Tourism Department

COURSE OUTLINE :

This course is designed to address Historic Preservation and Conservation as an approach that establishes a link between past, present and future. To familiarize the students with the status of conservation movement, various agencies involved in the field of conservation worldwide and their policies.

ABOUT INSTRUCTOR :

Prof. Sanghamitra Basu, Ph D , MA (Conservation Studies, IAAS , York. UK), Post Graduate (Urban Planning , School of Planning and Architecture , New Delhi), B Arch (Hons.), is currently an Associate Professor in the Department of Architecture & Regional Planning, Indian Institute of Technology (IIT), Kharagpur, India . She has 33 years' experience in teaching at undergraduate and post graduate levels. She has been active in research and consultancy projects in the field of historic preservation, sustainable tourism, heritage management , participatory planning , housing and neighbourhood planning, GIS application and architectural pedagogy. She has several publications in journals, chapters in books, monograph and papers presented in international and national conferences.

COURSE PLAN :

Week 1 : Understanding Heritage. Types of Heritage. Heritage conservation- Need, Debate and purpose. Defining Conservation, Preservation and Adaptive reuse. Distinction between Architectural and Urban Conservation. Ethics of conservation , Significance and Value Assessment.

Week 2 : History of Conservation Movement, International agencies like ICCROM , UNESCO and their role in Conservation, World Heritage Sites , Selection criteria , Case Studies , Endangered sites Inviscid Flows and Reynolds Transport Theorem.

Week 3 : Monument conservation and the role of Archeological Survey of India –role of INTACH – Central and state government policies and legislations – inventories and projects- select case studies of sites such as Hampi, Golconda, Mahabalipuram - craft Issues of conservation.

Week 4 : Listing of monuments- documentation of historic structures- assessing architectural character –historic structure report- guidelines for preservation, rehabilitation and adaptive re-use of historic structures- Case studies, seismic retrofit and disabled access/ services additions to historic buildings-heritage site management.

Week 5 : Over view of urban history of India - understanding the character and issues of historic cities – select case studies of towns - historic districts and heritage precincts.

Week 6 : New building in historic settings. Townscape analysis, Visual Integration heritage impact assessment.

Week 7 : Interpretation and Presentation of Historic Sites. urban conservation and heritage tourism, Heritage Trail.

Week 8 : Conservation as a planning tool.- financial incentives and planning tools such as Transferable Development Right (TDR)- conservation project management, Community participation (contd.)

ARCHITECTURE
AND PLANNING

URBAN GOVERNANCE AND DEVELOPMENT MANAGEMENT (UGDM)

PROF. UTTAM K. ROY
Department of Architecture and Planning
IIT Roorkee

TYPE OF COURSE : New | Elective | UG/PG
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
INTENDED AUDIENCE : Students, academicians and professionals working in the field of urban planning and management
EXAM DATE : 28 Apr 2019
PRE-REQUISITES : B. Arch/B.E (Civil)/B Plan M.A/MSc (Economics, Geography, Sociology)

INDUSTRIES APPLICABLE TO : Ministry of Housing and Urban Affairs, Urban Development Missions and Project Management Units, Development Authorities and Municipal Corporations

COURSE OUTLINE :

Our cities are shaped by the professionals working at the city and regional level organizations like municipal corporations, development authorities etc. In the current day paradigm, the role of professionals like city planners and city managers at the urban sector is multifarious and ever challenging in visioning, planning,designing and executing urban development projects. With the increasing role of city managers as expected in all centrally sponsored programmes like Smart City, PMAY, AMRUT, Swachh Bharat Mission etc the job profile of future city mangers is very much challenging.

ABOUT INSTRUCTOR :

Dr. Uttam K. Roy is an Architect and City Planner with more than sixteen years of academic, research and professional experience in the field of housing and urban planning and currently serving as Assistant Professor at the Department of Architecture and Planning, IIT Roorkee. He has served as HUDCO chair faculty in Kolkata and has been instrumental in planning of New Town, Kolkata and many municipal towns prior to the present responsibility. His broad interest area is housing and city planning. He is a 'Recognized Trainer' (RT)of Design of Training (D.O.T) by DOPT, Government of India and delivered more than fifty short term courses including Training of Trainers (TOT) courses. course in Housing Policy and Planning which got huge success of more than four thousand enrollments in two phases.

COURSE PLAN :

Week 01 : Introduction: Basic Concept & legal provisions:
Week 02 : An overview of People, Land and Environment:
Week 03 : Organisation development:
Week 04 : Managing change:
Week 05 : Urban and Metropolitan planning:
Week 06 : Municipal Finance, Accounts and Revenues:
Week 07 : Urban Land, housing and risk management:
Week 08 : Dealing Challenging Urban Issues:
Week 09 : Managing Centrally sponsored Urban Missions:
Week 10 : Project Planning and Execution:
Week 11 : Leadership Role of City Managers
Week 12 : Self Development for City Managers

BIOTECHNOLOGY & BIOSCIENCES

BIOTECHNOLOGY & BIOSCIENCES

04 weeks

01. Principles Of Downstream Techniques In Bioprocess
02. Human Molecular Genetics
03. Demystifying The Brain
04. Bioreactors
05. Learning about Learning: A Course on Neurobiology of Learning and Memory

08 weeks

01. Introductory Mathematical Methods for Biologists
02. Medical Biomaterials
03. Cell Culture Technologies
04. Forest Biometry
05. Bioengineering: An Interface with Biology and Medicine
06. Applications of interactomics using genomics and proteomics technologies

12 weeks

01. Bio-Informatics:Algorithms and Applications
02. Wild Life Ecology
03. Animal Physiology

BIOTECHNOLOGY & BIOSCIENCES

PRINCIPLES OF DOWNSTREAM TECHNIQUES IN BIOPROCESS

PROF. MUKESH DOBLE
Department of Biotechnology
IIT Madras

TYPE OF COURSE : Rerun | Elective | UG/PG
PRE-REQUISITES : Basics of physics/chemistry /Maths, Mass and heat balance, and thermodynamics
INTENDED AUDIENCE : BE (Biotechonology), BSc/MSc
COURSE DURATION : 4 weeks (28 Jan'19 - 22 Feb'19)
EXAM DATE : 31 Mar 2019

COURSE OUTLINE :

A product that is manufactured in a bioreactor or a fermentor, is recovered and purified in several subsequent unit operations. The economy of a manufacturing process is determined by the cost effectiveness of these downstream operations. This course discusses these operations and the basic underlying principles with worked out problems.

ABOUT INSTRUCTOR :

Prof. Mukesh Doble is a Professor at the Department of Biotechnology at IIT Madras. He has previously worked in Imperial chemical Industries (ICI) and General Electric (GE) for 20 years. Areas of research are Biomaterials, Biopolymers, and Drug design. He has Published 250 papers and 8 books and filed 6 patents.

COURSE PLAN

Week 1 : Introduction, Mass balance, Heat Balance, flow sheet Costing,Cell Breakage

Week 2 : Solid Liquid Separation, Pre-treatment and Filters/centrifuge, Liquid-Liquid Extraction

Week 3 : Adsorption,Reversed micellar and aqueous two phase extraction, Membranes.

Week 4 : Precipitation and crystallization,Product stabilization, drying, Lyophilisation,Electrophoresis / SDS PAGE, Chromatography, Future trends, Other downstream operations/Summary of the course

HUMAN MOLECULAR GENETICS

PROF. S. GANESH
Department of Biological Science and Bioengineering
IIT Kanpur

TYPE OF COURSE : Rerun | Core | UG/PG

COURSE DURATION : 4 weeks (28 Jan'19 - 22 Feb'19)

PRE-REQUISITES : Participants are expected to have at least class 12 level understanding in genetics.

EXAM DATE : 31 Mar 2019

INTENDED AUDIENCE : Students interested in pursuing research in human molecular genetics | Medical students and practicing clinicians interested in understanding the principles and complexities of human genetics | Students interested in careers in genetic counselling and DNA diagnostics | Scientists working in public health service, counselling centres, and diagnostic laboratories.

INDUSTRIES APPLICABLE TO : Medical and pharma companies, paramedic clinical centers, educational institutes, and hospitals

COURSE OUTLINE :

This is an introductory course designed primarily for students in the undergraduate or master's programs interested in biomedical research, genetic counseling, medicine, and clinical genetics. This course is expected to introduce the rapid advancements in our understanding of the role of human genome in health and disease. We would introduce key concepts of inheritance of human traits, pedigree analysis, and chromosome organization. Molecular biology tools used for understanding the genome, gene structure and gene mutations, gene mapping and gene cloning strategies will also be covered. Objectives and outcome of human genome project and the HapMap project will also be discussed at the end.

ABOUT INSTRUCTOR :

Prof. S. Ganesh teaches biology, genetics and genomics at IIT Kanpur. His research interests include human molecular genetics and neuroscience. He works on genetic forms of neurodegenerative disorders in humans to understand their genetics and disease mechanisms, and to develop therapeutics.

COURSE PLAN :

Week 01 : Fundamentals of central dogma (DNA, RNA and proteins; mutations) | Chromosome structure and function (organization; structure-function relationship; chromosome abnormalities).

Week 02 : Genes in pedigree (Mendelian pedigree patterns, complications to pedigree patterns) | DNA cloning and hybridization techniques (vector based cloning; nuclei acid hybridizations; PCR-based DNA analyses).

Week 03 : Mutation and instability of human DNA (mutation and polymorphism; pathogenic mutations, repeat expansions) | Molecular pathology (types of mutations; animal models for human disease).

Week 04 : Identifying human disease genes (functional cloning versus positional cloning; mutation screening) | Complex diseases; The Human Genome and HapMap projects

BIOTECHNOLOGY & BIOSCIENCES

DEMYSTIFYING THE BRAIN

PROF. SRINIVAS CHAKRAVARTHY
Department of Biotechnology
IIT Madras

TYPE OF COURSE : Rerun | Elective | UG/PG
INTENDED AUDIENCE : Any one can take this course
PRE-REQUISITES : Only college level general science background is required
COURSE DURATION : 4 weeks (28 Jan'19 - 22 Feb'19)
EXAM DATE : 31 Mar 2019

COURSE OUTLINE :

The course presents the contemporary computational perspective of the brain function using few or and for no equations. Therefore, it is accessible to people coming from both biological sciences and engineering sciences for someone from the 'hard' science it presents neuroscience in an engineering-style without using too much biology jargon.

ABOUT INSTRUCTOR :

Prof. Srinivas Chakravarthy is a faculty of Department of Biotechnology, IIT Madras. His research interests are in computational neuroscience, computational cardiology, Biomedical engineering and pattern recognition. He did his MS & PhD from University of Texas, USA.

COURSE PLAN

Week 1 : History of neuroscience, Brain through evolution

Week 2 : Neurons and neural signaling Networks that learn

Week 3 : Organization of the nervous system Maps in the brain

Week 4 : Memories and holograms, Emotions in the brain, Theories of Consciousness

BIOTECHNOLOGY & BIOSCIENCES

BIOREACTORS

PROF. G. K. SURAISHKUMAR
Department of Biotechnology
IIT Madras

TYPE OF COURSE : Rerun | Core | UG
COURSE DURATION : 4 weeks (28 Jan'19 - 22 Feb'19)
INTENDED AUDIENCE : Biological Eng., Biotechnology, Biochemical Eng., Chemical Eng., BE (other experienced students such as ME/MS/PhD can also register to get a unique viewpoint)
EXAM DATE : 31 Mar 2019
PRE-REQUISITES : Ability to appreciate simple mathematical analysis

INDUSTRIES APPLICABLE TO : All biotech and pharma industries (Biocon, Sanofi-Pasteur, Dr. Reddys, …)

COURSE OUTLINE :

Bioprocesses are used by any biotechnology/pharma industry to produce biological products that are widely used. This course, Bioreactors, will consider the heart of any bioprocess. It will present all aspects that are relevant for an appreciation of all relevant aspects of bioreactors. This course is expected to be of interest to students who want to learn about bioreactors, teachers who want to better understand the basis of their material, as well as industry personnel who are looking to better understand the principles and apply them to creatively solve their existing challenges.

ABOUT INSTRUCTOR :

Prof. G. K. Suraishkumar is a Professor in the Department of Biotechnology, Indian Institute of Technology Madras (IITM). He has been at IITM as a Professor since May 2004, and was earlier a faculty member in the Department of Chemical Engineering and centre for Biotechnology at the Indian Institute of Technology Bombay (IITB) from April 1993 until mid-May 2004. He earned his Ph.D. from Drexel University, Philadelphia, USA in 1993, and his B.Tech. in Chemical Engineering from IITM in 1986. He also did his Masters work at the University of Cincinnati, USA, between 1986 and 1988.

COURSE PLAN :

Week 01 : Introduction | Two important outcomes of a bioprocess: biomass (cells) and bio-products.
Week 02 : Common bioreactor operation modes.
Week 03 : Factors that affect bioreactor performance.
Week 04 : The cell-view of a bioreactor.

LEARNING ABOUT LEARNING: A COURSE ON NEUROBIOLOGY OF LEARNING AND MEMORY

BIOTECHNOLOGY & BIOSCIENCES

PROF. BALAJI JAYAPRAKASH
Centre for Neuroscience
IISc Bangalore

TYPE OF COURSE : New | Elective | UG/PG
INTENDED AUDIENCE : Advanced UG, MSc, PhD
COURSE DURATION : 4 weeks (28 Jan'19 -22 Feb'19)
EXAM DATE : 31 March 2019

INDUSTRIES APPLICABLE TO : Reinforcement Learning Based Industries, Learning Systems, Reward Mechanisms, Consulting Industry

COURSE OUTLINE :

In this course we propose to teach the rules governing learning and how they result in storage of information in the form of memory. The course structure is such that the lectures introduce the student/listener to the fundamental rules that determine learning through a historical perspective. Such a design helps the listener/student to understand how these rules came about, what were the experimental observations that led to the rules. In the course we will be using these rules and apply to various situations and experimental setting and analyse the behavioural outcomes.The framework for understanding associative learning is presented in the first few lectures followed by reinforcement learning/instrumental conditioning. In the end synergistic views of both the learning are presented followed by description of some of the modern behavioural paradigms. Towards the later part of the course the lectures connect these behavioural studies to molecular underpinnings.

ABOUT INSTRUCTOR :

Dr. Jayaprakash is an Assistant Professor at the Centre for Neuroscience, Indian Institute of Science Research:

- ✔ Learning and Memory Post Doctoral Fellow with Prof. Silva, Department of Neurobiology, UCLA, Los Angeles, July 2007- Dec 2011 .
- ✔ Post Doctoral Fellow with Prof. Ryan, Department of Biochemistry, Weil Medical College of Cornell University, New York, NY - 10021. USA, 2005 - 2007 .
- ✔ Tata Institute of Fundamental Research, Visiting Fellow, 2004 - 2005.
- ✔ Institute of Fundamental Research, Ph.D. (Chemistry), 2004.

COURSE PLAN :

Week 01 : Introduction, Ebbinghaus, Lashley, Penfield, Brenda Millner, Memory Classification
Week 02 : Classification of Learning, Intro to non-associative learning, Habituation, Sensitisation Gil withdrawal reflex
Week 03 : Introduction to Classical Conditioning: Associative Learning, Pavlovian Conditioning Factors governing association Contiguity vs Contingency, Negative Contingency, Garcia and Koleings Experiment & Kamin's Blocking
Week 04 : Theories of Conditioning: Rescorla Wagner -1 Development of the Framework

INTRODUCTORY MATHEMATICAL METHODS FOR BIOLOGISTS

BIOTECHNOLOGY & BIOSCIENCES

PROF. RANJITH PADINHATEERI
Department of Biotechnology
IIT Bombay

TYPE OF COURSE : Rerun | Core | UG/PG
INTENDED AUDIENCE : Students, PhD scholars, teachers, industry
COURSE DURATION : 8 weeks (25 Feb'19 - 19 Apr'19)
EXAM DATE : 28 Apr 2019

COURSE OUTLINE :

It is an introductory mathematics course for biology students with the aim of training them to do quantitative analysis of biological systems. Students will be trained on how to use the language of mathematics to describe biological processes, how to write down simple mathematical equations for various phenomena occurring in biology.

ABOUT INSTRUCTOR :

Prof. Ranjith Padinhateeri completed his MSc and PhD in Physics from IIT Madras. He is currently a faculty at Department of Biosciences & Bioengineering at Indian Institute of Technology Bombay. During PhD he studied statistical mechanics of DNA. After PhD he did post-doctoral research in University of Illinois Chicago, USA, Northwestern University, Evanston, USA, and Institute Curie, Paris, France. He does his research in the broad area of biological physics. Prof. Ranjith Padinhateeri does theoretical studies to understand various biological phenomena using a variety of tools from physics, including equilibrium and non-equilibrium statistical mechanics, polymer physics, and soft-matter theory. He tackles research problems using a combination of computational and analytical methods. His specific areas of interest include Nucleosome dynamics, Chromatin assembly, DNA mechanics and self-assembly of proteins.

COURSE PLAN

Week 1 : Introduction, Graphs and Functions

Week 2 : Functions and its Derivatives, Computing Derivatives of Curves

Week 3 : Plotting Curves , Numerical Calculation of Derivatives, Partial Derivatives

Week 4 : Integration, Graphical Understanding

Week 5 : Vectors : Position and Movement in 2D, Cell Symmetry : Use of Polar Coordinates

Week 6 : Gradient, Forces and Flows , Understanding Diffusion

Week 7 : Introduction to Fourier series , Fourier Transform

Week 8 : Basics of bio-statistics

MEDICAL BIOMATERIALS

BIOTECHNOLOGY & BIOSCIENCES

PROF. MUKESH DOBLE
Department of Biotechnology
IIT Madras

TYPE OF COURSE : Rerun | Elective | UG/PG

PRE-REQUISITES : Basics of physics, chemistry and mathematics.

COURSE DURATION : 8 weeks (25 Feb'19 - 19 Apr'19)

EXAM DATE : 27 Apr 2019

INDUSTRIES APPLICABLE TO : Implants,devices,biomaterials industries.

INTENDED AUDIENCE : UG/PG Biotech programmes (core or elective) and research scientists in biotechnology, material science and metallurgy,surgeons,clinicians, dentists

COURSE OUTLINE :

Biomaterial is any natural or synthetic material used to replace or augment a part of the body so that it improves the human health by restoring the function of the natural living tissue or organ. It should be biocompatible and should not cause any adverse systemic reaction to the host. It could be a polymer,metal,ceramic or combination of these. It may have to be in contact or remain in the body for few hours or for rest of the life of the person.

ABOUT INSTRUCTOR :

Prof. Mukesh Doble is a Professor at the Department of Biotechnology at IIT Madras. He has previously worked in Imperial chemical Industries(ICI) and General Electric(GE) for 20 years . Areas of research are Biomaterials, Biopolymers and Drug design. Published 270 papers and 10 books and filed 10 patents (including two US). Has delivered on line video courses in Downstream processes and Biostatistics.

COURSE PLAN

Week 1 : Introduction to Biomaterials
Background history
Properties (Mechanical and Physico-chemical)

Week 2 : Mechanical properties; Resorbability, biodegradation; Biofilm

Week 3 : Biofilm; Material characterization - Analytical instruments

Week 4 : Analytical instruments; Biological responses, compatibility, cytotoxicity
Proteins, Tissue and blood Response; Cell-biomaterial interaction

Week 5 : Animal trials (in vivo)
Metals-types, classifications, applications
Metals - properties

Week 6 : Metals
Polymers-types, classifications, applications

Week 7 : Blends/composites
Biopolymers; Hydrogels
Preparation of different morphologies (with experiments)
Surface modifications (with experiments)

Week 8 : Ceramics; Drug delivery systems/encapsulation
Biomaterials for cardiovascular/pulmonary/ophthalmological applications
Biomaterials for urinary/dental/skin applications
Sterilization of implants, device failures, unique issues, conclusion

BIOTECHNOLOGY & BIOSCIENCES

CELL CULTURE TECHNOLOGIES

PROF. MAINAK DAS
Department of Bioengineering and Design
IIT Kanpur

TYPE OF COURSE : Rerun | Core | UG/PG

COURSE DURATION : 8 weeks (25 Feb'19 - 19 Apr'19)

INTENDED AUDIENCE : UG and PG students pursuing biology, biotechnology, zoology and bio-engineering.

EXAM DATE : 27 Apr 2019

PRE-REQUISITES : Biology at standard 10th (Secondary school examination)

INDUSTRIES APPLICABLE TO : Biomedical industries, Biotechnology industry, Drug -discovery industry

COURSE OUTLINE :

The course will be a short primer to understand how 'animal cell culture technologies' have strengthened the bio-medical research from basic research to the modern drug discovery. Animal cell culture was first performed in the very first decade of 19th century. Since then, tremendous development has taken place in this field. The lectures will help the researcher to appreciate the developments during last hundred years and will help them to independently set up cell culture laboratories. For non-biologist, it will be an informal way to demystify the intriguing routes of biomedical research where cell culture is a very 'potent tool'.

ABOUT INSTRUCTOR :

Prof. Mainak Das is a faculty of IIT Kanpur India in the Department of Biological Sciences & Bioengineering since April 2010. He did his bachelors degree (1989-1994) in agriculture from College of Agriculture Indore. Thereafter he did his post graduate degree (1994-1997) in animal physiology from National Dairy Research Institute Karnal India. Following his post graduate studies, he worked as researcher in IISc Bangalore India (1997-1999), University of Neuchatel, Switzerland (1999-2000), University of Clemson, USA (2000-2004) and in University of Central Florida, USA (2004-2010). He did his doctoral studies from College of Medicine of University of Central Florida (2004-2008), while working as a full time employee of the university.

COURSE PLAN :

Week 01 : Introduction & biology of cultured cells

Week 02 : Equipments, aseptic techniques, safety protocols

Week 03 : Culture vessels & media development

Week 04 : Serum-free medium development & sterilization

Week 05 : Primary culture, secondary culture, cloning & selection

Week 06 : Cell separation, characterization, differentiation & transformation

Week 07 : Contamination, cryo-preservation & cyto-toxicity

Week 08 : Organo-typic culture & specialized cell culture techniques

BIOTECHNOLOGY & BIOSCIENCES

FOREST BIOMETRY

PROF. ANKUR AWADHIYA
MP Forest Department
(Indian Forest Service)

PROF. MAINAK DAS
Dept. of Bioengineering and Design
IIT Kanpur

TYPE OF COURSE : Rerun | Elective | PG

INTENDED AUDIENCE : Officers and staff of Forest dept, Students of Forestry, Students of Agriculture, Policy makers

PRE-REQUISITES : Has cleared 10+2 with science

COURSE DURATION : 8 weeks (25 Feb'19 - 19 Apr'19)

EXAM DATE : 27 Apr 2019

INDUSTRIES APPLICABLE TO : Green energy industries, Renewable energy / materials industry, Bio-fuel industries, Paper and pulp manufacturing industries, Plywood industries, Agroforestry industries.

COURSE OUTLINE :

This course aims to provide an overview of the methods of measuring the tree resources present in the forest. Going by the adage "whatever cannot be measured, cannot be managed," the estimation of the tree resources becomes crucial for managing a forest. It is important whether the forests are to be managed for commercial purposes such as wood production and energy production, or for non-commercial purposes. Forest biometry forms the foundation for the preparation of working plans that are technical documents for the working of any forest in India. The course will not only focus on the theories of measurement, but shall also provide an overview of the instrumentation basics of various equipments used for the purpose.

ABOUT INSTRUCTOR :

Dr. Ankur Awadhiya (B.Tech IIT Kanpur 2009, Ph. D IIT Kanpur 2015, AIGNFA IGNFA Dehradun 2016) is an IFS officer borne on the Madhya Pradesh cadre. His interests include photography, tourism, research, instrumentation and creative literary pursuits.

Prof. Mainak Das is an agriculture graduate (1989-1994) from College of Agriculture Indore, India. He did his master's in animal physiology (1994-1997) from National Dairy Research Institute, Karnal, India. Later, he did his doctoral studies (2004-2008) in biomedical sciences from University of Central Florida, USA. Since April 2010, he is a tenured faculty in bioengineering and design at Indian Institute of Technology, Kanpur, India. His area of research is green energy, bio-electricity, physiology and sensors.

COURSE PLAN :

Week 01 : Introduction
Week 02 : Tree form
Week 03 : Tree diameter
Week 04 : Tree height
Week 05 : Tree canopy
Week 06 : Basal area
Week 07 : Volume
Week 08 : Measurement of other attributes

BIOTECHNOLOGY & BIOSCIENCES

BIOENGINEERING: AN INTERFACE WITH BIOLOGY AND MEDICINE

PROF. SANJEEVA SRIVASTAVA
Department of Biosciences & Bioengineering
IIT Bombay

TYPE OF COURSE : New | Core | UG
COURSE DURATION : 8 weeks (25 Feb'19 - 19 Apr'19)
INTENDED AUDIENCE : B.E/B.Tech, B.Sc
EXAM DATE : 27 Apr 2019
INDUSTRIES APPLICABLE TO : GE Healthcare, Pall Life Sciences, Thermofisher Scientific

COURSE OUTLINE :

A basic biology course for first year engineering background. Course would provide basic understanding of biological concepts and also motivate students why understanding biology and bioengineering is crucial by illustrating several applications.

ABOUT INSTRUCTOR :

Dr. Sanjeeva Srivastava is the Group Leader of Proteomics Laboratory at the Indian Institute of Technology Bombay India (IITB). He obtained his Ph.D. from the University of Alberta and post-doc from the Harvard Medical School in the area of proteomics, stress physiology and has specialized expertise in applications of data enabled sciences in global health, developing country and resource limited settings. Dr. Srivastava has considerable experience for teaching proteomics courses and conducting hands-on crash-courses on proteomics at IIT Bombay and many other institutes.

COURSE PLAN :

Week 01 : Why biology for engineers | Life processes & Cell, Cell and its properties | Clinician's Perspective.
Week 02 : DNA Tools-Gene cloning | DNA Tools & Biotechnology.
Week 03 : DNA Tools & Biotechnology | Clinician's Perspective.
Week 04 : Genetics | Clinician's Perspective.
Week 05 : Chromosomal basis of inheritance | Linkage, chromosomal disorders | Classical Genetics experiments | Bacteria and Viruses | Clinician's Perspective.
Week 06 : Cell cycle | Cell cycle disregulation & Cancer | Developmental Biology | Principles and application of Animal Cloning | Evolution & Bioinformatics.
Week 07 : Amino acids & proteins | Proteins & Proteomics | Techniques to Study Protein & Proteome.
Week 08 : Techniques to Study Protein & Proteome | Protein Interactions & Microarrays | Protein interactions & Systems biology | Bioinformatics | Ethics in Research and Publications.

APPLICATIONS OF INTERACTOMICS USING GENOMICS AND PROTEOMICS TECHNOLOGIES

PROF. SANJEEVA SRIVASTAVA
Department of Biosciences and Bioengineering
IIT Bombay

TYPE OF COURSE : New | Elective | UG/PG
INTENDED AUDIENCE : (BE/B.Tech) Biotechnology, B.Sc. students
COURSE DURATION : 8 weeks (25 Feb'19 - 19 Apr'19)
EXAM DATE : 27 Apr 2019

INDUSTRIES APPLICABLE TO : GE Healthcare, Pall Life Sciences, Thermofisher Scientific, Illumina

COURSE OUTLINE :

Due to rapidly evolving technological platforms in biology, there is a need to keep pace with latest developments in field to explore their versatile applications. Interactions resulting from protein-protein, protein-peptide, protein-RNA, protein-DNA or protein- small molecule have immense application in life-sciences and translational biology. Through this course, we aim to provide an interface between distinguished scientists involved in advanced interactomics research, industrial partners, faculties and students. This course would feature an intensive lecture series followed by some demonstrations designed to provide the much needed training required to explore the endless possibilities in interactomics research using genomics and proteomics approach, that can be useful for a researcher at any stage.

ABOUT INSTRUCTOR :

Prof. Sanjeeva Srivastava was an Assistant Professor, Department of Biosciences and Bioengineering, IIT Bombay from 2009 to 2014, where he now is an Associate Professor, from 2014 onwards. Proteomics describes the study and characterization of complete set of proteins present in a cell, organ or organism at a given time. His laboratory is using high throughput proteomic techniques such as mass spectrometry and protein microarray etc. for biomarker discovery in cancer & tropical diseases of India, to study protein-protein interactions and drug target discovery. Information obtained from research program is also used for in silico studies and computing models to enhance the understanding in systems approach.

COURSE PLAN :

Week 01 : Introduction to Interactomics and Protein Arrays, Basics and Applications of Reverse Phase Protein Arrays-I, II, III, Weekly Perspective-I

Week 02 : NAPPA Technology and Protein Arrays - I, II, Using functional proteomics to identify biomarkers and therapeutic targets-I, II, Weekly Perspective-II

Week 03 : NAPPA Arrays: Workflow, NAPPA and its applications in study of antibody immune response in disease and in drug screening-I, II, III, Weekly Perspective -III

Week 04 : Biomarkers: Harnessing the immune system for early detection of disease-I, II, III, Multi-variate data analysis to identify potential leads from proteomic datasets-I, II

Week 05 : The Human Pathology Atlas: A Pathology Atlas of the Human Transcriptome-I, II, Antibody signatures defined by high-content peptide microarray analysis, Introduction to Bioprinting and Iris Optical QC Benefits, Cell-free expression system based protein arrays

Week 06 : An overview of label-free technologies-I, II, Mass Spectrometry coupled Interactomics-I, II, Biomolecular interactions using Bio-Layer Interferometry (BLI)

Week 07 : Surface Plasmon Resonance- Principles and Assays-I, II, SPR Application, Biomolecular interaction analytics using MicroScale Thermophoresis, NGS target enrichment workflow for exomes, targeted panels and beyond

Week 08 : Next-Gen Sequencing Technology-I, II, III, IV, Summary

BIOTECHNOLOGY & BIOSCIENCES

BIO-INFORMATICS:ALGORITHMS AND APPLICATIONS

PROF. MICHAEL GROMIHA
Department of Biotechnology
IIT Madras

TYPE OF COURSE : Rerun | Core/Elective | UG/PG
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
INTENDED AUDIENCE : PhD scholars, teachers, industry
EXAM DATE : 28 Apr 2019
PRE-REQUISITES : Basic knowledge of Biology and any computer language would be helpful

INDUSTRIES APPLICABLE TO : Cognizant, TCS

COURSE OUTLINE :

Bioinformatics is an interdisciplinary field of science for analyzing and interpreting vast biological data using computational techniques. In this course, we aim to give a walkthrough of the major aspects of bioinformatics such as the development of databases, computationally derived hypothesis, algorithms, and computer-aided drug design.

ABOUT INSTRUCTOR :

M Michael Gromiha received his Ph.D in Physics from Bharathidasan University, India and served as STA fellow, RIKEN Researcher, Research Scientist and Senior Scientist at Computational Biology Research Center, AIST, Japan till 2010. Currently, he is working as an Associate Professor at Indian Institute of Technology (IIT) Madras, India. He is teaching courses on bioinformatics, protein structure and function, protein interactions: computational techniques, big data analysis and handling computational biology lab. His main research interests are structural analysis, prediction, folding and stability of globular and membrane proteins, protein interactions and development of bioinformatics databases and tools. He has published over 200 research articles, 40 reviews, 5 editorials and a book on Protein Bioinformatics: From Sequence to Function by Elsevier/Academic Press.

COURSE PLAN

Week 1 : Introduction, DNA sequence analysis, DNA Databases

Week 2 : Protein structure and function, protein sequence databases, sequence alignment

Week 3 : PAM matrix, Global and local alignment, BLAST: features and scores

Week 4 : Multiple sequence alignment, Conservation score, phylogenetic trees

Week 5 : Protein sequence analysis, hydrophobicity profiles, non-redundant datasets

Week 6 : Protein secondary structures, Ramachandran plot, propensity, secondary structure prediction

Week 7 : Protein tertiary structure, Protein Data Bank, visualization tools, structural classification, contact maps

Week 8 : Protein structural analysis, protein structure prediction

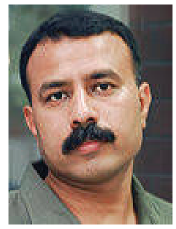
Week 9 : Protein stability, energetic contributions, database, stabilizing residues, stability upon mutations

Week 10 : Protein folding rates, proteins interactions, binding site residues

Week 11 : Computer aided drug design, docking, screening, QSAR

Week 12 : Development of algorithms, awk programming, machine learning techniques, applications using WEKA

WILD LIFE ECOLOGY



PROF. MAINAK DAS
Dept of Biological Science & Bioengineering Science
IIT Kanpur

PROF. ANKUR AWADHIYA
Madhya Pradesh Forest Department
Indian Forest Service

TYPE OF COURSE : New | Elective | UG |PG
PRE-REQUISITES : +2 Science
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 28 Apr 2019
INTENDED AUDIENCE : Officers and staff of Forest departments, Students of Forestry, Wildlife conservation and allied disciplines, Policy makers

INDUSTRIES APPLICABLE TO : Tourism industries, Education industries, Green energy industries, Renewable energy / materials industry

COURSE OUTLINE :

Wildlife is an enamouring field for most of us. In my professional tenure, I've observed numerous people flocking to get a glimpse of the tiger, to get an opportunity of diving with the fishes, or to get access to a National Park or a Wildlife Sanctuary. And these experiences gets even more endearing when you get to know how the show is getting managed, how and why we regulate access, and also how we maintain grasslands and water bodies to keep the systems up and running. This course will cover one such aspect of wildlife management by providing an overview of the field of Ecology.

ABOUT INSTRUCTOR :

Dr. Ankur Awadhiya (B. Tech IIT Kanpur 2009, Ph. D IIT Kanpur 2015, AIGNFA IGNFA Dehradun 2016, PGDAWM WII Dehradun 2018) is an IFS officer borne on the Madhya Pradesh cadre. His interests include photography, tourism, research, instrumentation and creative literary pursuits.

Prof. Mainak Das is a Faculty of IIT Kanpur, India in the Deparment of Biological Science & Bioengineering Science since April 2010. He did his bachelors degree in Agriculture from College of Agriculture, Indore. Thereafter he did his PG in Animal Physiology from National Dairy Research Institute, Karnal, India. He did his doctoral studies from College of Medicine of University of Central Florida.

COURSE PLAN :

Week 01 : Introduction
Week 02 : Ecological structure
Week 03 : Ecological interactions
Week 04 : Ecological energetics
Week 05 : Population Ecology
Week 06 : Community Ecology
Week 07 : Distribution & abundance
Week 08 : Management of threatened species
Week 09 : Human Ecology
Week 10 : Ecology of change
Week 11 : Applied Ecology
Week 12 : Revision

BIOTECHNOLOGY & BIOSCIENCES

ANIMAL PHYSIOLOGY

PROF. MAINAK DAS
Department of Bioengineering and Design
IIT Kanpur

TYPE OF COURSE : Rerun | Core | UG/PG
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
INTENDED AUDIENCE : BE/B.Sc, ME/M.Sc biology, biotechnology,zoology and bio-engineering
EXAM DATE : 28 Apr 2019
PRE-REQUISITES : Biology at standard 10th (Secondary school examination)

INDUSTRIES APPLICABLE TO : Biomedical industries

COURSE OUTLINE :

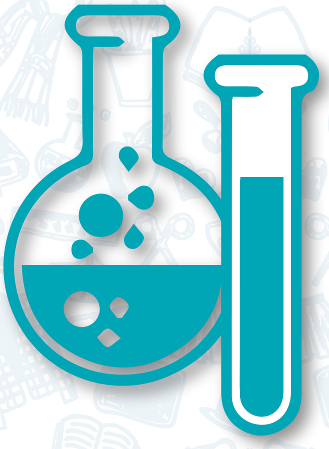
The course will be an informal journey to 'know your own body'. It will provoke you to think the following: How our body functions. What it is made up of and what are the organizational hierarchy of your body. How its regular function is disrupted and how the body tries to restore its normal functioning. How the body adjusts itself under extreme physiological situations and how it re-calibrates its functions?

ABOUT INSTRUCTOR :

Prof. Mainak Das is a faculty of IIT Kanpur India in the department of Biological Sciences & Bioengineering since April 26, 2010. He did his Bachelors degree (1989-1994) in agriculture from College of Agriculture Indore. Thereafter he did his post graduate degree (1994-1997) in animal physiology from National Dairy Research Institute Karnal India. Following his post graduate studies, he worked as researcher in IISc Bangalore India (1997-1999), University of Neuchatel, Switzerland (1999-2000), University of Clemson, USA (2000-2004) and in University of Central Florida, USA (2004-2010). He did his doctoral studies from College of Medicine of University of Central Florida (2004-2008), while working as a full time employee of the university. He introduced the regular physiology course for the PG students in IIT Kanpur in 2011.

COURSE PLAN :

Week 01 : Introduction
Week 02 : Skeletal system
Week 03 : Neural system
Week 04 : Neural system (contd...)
Week 05 : Endocrine system
Week 06 : Blood & heart
Week 07 : Lymphatic and respiratory system
Week 08 : Digestive system
Week 09 : Urinary system & fluid-electrolyte balance
Week 10 : Reproductive system and extreme physiology
Week 11 : Respiratory and Blood
Week 12 : Endocrine, Digestive, Blood, Kideny and Reproductive system



CHEMICAL ENGINEERING

CHEMICAL ENGINEERING

04 weeks

01. Mechanical Operations
02. Equipment Design: Mechanical Aspects

08 weeks

01. Engineering Thermodynamics
02. Chemical Process Control
03. Waste to Energy Conversion
04. Thermodynamics Of Fluid Phase Equilibria
05. Mass, Momentum and Energy balances in Engineering Analysis

12 weeks

01. Chemical Engineering Thermodynamics
02. Mass Transfer Operations -I
03. Computational Fluid Dynamics
04. Chemical Reaction Engineering II
05. Heat Transfer
06. Process Control - Design, Analysis and Assessment
07. Transport Phenomena of Non-Newtonian Fluids
08. Fluid Flow Operations

CHEMICAL ENGINEERING

MECHANICAL OPERATIONS

PROF. SHABINA KHANAM
Department of Chemical Engineering
IIT Roorkee

COURSE DURATION : 4 weeks (28 Jan'19 - 22 Feb'19)

EXAM DATE : 31 Mar 2019

TYPE OF COURSE : Rerun | Core | UG

INTENDED AUDIENCE : Undergraduate students. However, this course will also be helpful for anyone of any professional level, preferably holding a college degree or with substantial industrial experience, working in the production, handling, processing, modification or characterization of particular solids (powders and bulk solids).

INDUSTRIES APPLICABLE TO : Any chemical industry which deals with particulate matter

COURSE OUTLINE :

Around 75% of chemical manufacturing processes involve small solid particles at some point. Proper design and handling of these fine particles often makes the difference between success and failure of the product. Many products such as catalysts, pigments, fertilizers, cements, ceramics and pharmaceuticals are currently manufactured in particulate forms. Mechanical Operations deal with Science and Technology of particulate matter, which is a multidisciplinary field including Materials Science, Environmental, Biomedical, Aerospace, Agricultural, Chemistry, Microbiology and Cell Science, Pharmacy and Medicine. The primary objective of this course is to identify the important physical mechanisms occurring in processes involving particles ; discuss unit operation and its role in Chemical industries, characteristics of particulate solids, Principles of size reduction, particle dynamics and separation of particles; formulate and solve mathematical descriptions of such processes.

ABOUT INSTRUCTOR :

Shabina Khanam is working as Associate Professor in Chemical Engineering Department of IIT Roorkee. She has completed B.Tech degree from AMU Aligarh, Aligarh in 2000 and M.Tech and Ph.D. degree from IIT Roorkee in 2002 and 2007, respectively. Her major fields of study are Process Integration, Energy Management and Modeling and Simulation. She has almost 9 years of experience in teaching and research. During this period she has supervised 1 Ph.D. and 14 M.Tech theses. At present 6 Ph.D and 3 M.Tech theses are in pipe line. She has published 29 and 24 research papers in different refereed journals and conferences, respectively. She has taught the course Mechanical Operations six times in her 9 years of teaching career.

COURSE PLAN :

Week 01 : Introduction | Characterization of a single particle | Characterization of collection of particles.

Week 02 : Fine grain size distribution | Effectiveness of screen | Industrial screening equipment | Size reduction.

Week 03 : Laws of comminution | Examples of laws of comminution | Size reduction equipment.

Week 04 : Particle dynamics | Particle dynamics – Examples | Classification and Jigging.

CHEMICAL ENGINEERING

EQUIPMENT DESIGN: MECHANICAL ASPECTS

PROF. SHABINA KHANAM
Department of Chemical Engineering
IIT Roorkee

TYPE OF COURSE : New | Core | UG
COURSE DURATION : 4 weeks (28 Jan'19 - 22 Feb'19)
INTENDED AUDIENCE : Undergraduate students. However, this course will also be helpful for those who have substantial industrial experience while working in chemical processes & designing process equipment.
EXAM DATE : 31 Mar 2019

INDUSTRIES APPLICABLE TO : Any chemical process plant

COURSE OUTLINE :

Chemical process plants include a number of important equipment such as reactors, distillation columns, absorbers, heat exchangers, evaporators, crystallizers, etc. Design of such equipment should be carried out a priory to set-up a process plant and thus, it is basic step in a chemical process. Mechanical design of equipment addresses the stress and strain produced in different parts of the equipment such as shell, head, support, etc. due to operating conditions of the process. The success and failure of the process depends on how perfectly stress and strain are considered while designing. Thus, the present course enables one to learn about the mechanical design of chemical process equipment.

ABOUT INSTRUCTOR :

The instructor is working as Associate Professor in Chemical Engineering Department of IIT Roorkee. She has completed B.Tech degree from AMU Aligarh, Aligarh in 2000 and M.Tech and Ph.D. degree from IIT Roorkee in 2002 and 2007, respectively. Her major fields of study are Process Integration, Energy and Mass Conservation and Modeling and Simulation of Chemical Processes. She has almost 10 years experience in teaching and research. During this period she has supervised 3 Ph.D. and 19 M.Tech. theses. At present 5 Ph.D and 3 M.Tech theses are in pipe line. She has published 29 and 28 research papers in different refereed journals and conferences, respectively. She has taught the proposed course six times in her 10 years teaching career.

COURSE PLAN :

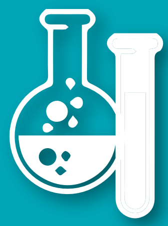
Week 01 : Introduction,Stress and Strain Relationship ,Terminologies,Design of Shell

Week 02 : Design of Heads ,Compensation for Opening

Week 03 : L/D ratio of vessel,Design of Flanges

Week 04 : Design of Support,Vessel under external pressure,Vessel under very high pressure

ENGINEERING THERMODYNAMICS



PROF. JAYANT K. SINGH
Department of Chemical Engineering
IIT Kanpur

TYPE OF COURSE : Rerun | Core | UG
COURSE DURATION : 8 weeks (28 Jan'19 - 22 Mar'19)
INTENDED AUDIENCE : BE
EXAM DATE : 31 Mar 2019
PRE-REQUISITES : An introductory background in chemistry, physics and maths (calculus) will be needed. Thus, the course is ideal for first or second year engineering students.
INDUSTRIES APPLICABLE TO : All engineering based industry

COURSE OUTLINE :

This course provides an introduction to the most powerful engineering principles -Thermodynamics: the science of energy and its transformation from one form to another form. The subject is widely applicable in several branches of engineering and science. The objective of this course is to introduce different tools needed to analyze energy systems from various daily lives to large scale engineering applications. More specifically, we will cover the topics of mass and energy conservation principles; first law analysis of closed and open systems; understanding second law of thermodynamics and entropy; exergy; properties of pure substances; power generation and refrigeration on thermodynamic cycles; thermodynamic relation, combustion and reaction.

ABOUT INSTRUCTOR :

Dr. Jayant K. Singh received his B.Tech from IIT Kanpur in Chemical engineering in 1997. He subsequently completed his Masters degree in computer science and engineering and Ph.D. in Chemical engineering in the area of molecular simulation from SUNY Buffalo, USA in 2004. Dr. Singh is currently a professor in the department of Chemical engineering at IIT Kanpur. Dr. Singh's current research interest is in thermodynamics and statistical mechanics, material modeling, confined fluids and development of molecular simulation tools. Dr Singh has co-authored more than 100 peer reviewed articles in international journals of repute. He is a recipient of prestigious awards such as Humboldt Fellow for experienced researcher, Young Engineers of Indian National Academy of Engineers, Amar-Dye Chem award and BRNS Young Scientist Award. He is also an elected member of National Academy of Sciences, Allahabad.

COURSE PLAN :

Week 01 : Introduction to Energy and Energy transfer
Week 02 : Properties of Pure Substances
Week 03 : Energy analysis of closed system
Week 04 : Mass and Energy analysis of open systems
Week 05 : The second law of thermodynamics and entropy
Week 06 : Energy Analysis
Week 07 : Power & Refrigeration cycles
Week 08 : Thermodynamic Potentials I Law application to Chemical Reacting Systems.

CHEMICAL PROCESS CONTROL

PROF. SUJIT JOGWAR
Department of Chemical Engineering
IIT Bombay

TYPE OF COURSE : New | Core | UG
INTENDED AUDIENCE : Chemical Engineering, BE (Chem Engg)
PRE-REQUISITES : Material and Energy balances
COURSE DURATION : 8 weeks (25 Feb'19 - 19 Apr'19)
EXAM DATE : 27 April 2019

COURSE OUTLINE :

In this course, we will begin with the dynamic analysis of chemical engineering systems which will tell us how these systems behave. After knowing their behavior, we will move to controlling this behavior as per our choice with the help of a control system. Lastly, using advanced controller, we will see how this can be achieved in the most intelligent way.

ABOUT INSTRUCTOR :

Professor Sujit Jogwar is an Assistant Professor in the Department of Chemical Engineering at IIT Bombay. He has 12+ years of research experience in the area of advanced process control. He has taught chemical process control course in academia as well as industry.

COURSE PLAN :

Week 01 : Introduction to process dynamics and control

Week 02 : First order dynamic systems

Week 03 : Second and higher order dynamic systems

Week 04 : Introduction to feedback control

Week 05 : Stability analysis

Week 06 : Feedback control design

Week 07 : Advanced control topics

Week 08 : Multivariable and batch process control

CHEMICAL ENGINEERING

WASTE TO ENERGY CONVERSION

PROF. PRASENJIT MONDAL
Department of Chemical Engineering
IIT Roorkee

TYPE OF COURSE : Rerun | Elective | UG/PG
INTENDED AUDIENCE : B.E/B.Tech,M.E/M.Tech,M.S
PRE-REQUISITES : BE in Chemical, Mechanical, Environmental Eng., Biotech.
COURSE DURATION : 8 weeks (25 Feb'19 - 19 Apr'19)
EXAM DATE : 28 Apr 2019

COURSE OUTLINE :

The course deals with the production of energy from different types of wastes through thermal, biological and chemical routes. It is intended to help the young scientific professionals to keep their knowledge upgraded with the current thoughts and newer technology options along with their advances in the field of the utilization of different types of wastes for energy production.

ABOUT INSTRUCTOR :

Prof. Prasenjit Mondal, is presently working as Associate Professor in the Department of Chemical Engineering, Indian Institute of Technology Roorkee, India. He joined the institute in 2009 as Assistant Professor. He has also worked as Process Engineer in industry for two years and as scientist in Centre for Scientific and Industrial Research, India for three years before joining IIT Roorkee. His area of research is Energy and Environmental Engineering (Water /wastewater treatment through adsorption, electrocoagulation and biological processes including phytoremediation, microbial fuel cells, oil from algae, energy from coal, biomass and wastes, life cycle assessment). He has handled number of R&D projects sponsored by Industry, Govt. of India and International Agencies.

COURSE PLAN :

Week 1 : Introduction, characterization of wastes.

Week 2 : Energy production form wastes through incineration, energy production through gasification of wastes.

Week 3 : Energy production through pyrolysis and gasification of wastes, syngas utilization.

Week 4 : Densification of solids, efficiency improvement of power plant and energy production from waste plastics.

Week 5 : Energy production from waste plastics, gas cleanup.

Week 6 : Energy production from organic wastes through anaerobic digestion and fermentation, introduction to microbial fuel cells.

Week 7 : Energy production from wastes through fermentation and transesterification.

Week 8 : Cultivation of algal biomass from wastewater and energy production from algae.

THERMODYNAMICS OF FLUID PHASE EQUILIBRIA

CHEMICAL ENGINEERING

PROF. JAYANT K. SINGH
Department of Chemical Engineering
IIT Kanpur

TYPE OF COURSE : Rerun | Core | PG
INTENDED AUDIENCE : BE - Chemical Engg.
PRE-REQUISITES : An introduction course on Thermodynamics
COURSE DURATION : 8 weeks (25 Feb'19 - 19 Apr'19)
EXAM DATE : 28 Apr 2019

INDUSTRIES APPLICABLE TO : All engineering based industies.

COURSE OUTLINE :

The goal of this course is to introduce molecular thermodynamics as a practical tool for engineering applications. In particular, the course would present the first year graduate student or senior undergraduate student a broad introduction to the thermodynamics of phase equilibria typically encountered in designing chemical products and processes. The course is suitable for those students who have completed their course in undergraduate thermodynamics. It would be further useful if the student has also done the first undergraduate course on chemical engineering thermodynamics.

ABOUT INSTRUCTOR :

Dr. Jayant K. Singh received his B.Tech from IIT Kanpur in Chemical engineering in 1997. He subsequently completed his Masters degree in Computer Science and Engineering and Ph.D. in Chemical Engineering in the area of molecular simulation from SUNY Buffalo, USA in 2004. Dr. Singh is currently a Professor in the Department of Chemical engineering at IIT Kanpur. Dr. Singh's current research interest is in thermodynamics and statistical mechanics, material modeling, confined fluids and development of molecular simulation tools. Dr Singh has co-authored more than 100 peer reviewed articles in international journals of repute. He is a recipient of prestigious awards such as Humboldt Fellow for experienced researcher, Young Engineers of Indian National Academy of Engineers, Amar-Dye Chem award and BRNS Young Scientist Award. He is also an elected member of National Academy of Sciences, Allahabad.

COURSE PLAN :

Week 01 : Introduction, Review of first Law for closed and open systems, Properties of ideal gas and real fluids
Week 02 : Thermodynamics calculus, thermodynamics derivatives, Euler's theorem for homogeneous functions, Legendre's transformations, Derivative in terms of measurable properties, elementary statistical mechanics
Week 03 : Thermodynamics of Phase Equilibria, Open systems, Ideal Mixtures, Equilibrium in a Heterogeneous Closed System, Fugacity
Week 04 : Thermodynamic Properties from Volumetric Data, Thermodynamic Properties with P, T as Independent Variable, Fugacity of Liquids and Solids, Thermodynamic Properties with V, T as Independent Variables, Approaches to Phase Equilibria Calculations
Week 05 : Intermolecular forces, corresponding states, Osmotic systems
Week 06 : Fugacity in Gas Mixture, Virial equation of state, fugacities from Virial equation, Fugacities at high densities, Solubilities of solids and liquids in compressed gases
Week 07 : Fugacities in Liquid Mixure: Excess function
Week 08 : Fugacities in Liquid Mixure: Models and Theory of Solution

CHEMICAL ENGINEERING

MASS, MOMENTUM AND ENERGY BALANCES IN ENGINEERING ANALYSIS

PROF. PAVITRA SANDILYA
Department of Cryogenic Engineering Centre
IIT Kharagpur

TYPE OF COURSE : New | Core | UG/PG
COURSE DURATION : 8 Weeks (28 Jan'19 - 22 Mar'19)
INTENDED AUDIENCE : Aerospace/ Mechanical/ Chemical/ Ocean/ Cryogenic/ Marine/ Naval
EXAM DATE : 31 March 2019
PRE-REQUISITES : 10+2 Science and Mathematics
INDUSTRIES APPLICABLE TO : All process and allied industries

COURSE OUTLINE :

The course is intended to revisit the conservation laws as a primer for the study of the transport phenomena and thermodynamics. Both macroscopic and microscopic approaches in applying these laws will be dealt with. The students will learn how to make mass, momentum and energy balances by going through the course.

ABOUT INSTRUCTOR :

Prof. Sandilya has been teaching at the Cryogenic Engineering Centre of IIT Kharagpur since 2002. He has been offering both core and elective courses on mass transfer, separation processes, LNG, CFD etc. to both UGs and PGs . His research area encompasses process intensification, nonconventional energy, carbon capture, cryogenic storage, catalyst development, hydrogen separation etc.

COURSE PLAN :

Week 01 - 02 : Introduction to linear algebra (vectors, tensors, and matrix operations)
Week 03 : Introduction to numerical methods (roots of nonlinear algebraic equations, regression, interpolation etc.)
Week 04 : Introduction to numerical methods (numericalintegration/differentiation, solution of ordinary and partial differential equations)
Week 05 : Macroscopic approaches to mass, momentum and energy balances
Week 06 : Microsopic approach to mass balance
Week 07 : Microsopic approach to momentum balance
Week 08 : Microsopic approach to energy balance

CHEMICAL ENGINEERING THERMODYNAMICS

CHEMICAL ENGINEERING

PROF. SASIDHAR GUMMA
Department of Chemical Engineering
IIT Guwahati

TYPE OF COURSE : New | Core | UG
INTENDED AUDIENCE : B.Tech in Chemical Engineering
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 27 April 2019

INDUSTRIES APPLICABLE TO : Chemical process industries including IOCL,HPCL,BPCL,GAIL,ONGC,etc.

COURSE OUTLINE :

This course will deal with evaluation and application of the laws of thermodynamics with respect to physical and chemical processes. Real gas behavior,solution thermodynamics,phase and reaction equilibria will be discussed.It will lay foundation for other chemical engineering courses such as mass transfer,chemical reaction engineering etc.It will demonstrate the application of the fundamental concepts of thermodynamics to a wide variety of processes occuring in Chemical Engineering. It will enable the students to develop skills necessary to make appropriate assumptions in specific Chemical Engineering problems.

ABOUT INSTRUCTOR :

Dr. Sasidhar Gumma is currently a Professor of Chemical Engineering at IIT Guwahati. Dr. Gumma has over 14 years of teaching and research experience at IIT Guwahati. He was visiting Research Professor at Cleveland state between 2003-2004. He has served as vice chairman, GATE 2012 as well as chairman, GATE 2013 for IIT Guwahati Zone. He has also been the convener for curriculum revision committee.

COURSE PLAN :

Week 01 : First Law and its applications

Week 02 : Entropy and the second law

Week 03 : Equations of state

Week 04 : Generalized correlations

Week 05 : Solution Thermodynamics

Week 06 : Ideal solutions and Excess properties

Week 07 : Phase equilibria and Raoult's law properties

Week 08 : Gamma-phi formulation

Week 09 : Thermodynamic consistency

Week 10 : Reaction Equilibria

Week 11 : Multi-reaction equilibria

Week 12 : Reaction equilibria in heterogeneous systems

MASS TRANSFER OPERATIONS -I

CHEMICAL ENGINEERING

PROF. BISHNUPADA MANDAL
Department of Chemical Engineering
IIT Guwahati

TYPE OF COURSE : New | Core | UG
INTENDED AUDIENCE : B.Tech in Chemical Engineering
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 28 April 2019

INDUSTRIES APPLICABLE TO : Almost all Chemical industries including IOCL, OIL,ONGC,etc.

COURSE OUTLINE :

This course will provide an overview of mass transfer operation at basic to an intermediate level.coverage will be relatively broad.This course applies the concepts of diffusion and interphase mass transfer to the analysis of differend mass transfer operations such as absorption and distillation.The goal is to provide students with the theoretical/analytical background to understand mass transfer operations as well as application and to tackle the sort of complex problems.

ABOUT INSTRUCTOR :

Dr. Bishnupada Mandal is currently a Professor and Head in the Department of Chemical Engineering at the Indian Institute of Technology Guwahati. Dr.Mandal has over 15 years of teaching and research experience at IIT Guwahati. He received B.Sc in Chemistry (Honours) and B.Tech in Chemical Engineering from University of Calcutta, M.Tech in Chemical Engineering from Jadavpur University, Kolkata and Ph.D in Engineering from IIT Kharagpur, India. He was Visiting Research Professor in the Department of Chemical & Biomolecular Engineering at the Ohio State Engineering, Columbus, Ohio, USA during May-July 2017. He has served as Vice Chairman, IIT-JEE 2011 as well as Chairman, IIT-JEE 2012 for IIT Guwahati Zone.

COURSE PLAN :

Week 01- 02 : Diffusion Mass Transfer

Week 03-04 : Mass Transfer Coefficients

Week 05 : Equipment for Gas-Liquid Operations

Week 06-07 : Absorption

Week 08-12 : Distillation

CHEMICAL ENGINEERING

COMPUTATIONAL FLUID DYNAMICS

PROF. SREENIVAS JAYANTI
Department of Chemical Engineering
IIT Madras

TYPE OF COURSE : Rerun | Elective | UG/PG

COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)

INTENDED AUDIENCE : Chemical/Mechanical/ Civil/Aerospace Engg

EXAM DATE : 28 Apr 2019

PRE-REQUISITES : At least one course in fluid mechanics. In addition, at least one course in numerical techniques and one course in computer programming would be essential

INDUSTRIES APPLICABLE TO : Automobile, Process, Power generation industries

COURSE OUTLINE :

The course deals with the numerical solution of equations governing fluid flow and would be of interest to engineers and scientists - both aspiring and professional - with chemical/ mechanical/ civil/ aerospace engineering applications. In all these fields, one needs to deal extensively with fluid flow related phenomena and one needs to resolve flow-related features of the processes and equipment. Although the equations governing fluid flow have been formulated more than 150 years ago, it is only in recent years that these are being solved in the practical applications in which the flow occurs. The course deals with the basic techniques that enable the numerical solution of these equations.

ABOUT INSTRUCTOR :

Dr. Sreenivas Jayanti studied mechanical engineering at IIT-BHU, Varanasi, India; nuclear engineering at Ohio State University, Columbus, Ohio, USA; fluid mechanics at INPG, Grenoble, France, and obtained his PhD from the department of Chemical Engineering at Imperial College, London, UK in 1990. After a post-doctoral fellowship at Imperial College, he joined IIT Madras as a visiting faculty in 1994. He is currently a Professor in the Department of Chemical Engineering at IIT Madras. His main research interests include computational fluid dynamics, combustion and fuel cells.

COURSE PLAN :

Week 01 : Introduction : calculation of flow in a rectangular duct
Week 02 : Calculation of fully developed flow in a triangular duct
Week 03 : Derivation of equations governing fluid flow
Week 04 : Equations for incompressible flow and boundary conditions
Week 05 : Basic concepts of CFD: Finite difference approximations
Week 06 : Basic concepts of CFD: Consistency, stability and convergence
Week 07 : Solution of Navier Stokes equations for compressible flows
Week 08 : Solution of Navier Stokes equations for incompressible flows
Week 09 : Solution of linear algebraic equations: basic methods
Week 10 : Solution of linear algebraic equations: advanced methods
Week 11 : Basics of finite volume method including grid generation
Week 12 : Turbulent flows and turbulence modelling

CHEMICAL ENGINEERING

CHEMICAL REACTION ENGINEERING II

PROF. GANESH VISWANATHAN
Department of Chemical Engineering
IIT Bombay

TYPE OF COURSE : New | Elective | UG/PG
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
INTENDED AUDIENCE : BE (Chemical/Energy/Environmental Engg/Biotechnology), Petrochemical engineering
EXAM DATE : 27 April 2019
PRE-REQUISITES : Linear algebra, First course in reaction engineering, Heat and mass transfer
INDUSTRIES APPLICABLE TO : Reliance, HPCL, BPCL, RCF, Other chemical, pharmaceutical and petrochemical companies

COURSE OUTLINE :

Multiphase catalytic and non-catalytic reactors are ubiquitously found in chemical, biochemical and petrochemical industries for manufacturing variety of useful products. Effective design of such reactors for improved productivity requires detailed understanding of the underlying principles that govern their functioning. This second level course on chemical reaction engineering will extensively cover design of fluid-solid catalytic and non-catalytic reactors. Moreover, residence time distribution is an important aspect that is often used for various fault-diagnosis purposes. This course also covers various aspects of RTD and its applicability in designing non-ideal reactors. The material covered in this course will build on the basic topics of the first level chemical reaction engineering course.

ABOUT INSTRUCTOR :

Ganesh Viswanathan is an Associate Professor in Department of Chemical Engineering at Indian Institute of Technology Bombay, Mumbai. He obtained his Ph.D in Chemical Engineering from University of Houston and Postdoctoral training at Mount Sinai School of Medicine. His research interests are in the areas of systems biology, reactor engineering and non-linear dynamics.

COURSE PLAN :

Week 01 : Introduction, Introduction to catalysis and catalytic processes, Catalyst properties and classification, Steps in catalysis, Adsorption isotherm
Week 02 : Surface reaction, Rate controlling steps and Rate law, Rate law: Pseudo-steady state hypothesis, Heterogeneous data analysis for reactor design
Week 03 : Design of reactors: PBR and CSTR, Case study: Chemical Vapor Deposition, Catalyst deactivation
Week 04 : Catalyst deactivation: Reactor design, Diffusional effects: Introduction, Internal diffusion effects: Model development, Thiele modulus, Concentration profile
Week 05 : Internal effectiveness factor, Falsification of kinetics, External mass transport limitations
Week 06 : Mass transfer coefficient, Mass transfer to a single particle with reaction
Packed-bed reactor design, Mass transfer coefficient in Packed-beds, Example problems
Week 07 : Overall effectiveness factor, Identification of internal diffusion- and reaction-limited regimes, Packed-bed reactor design, Generalized criterion
Week 08 : Network of first order reactions, Use of experimental data, Packed-bed reactor design with external and internal mass transfer limitations, Fluidized bed reactor design
Week 09 : Fluidized bed reactor design, Fluid-solid non-catalytic reactions
Week 10 : Fluid-solid non-catalytic reactions, Residence time distribution (RTD): Introduction, Non-ideal reactors
Week 11 : Measurement of RTD, RTD function, Properties of RTD function, Reactor diagnostics and troubleshooting
Week 12 : Reactor diagnostics and troubleshooting, Modeling non-ideal reactors, Zero parameter models

CHEMICAL ENGINEERING

HEAT TRANSFER

PROF. GANESH VISHWANATHAN
Department of Chemical Engineering
IIT Bombay

TYPE OF COURSE : Rerun | Core | UG
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
INTENDED AUDIENCE : Chemical and Mechanical Engg Process engineers
EXAM DATE : 28 Apr 2019
PRE-REQUISITES : Linear algebra, Fluid Mechanics
INDUSTRIES APPLICABLE TO : Reliance, HPCL, BPCL, RCF, Other chemical and petrochemical industries

COURSE OUTLINE :

Heat transfer occurs in many unit operations in variety of processes in chemical, petrochemical, power and pharmaceutical industries. Understanding the fundamentals governing heat transfer is key to designing equipment that involves heat exchange. This course for undergraduate students covers the fundamental aspects and quantitation of different modes of heat transport. The course can also serve as a refresher for graduate students.

ABOUT INSTRUCTOR :

Ganesh Viswanathan is an Associate Professor in Department of Chemical Engineering at Indian Institute of Technology Bombay, Mumbai. He completed his Ph.D in Chemical Engineering from University of Houston, Houston and Postdoctoral Fellowship at Mount Sinai School of Medicine, New York. He conducts research in systems biology of signaling networks and nonlinear dynamics of reactors. Further information about his research and teaching activities is available at http://www.che.iitb.ac.in/faculty/ganesh/

COURSE PLAN :

Week 1: Introduction; Introduction to Conduction; : Energy Balance; 1D Steadystate Conduction - Resistance Concept; Resistances in Composite Wall Case
Week 2: Resistances in Radial systems; Heat Generation I : Plane and Cylindrical Wall; Introduction to Extended Surfaces; Extended Surfaces I : General formulation; Extended Surfaces II - Uniform Cross-sectional Area
Week 3: Extended Surfaces III – Varying Cross-section area; 2D Plane wall; Transient Analyses I : Lumped Capacitance Method; Transient Analyses II : Full Method; Transient Analyses : Semi-infinite Case
Week 4: Introduction to Convective Heat Transfer; Heat and Mass Transport Coefficients; Boundary Layer : Momentum,Thermal and Concentration; Laminar and Turbulent Flows ; Momentum Balance; Energy and Mass Balances ; Boundary Layer Approximations
Week 5: Order of Magnitude Analysis; Transport Coefficients; Relationship between Momentum,Thermal and Concentration boundary Layer; Reynolds and Chilton-Colburn Analogies; Forced Convection : Introduction
Week 6: Flow Past Flat Plate I – Method of Blasius; Flow Past Flat Plate II - Correlations for Heat and Mass Transport; Flow Past Cylinders; Flow through Pipes I; Flow through Pipes II
Week 7: Flow through Pipes III; Flow through Pipes IV – Mixing-cup Temperature; Flow through Pipes V – Log mean Temperature difference; Flow through Pipes VI – Correlations for Laminar and Turbulent Conditions; Example problems : Forced Convection
Week 8: Introduction to Free/Natural Convection; Heated plate in a quiescent fluid- I; Heated plate in a quiescent fluid- II; Boiling I; Boiling II
Week 9: Condensation : I; Condensation : II; Radiation : Introduction; Spectral Intensity; Radiation : Spectral properties,Blackbody
Week 10: Properties of a Blackbody; Surface Adsorption; Kirchoff's Law; Radiation Exchange - View Factor; View Factor Examples
Week 11: View factor - Inside Sphere Method, Blackbody Radiation Exchange; Diffuse, Gray Surfaces in an Enclosure; Resistances - Oppenheim matrix method; Resistances - Examples; More Examples : Volumetric Radiation
Week 12: Introduction and Examples; Parallel Flow Heat Exchangers; LMTD I; Shell and Tube Heat Exchangers; Epsilon-NTU Method

PROCESS CONTROL - DESIGN, ANALYSIS AND ASSESSMENT

CHEMICAL ENGINEERING

PROF. RAGUNATHAN RENGASAMY
Department of Chemical Engineering
IIT Madras

TYPE OF COURSE : New | Core | UG
INTENDED AUDIENCE : BE, ME, MS
COURSE DURATION : 12 weeks (28 Jan 19-19 Apr 19)
EXAM DATE : 28 April 2019

INDUSTRIES APPLICABLE TO : ABB, Honeywell, GE, Reliance, Aditya Birla, FL Schmidt, DRL

COURSE OUTLINE :

The course will include as the first-third, material on transfer function, controller concepts, tuning and stability that are usually taught in a control class. The second-third of the course deals with MIMO control concepts at a basic level. The final-third of the course deals with performance assessment of SISO controllers.

ABOUT INSTRUCTOR :

Raghunathan Rengaswamy is a Professor at the Department of Chemical Engineering and a core member of the recently established Robert Bosch Center for Data Science and AI (RBC-DSAI) at IIT Madras. He is also a co-Founder and Director of Gyan Data Pvt. Ltd. (GDPL, identified as one of the top 10 start-ups to watch out for in 2018 by Analytics India Magazine), a high tech start-up in the area of data analytics located at IIT Madras Research Park. Recently, he co-founded GITAA Pvt. Ltd., a data science education company, incubated by the IITM Incubation Cell. Prior to this, he was Professor, Chemical Engineering and co-director of the Process Control and Optimization Consortium (PCOC) at Texas Tech University, Lubbock, TX USA, Associate and full Professor at Clarkson University, Potsdam, NY and Assistant Professor at IIT Bombay, Mumbai, India. He has also been a visiting professor at Purdue University, USA, University of Delaware, USA and University of Alberta, Canada. He has a B. Tech degree in Chemical Engineering from IIT Madras, India and a PhD in Chemical Engineering from Purdue University, West Lafayette, IN, USA.

COURSE PLAN :

Week 01 : Introduction
Week 02 : Models for Control
Week 03 : Analysis of Transfer Function Models
Week 04 : Controllers and Closed Loop Transfer Functions
Week 05 : Stability Analysis
Week 06 : Controller Tuning – Stability Based Methods
Week 07 : Controller Tuning – Direct Synthesis
Week 08 : Traditional Multivariable Control
Week 09 : Model Predictive Control Fundamentals
Week 10 : Model Predictive Control Implementation
Week 11 : Controller Performance Assessment and Diagnosis Fundamentals
Week 12 : Controller Performance Assessment and Diagnosis Implementation

TRANSPORT PHENOMENA OF NON-NEWTONIAN FLUIDS

CHEMICAL ENGINEERING

PROF. NANDA KISHORE
Department of Chemical Engineering
IIT Guwahati

TYPE OF COURSE : New | Elective | UG/PG
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 28 April 2019
INTENDED AUDIENCE : Chemical Engineering, Biotechnology, Food Engineering, Mechanical Engineering
PRE-REQUISITES : Fluid Mechanics, Heat Transfer, Mass Transfer

COURSE OUTLINE :

Non-Newtonian fluids are often encountered in our daily life as well as in many industries. Some of the daily-life applications include personal care products such as cosmetics, gels, pastes; food stuffs such as sandwich spreads, ketchup, chocolate, soups, etc. Some of the industrial applications include processing of many polymers, paints and detergents, degassing of polymeric melts and glasses, use of non-Newtonian polymers in enhanced oil recovery, non-Newtonian fluidized beds, wastewater treatment, production of polymeric alloys and ceramics via liquid routes, pharmaceutical products wherein the polymer thickening agents are used to enhance their stability for extended shelf-life, pulp and paper industries, etc. Because of aforementioned overwhelming applications, it is required for both undergraduate and postgraduate students to acquire enough academic experience related to the momentum, heat and mass transfer phenomena associated with non-Newtonian fluids.

ABOUT INSTRUCTOR :

Dr Nanda Kishore completed PhD from Indian Institute of Technology (IIT) Kanpur in 2008 and presently is an Associate Professor in the Department of Chemical Engineering of IIT Guwahati, India, since April, 2014. He has been working in the area of "Transport Phenomena of Bubbles/Drops/Particles in Non-Newtonian Fluids" for last 15 years. After a brief stint as Assistant Professor, Department of Chemical Engineering in National Institute of Technology Warangal, Telangana, he was Brunel Research Fellow from Dec. 21, 2009 to March 31, 2011 at School of Engineering Sciences, University of Southampton, UK. He has published over 65 research articles in various international level reputed journals and published 28 papers in national/international conference proceedings and published 06 book chapters.

COURSE PLAN :

Week 01 : Introduction to Non-Newtonian Fluids

Week 02 : Rheology Measuring Instruments

Week 03 : Equations of Change

Week 04 : Momentum Transfer of Non-Newtonian Fluids

Week 05 : Momentum Transfer of Non-Newtonian Fluids

Week 06 : Flow of Non-Newtonian Fluids though Porous Media

Week 07 : Heat Transfer Phenomena of Non-Newtonian Fluids

Week 08 : Heat Transfer Phenomena of Non-Newtonian Fluids

Week 09 : Mass Transfer Phenomena of Non-Newtonian Fluids

Week 10 : Simultaneous Heat and Mass Transfer with Chemical Reactions

Week 11 : Mass Transfer Combined with Heat Transfer

Week 12 : Boundary Layer Flows of Non-Newtonian Fluids

CHEMICAL ENGINEERING

FLUID FLOW OPERATIONS

PROF. SUBRATA KUMAR MAJUMDER
Department of Chemical Engineering
IIT Guwahati

COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 27 April 2019

TYPE OF COURSE : New | Core | UG/PG
INTENDED AUDIENCE : Chemical Engineering, Civil Engineering and Mechanical Engineering UG and PG students and Faculty

INDUSTRY SUPPORT : Chemical Industries, Flow reactor handling, Piping system, Metering fluent etc.

COURSE OUTLINE :

This course is structured as a MOOCS course for students or junior engineers studying chemical, mechanical or civil engineering. In this course, effort will be made to introduce students /engineers to fluid mechanics by making explanations easy to understand, including recent information and comparing the theories with actual phenomena. The following features will be included in the course

1. Many illustrations, photographs and items of interest will be presented for easy understanding.
2. Assignments and exercises will be given at the ends of course lecture to test understanding of the chapter topic.
3. Special emphasis will be given on real multiphase flow phenomena with specific applications

ABOUT INSTRUCTOR :

Dr. S. K. Majumder is a Professor at Chemical Engineering Department in Indian Institute of Technology Guwahati, India. He completed his Ph.D. in Chemical Engineering from Indian Institute of Technology Kharagpur. His research interests include multiphase flow and reactor development, hydrodynamics in multiphase flow, mineral processing, process intensifications and micro-nano bubble science and technology and its applications. He is a Fellow of Council of Engineering and Technology (India) and Fellow of the International Society for Research and Development, London. He is a recipient of various honours and awards like: Editor, Journal of Chemical Engineering Research Studies, Guest editor, American Journal of Fluid Dynamics, published by Scientific & Academic Publishing Co., USA, Editorial board member of Scientific Journal of Materials Science, IIME Award on beneficiation in year 2008 from Indian Institute of Mineral Engineers (IIME), Editorial board Member of the Journal of Science and Technology, Scientific and Academic Publishing, USA, Advisory board member of Excelling Tech Publishers (ETP), London, UK.

COURSE PLAN :

Week 01 : Characteristics of a fluid

Week 02 : Fluid statics

Week 03 : Fundamentals of flow

Week 04 : One-dimensional flow

Week 05 : Flow of viscous fluid

Week 06 : Flow in pipes

Week 07 : Flow in a water channel

Week 08 : Drag and lift

Week 09 : Dimensional analysis and law of similarity

Week 10 : Measurement of flow

Week 11 : Multiphase flow pattern

Week 12 : Applications of multiphase flow

CHEMISTRY AND BIOCHEMISTRY

CHEMISTRY AND BIOCHEMISTRY

04 weeks

01. Organometallic Chemistry
02. Reactive Intermediates Carbene and Nitrene
03. Metal Mediated Synthesis-I

08 weeks

01. Multidimensional NMR Spectroscopy for Structural Studies of Biomolecules
02. Laser: Fundamentals and Applications

12 weeks

01. Thermodynamics & Kinetics
02. Molecular Spectroscopy: A Physical Chemist's perspective
03. Medicinal Chemistry
04. Biochemistry
05. Experimental Biochemistry
06. Advanced Transition Metal Organometallic Chemistry
07. Chemical Principles II
08. Industrial Inorganic Chemistry
09. Electrochemical impedance Spectroscopy
10. Solid State Chemistry
11. Symmetry and Structure in the Solid State

CHEMISTRY AND BIOCHEMISTRY

ORGANOMETALLIC CHEMISTRY

PROF. DEBABRATA MAITI
Department of Chemistry
IIT Bombay

TYPE OF COURSE : Rerun | Elective | UG/PG
INTENDED SUPPORT : All Pharmaceutical Industries
PRE-REQUISITES : UG General Chemistry
INTENDED AUDIENCE : Students, PhD scholars, teachers, industry
COURSE DURATION : 4 weeks (28 Jan'19 - 22 Feb'19)
EXAM DATE : 31 Mar 2019

COURSE OUTLINE :

The basic principles of organometallic chemistry will be discussed in this course. The modern chemistry is merged into one from classical organic chemistry and traditional inorganic chemistry. We will shed light on activation of small molecule by metal-ligand complex. We will discuss the stepwise mechanism of insertion of metal into organic molecules and elimination by different pathway. Only catalytic amount of metal can produce the large number of molecules those include drug, natural products, pharmaceuticals, our daily needs, etc. in gigantic quantity.

ABOUT INSTRUCTOR :

Prof. Debabrata Maiti, Department of Chemistry, Indian Institute of Technology,Bombay has done MSc (Chemistry, IIT B) and received his Ph.D. from Johns Hopkins University (USA) in 2008. After postdoctoral studies at Massachusetts Institute of Technology (MIT), he joined the Department of Chemistry at IIT Bombay in 2011. His research and teaching interests include organometallic chemistry, the development of new and sustainable synthetic methodologies and mechanistic insight.

COURSE PLAN

Week 1 :
Lecture 1: Introduction of Organometallic Chemistry
Lecture 2: Counting of Electrons
Lecture 3: Ligand Substitution Reactions
Lecture 4: Oxidative Addition [1.Concerted Mechanism]
Lecture 5: Oxidative Addition[2.SN2 Mechanism]

Week 2 :
Lecture 6: Oxidative Addition[3.Radical Mechanism]
Lecture 7: Reductive Elimination
Lecture 8: Migratory Insertion & Elimination Reactions
Lecture 9: Migration & Insertion Reactions
Lecture 10: Alpha-Migratory Insertion & Alpha-Elimination Reactions

Week 3 :
Lecture 11: Beta-Migratory Insertion
Lecture 12: Beta-Elimination Reaction
Lecture 13: Alpha-Abstraction & Beta-Abstraction
Lecture 14: 4-Center Reactions [2+2]
Lecture 15: External Attack by a Ligand & Reductive Coupling

Week 4 :
Lecture 16: Hydrogenation Reaction
Lecture 17: Hydrogenation Reaction [Dihydride Catalyst]
Lecture 18: Stereoselective Hydrogenation Reaction
Lecture 19: Carbonylation Reaction [1.Monsanto Acetic Acid Process 2.Hydroformylation 3.Hydrocarboxylation]
Lecture 20: Carbonylation Reaction [1.Hydroformylation 2.Hydrocarboxylation 3.Hydrocyanation]

REACTIVE INTERMEDIATES CARBENE AND NITRENE

CHEMISTRY AND BIOCHEMISTRY

PROF. RAJARSHI SAMANTA
Department of Chemistry
IIT Kharagpur

TYPE OF COURSE : New | Core | UG
INTENDED AUDIENCE : Chemistry/Chemical Science
PRE-REQUISITES : Basic Organic Chemistry courses (1st year level)
INDUSTRIES APPLICABLE TO : Pharma Companies
COURSE DURATION : 4 weeks (25 Feb'19 - 22 Mar'19)
EXAM DATE : 28 April 2019

COURSE OUTLINE :

Reactive intermediates are one of the important subjects in basic organic chemistry courses. Among different reactive intermediates, carbene & nitrene being neutral and highly electron deficient species play a significant role in various organic transformations. In this course we will disclose its generation, stability, structure, reactivity etc. Next, the application of these reactive intermediates in various organic reactions will be disclosed in detail. Furthermore, the course will accommodate related assignments which might help in various competitive exams in future.

ABOUT INSTRUCTOR :

Dr. Rajarshi Samanta did his BSc (2002) and MSc (2004) from Department of Chemistry, Jadavpur University. He received his PhD from IICT, Hyderabad under the supervision of Prof. Tushar Kanti Chakraborty in 2010. After completing his postdoctoral studies under the supervision of Dr. A. P. Antonchick at Max-Planck Institute of Molecular Physiology (Dortmund, Germany), he joined IIT Kharagpur in September 2013. His research interests include transition metal catalysed organic transformations, asymmetric synthesis, natural product synthesis.

COURSE PLAN :

Week 01 : Structure and Reactivity of carbenes
Week 02 : Generation of carbenes
Week 03 : Different types of reactions with carbenes
Week 04 : Generation and different reactions of nitrenes and related intermediates

METAL MEDIATED SYNTHESIS - I

PROF. DEBABRATA MAITI
Department of Chemistry
IIT Bombay

TYPE OF COURSE : Rerun | Elective | UG/PG
COURSE DURATION : 4 weeks (28 Jan'19 - 22 Feb'19)
INTENDED SUPPORT : All Pharmaceutical Industries
EXAM DATE : 31 Mar 2019
PRE-REQUISITES : Advance Organic and Inorganic Chemistry
INTENDED AUDIENCE : Students, PhD scholars, teachers, industry

COURSE OUTLINE :

The course covers an advance level of organometallic chemistry. Recent development of cross coupling reactions and their applications in organic synthesis, starting from small molecule to naturally and pharmaceutically important compounds, has been described in the prescribed course. In this course, a brief overview about the carbine chemistry and oxidative cyclization is also portrayed.

ABOUT INSTRUCTOR :

Prof. Debabrata Maiti, Department of Chemistry, Indian Institute of Technology,Bombay has done MSc (Chemistry, IITB) and received his Ph.D. from Johns Hopkins University (USA) in 2008. After postdoctoral studies at Massachusetts Institute of Technology (MIT), he joined the Department of Chemistry at IIT Bombay in 2011. His research and teaching interests include organometallic chemistry, the development of new and sustainable synthetic methodologies and mechanistic insight.

COURSE PLAN

Week 1 :
Lecture 1: Assymetric Hydrogenation
Lecture 2: Transition metal carbenes,Fischer and Schrock carbenes
Lecture 3: Olefin metathesis
Lecture 4: Alkyne metathesis
Lecture 5: Cyclopropanation reaction

Week 2 :
Lecture 6: Catalytic cyclopropanation reaction,Introduction to cross coupling reaction
Lecture 7: Kumada Coupling reaction
Lecture 8: Suzuki coupling reaction
Lecture 9: Stille coupling reaction
Lecture 10:Assymetric Suzuki coupling reaction

Week 3 :
Lecture 11: Sonogashira coupling reaction
Lecture 12: Heck coupling reaction
Lecture 13: Assymetric Heck reaction,Introduction to Buchwald-Hartwig coupling reaction
Lecture 14: Buchwald-Hartwig coupling reaction
Lecture 15: Role of Ligands its influence in Buchwald-Hartwig coupling reaction

Week 4 :
Lecture 16: Oxidative cyclization process
Lecture 17: Application of oxidative cyclization in natural product synthesis
Lecture 18: Synthesis of reactive metallacycle intermediate via-Beta-abstraction and their applications
Lecture 19: Kulinkovich Reaction and its mechanism
Lecture 20: Pauson–Khand reaction

MULTIDIMENSIONAL NMR SPECTROSCOPY FOR STRUCTURAL STUDIES OF BIOMOLECULES

CHEMISTRY AND BIOCHEMISTRY

PROF. HANUDATTA S. ATREYA
NMR Research Centre
IISc Bangalore

TYPE OF COURSE : New | Elective | PG
COURSE DURATION : 8 weeks (28 jan'19 - 22 Mar'19)
INTENDED AUDIENCE : M. Sc/Ph. D students, Scientists from Pharma/Biotech Companies
EXAM DATE : 31 Mar 2019
PRE-REQUISITES : Mathematics at the 12th Std level, Basic Knowledge of Proteins/Nucleic Acids , A basic knowledge of NMR would be useful, though not necessary

INDUSTRIES APPLICABLE TO : Biocon, Aurigene Laboratories, Pharma Industry

COURSE OUTLINE :

The objective of the course is to introduce methods used in NMR spectroscopy for structure determination of biomolecules and for studying protein-ligand interactions. The course will cover principles and application of two- and three-dimensional NMR experiments along with different isotope labelling schemes that are routinely used for protein structure determination.

ABOUT INSTRUCTOR :

Academic Career : M. Sc – Indian Institute of Technology, Mumbai (1997). Ph. D – Tata Institute of Fundamental Research, Mumbai (2002). Post doctoral Research fellow at State University of New York, Buffalo USA (2002-2006). Currently he is Associate Professor at NMR Research Centre, Indian Institute of Science, Bangalore, India. Research Interests: Development and application of new NMR methodologies in structural Publications/patents/books: Approximately 90 publications in peer.

COURSE PLAN :

Week 01 : Introduction to Basics of NMR

Week 02 : Two dimensional NMR

Week 03 : Important 2D NMR experiments for Biomolecules

Week 04 : 3D NMR Spectroscopy

Week 05 : Basics of Protein and Nucleic Acid Structure

Week 06 : Isotope Labelling

Week 07 : Resonance assignment of Proteins with NMR and Structure Determination

Week 08 : NMR Experiments for Studying Protein-Ligand Interactions

LASER: FUNDAMENTALS AND APPLICATIONS

CHEMISTRY AND BIOCHEMISTRY

PROF. MANABENDRA CHANDRA
Department of Chemistry
IIT Kanpur

TYPE OF COURSE : Rerun | Elective | UG/PG
COURSE DURATION : 8 weeks (28 Jan'19 - 22 Mar'19)
INTENDED AUDIENCE : Senior UG and PG students
EXAM DATE : 31 Mar 2019
PRE-REQUISITES : Basic knowledge of quantum mechanics and optics would be helpful

COURSE OUTLINE :

A Laser is a device that emits light through a process of optical amplification based on the stimulated emission of electromagnetic radiation. Because of its extremely high degree of monochromaticity, coherence, directionality, polarization, and power, etc., laser radiation or light has been widely used in high resolution spectroscopy and imaging, chemistry, optical communications, biomedicine, defense industries, etc. This course is intended for students who need to understand the basic principles of how lasers work and their main properties. This course provides the students a thorough understanding of the fundamentals of lasers: their unique properties, their operations and their applications. It will equip the students with the knowledge of how a coherent light is generated and amplified, the techniques behind different lasers' design, and applications of lasers in spectroscopy, chemistry, medicine, biology, military and other areas.

ABOUT INSTRUCTOR :

Dr. Manabendra Chandra is an Assistant Professor in the Department of Chemistry at IIT Kanpur. His area of specialization is experimental physical chemistry.

COURSE PLAN :

Week 01 : Introduction; Importance: why laser?, unique properties of lasers; Brief history of laser development ; Laser basics

Week 02 : Concept of stimulated emission; Einstein's coefficients; Population inversion; Amplification of stimulated emission; Laser instrumentation fundamentals: Cavity, resonator and pumping processes; Gain medium

Week 03 : Coherent radiation, standing waves and modes; The kinetics of laser emission; Rate equations; Threshold conditions; Pulsed and continuous wave laser emission; Various pulsing techniques: cavity dumping, Q-switching and mode-locking

Week 04 : Transitions, lifetimes and linewidths: Three level laser, Four-level laser, emission linewidth; Properties of laser light: monochromaticity, spatial and temporal coherence, intensity, beam-width Similarity transforms.

Week 05 : Laser sources; different types of lasers; Laser instrumentation details

Week 06 -08 : Applications of lasers in spectroscopy, chemistry, biology, medical sciences and other fields

THERMODYNAMICS AND KINETICS

CHEMISTRY AND BIOCHEMISTRY

PROF. ARIJIT KUMAR DE
Department of Chemistry
IISER Mohali

TYPE OF COURSE	: Rerun | Elective | UG/PG	**COURSE DURATION**	: 12 weeks (28 Jan'19 - 19 Apr'19)
INTENDED AUDIENCE	: B.Sc, M.Sc, BE/B.Tech, Ph.D	**EXAM DATE**	: 27 Apr 2019
PRE-REQUISITES	: Any introductory course on Thermodynamics is preferred but not absolutely necessary		

COURSE OUTLINE :

This course will cover classical thermodynamics and kinetics developed to explain a variety of macroscopic physico-chemical phenomena with applications in Chemistry. This course is designed as an introductory level course to the broad area of thermodynamics and kinetics and the lectures will be pitched at the level of undergraduates (both freshman and sophomore level).

ABOUT INSTRUCTOR :

Arijit Kumar De completed his BSc (2003) with Chemistry major from University of Calcutta (WB, India) and M.Sc (2005) in Chemistry from IIT Kanpur (UP, India). He pursued his PhD with Debabrata Goswami at IIT Kanpur (2005-2010). He was a postdoctoral fellow at Lawrence Berkeley National Lab and University of California Berkeley (CA, USA) with Graham R. Fleming (2010-2014). In 2014, he joined IISER Mohali (PB, India) as an Assistant Professor in the Department of Chemical Sciences.

COURSE PLAN :

Week 1: Review of states of matter, Equations of state for ideal and real gases, Heat capacities at constant volume and pressure. Introduction to Thermodynamics, Laws of thermodynamics, Zeroth law.
Week 2: First law, Concept of work and heat, Work done in reversible and irreversible processes.
Week 3: Concept of enthalpy, Joule's experiment and Joule-Thompson experiment, Thermochemistry.
Week 4: Second law, Concept of entropy, Carnot cycle, Clausius inequality, Concept of maximum work.
Week 5: Gibbs and Helmholtz free energies, Maxwell's relations, Chemical potential, Gibbs-Helmholtz equation, Gibbs-Duhem equation.
Week 6: Phase equilibrium, Clapeyron equation and Clausius-Clapeyron equation,Phase rule, Phase diagrams of one and two-component systems.
Week 7: Thermodynamics of mixtures, Partial Molar Properties, Ideal, Ideal-dilute and Real Solutions, Colligative properties.
Week 8: Chemical equilibrium, Equilibrium constant, van't Hoff equation, Le Chatelier's principle.
Week 9: Equilibrium electrochemistry, Types of electrochemical cells, Standard electrode potential, Nernst equation, Liquid junction potential.
Week 10: Introduction to chemical kinetics, rate laws for elementary reactions of different orders, competing reactions.
Week 11: Mechanisms of composite reactions, steady state and rate determining step approximations, homogeneous (acid-base catalysis and enzyme catalysis) and heterogeneous catalysis (Langmuir adsorption isotherm).
Week 12: Temperature dependence of rate constant, Introduction to gas-phase chemical reaction dynamics, Maxwell-Boltzman distribution of molecular speeds and its application in collision theory, Unimolecular reactions.

MOLECULAR SPECTROSCOPY: A PHYSICAL CHEMIST'S PERSPECTIVE

CHEMISTRY AND BIOCHEMISTRY

PROF. ANINDYA DATTA
Department of Chemistry
IIT Bombay

TYPE OF COURSE : New | Core| UG/PG
INTENDED AUDIENCE : Chemistry, Physics and UG students of Engineering
COURSE DURATION : 12 weeks (28 Jan'19 -19 Apr'19)
EXAM DATE : 28 Apr 2019

COURSE OUTLINE :

This is a comprehensive course on molecular spectroscopy. We start with dispersive and Fourier transform spectroscopic techniques, go on to derive selection rules from Time dependent perturbation theory, develop a quantum mechanical treatment of spin resonance spectroscopy and then move on to a discussion of spectra of polyatomic molecules using symmetry.

ABOUT INSTRUCTOR :

Since 2002, Prof. Datta has taught courses on Chemical thermodynamics, kinetics, spectroscopy and group theory to undergraduate as well as graduate students in IIT Bombay. This year, he received an excellence in teaching award. He has also taught in IIT Goa and in several workshops and refresher courses across the country, for students as well as teachers. His area of research is ultrafast processes in Chemistry.

COURSE PLAN :

Week 01 : Introduction, Disperive spectrometers, Fourier Transform spectrometers, Signal to Noise Ratio,Microwave Spectroscopy of diatomic molecules

Week 02 : Derivation of selection rules for microwave spectra, Simple harmonic oscillator, Selection rule Rovibrational spectra

Week 03 : Anharmonic perturbation, Raman effect, Raman spectroscopy

Week 04 : Time dependent perturbation theory, Interaction of radiation with matter, Fermi's golden rule

Week 05 : Einstein treatment, Lasers and lineshapes, Laser spectroscopy

Week 06 : Magnetic resonance, Classical treatment of relaxation, Pulse sequences

Week 07 : Perturbation theory for weak coupling, Variation method for strong coupling, Double resonance techniques

Week 08 : Nuclear quadrupole resonance, Zeeman effect, Field effect on diatomic vibrotor

Week 09 : Hyperfine interactions, Electronic spectra of diatomic molecules, Fortrat diagram

Week 10 : Matrix vector formulation of vibration of polyatomic molecules, Normal modes of vibration, Symmetry of normal modes and IR/Raman activity

Week 11 : Summary

Week 12 : Revision

MEDICINAL CHEMISTRY

CHEMISTRY AND BIOCHEMISTRY

PROF. HARINATH CHAKRAPANI
Department of Chemistry
IISER Pune

TYPE OF COURSE : New | Core| UG/PG

COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)

EXAM DATE : 27 Apr 2019

PRE-REQUISITES : Any student who has done basic organic chemistry and has some knowledge of biochemistry with an interest in drug discovery.

INDUSTRIES APPLICABLE TO : Companies in the pharmaceutical sector may recognize and value this course.

COURSE OUTLINE :

The main objective of this course is to familiarize students with the fundamental concepts of drug discovery and development. The course is intended for students who have a background in chemistry and interested in the process of drug discovery. The intended outcome is to train students on various aspects of new drug discovery/ development, drug screening, target identification, lead discovery, optimization and the molecular basis of drug design and drug action.

ABOUT INSTRUCTOR :

Harinath Chakrapani completed his undergraduate and post-graduate studies in Chemistry from Loyola College and Indian Institute of Technology Madras, respectively. He moved to Duke University, USA to pursue his doctoral studies and after post-doctoral research stints at Wake Forest University and the National Cancer Institute, USA, he joined IISER Pune in July 2009 and is currently Associate Professor. His research interests are in organic chemistry and chemical biology. His laboratory works on developing new tools to study effects of oxidative stress responses in cells and antibiotic resistance. He has over eight years of teaching experience at IISER Pune.

COURSE PLAN :

Week 01 : An overview of drugs and drug targets; structure of a cell; intermolecular binding forces; classification of drugs.

Week 02 : Principles of enzyme structure, catalysis and inhibition in drug discovery: Enzyme mechanisms overview; enzyme catalysis and inhibition in drug discovery; reversible and irreversible inhibitors; transition-state inhibitors; case studies

Week 03 : Principles of enzyme structure, catalysis and inhibition in drug discovery: Enzyme mechanisms overview; enzyme catalysis and inhibition in drug discovery; reversible and irreversible inhibitors; transition-state inhibitors; case studies,Receptors function and ligand binding interactions; Ion channel receptors; kinase-linked receptors; G-Protein coupled receptors, drug-receptor interaction; dose-response curves; case studies

Week 04 : Receptors function and ligand binding interactions; Ion channel receptors; kinase-linked receptors; G-Protein coupled receptors, drug-receptor interaction; dose-response curves; case studies

Week 05 : Nucleic acids structure and function; DNA Interactive agents and chemotherapy: DNA binding agents; intercalation and alkylation; DNA strand breakers; case studies

Week 06 : Synthetic methods in medicinal chemistry: Combinatorial and parallel synthesis: solid phase techniques, mix and split method in combinatorial synthesis; dynamic combinatorial synthesis; solid phase synthesis; diversity-oriented synthesis.

Week 07 : Lead discovery; Bioassays; drug targets; Lead Modification; optimization; pharmacophore; homologation; bioisostere; chain branching; Electronic effects; Lipophilicity; Structure-Activity Relationships; Quantiative-structure activity relationships (QSAR).

Week 08 : Lead discovery; Bioassays; drug targets; Lead Modification; optimization; pharmacophore; homologation; bioisostere; chain branching; Electronic effects; Lipophilicity; Structure-Activity Relationships; Quantiative-structure activity relationships (QSAR).

Week 09 : Drug metabolism and pharmacology: Analytical methods in metabolism; Phase I and Phase II transformations; Absorption, distribution, metabolism and excretion (ADME); bioavailability; pre-clinical and clinical development; therapeutic index and therapeutic window.

Week 10 : Prodrugs and drug delivery systems: Use of prodrug systems; prodrugs for stability, solubility and slow release; overview of drug delivery

Week 11 - 12 : Drug resistance mechanisms and synergism: Mechanisms of drug resistance; circumventing drug resistance; drug synergy

BIOCHEMISTRY

PROF. SWAGATA DASGUPTA
Department of Chemistry
IIT Kharagpur

TYPE OF COURSE : Rerun| Core | UG/PG
INTENDED AUDIENCE : BSc/MSc/MS/PhD
PRE-REQUISITES : Basic concepts in Chemistry and Biology
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 28 Apr 2019

COURSE OUTLINE :

This course has introductory course that will focus on basic concepts in biochemistry. The course deals with an understanding of biological macromolecules: proteins, carbohydrates, lipids, and nucleic acids. The structure and functional roles of the macromolecules will be studied in addition to fundamentals of enzyme chemistry: kinetics, mechanisms, inhibition, structure and mechanism. The course will also touch upon the basics of membrane transport and bioenergetic principles. After completion of the course, the students should be able to understand the chemical properties and three-dimensional structure of these biological macromolecules in relationship to their biological function.

ABOUT INSTRUCTOR :

Professor Dasgupta completed her B.Sc. (Hons) from Presidency College, Calcutta, M.Sc. from IIT Kanpur and Ph.D. from Rensselaer Polytechnic Institute, USA. Her research interests in Protein Chemistry encompass protein–protein and protein-small molecule interactions and protein structure analyses. She has contributed to teaching and research at IIT Kharagpur for the past 20 years, guided 21 students to date with 130+ publications. The main focus of research includes the study of polyphenols and their interactions with biomacromolecules. She has received several awards including the CRSI Bronze medal in 2016 and has been elected as a Fellow of the Indian Academy of Sciences Bangalore in 2018.

COURSE PLAN :

Week 01 : Amino Acids
Week 02 : Protein Structure
Week 03 : Protein Structure (continued)
Week 04 : Enzymes
Week 05 : Enzymes (continued)
Week 06 : Enzyme mechanisms
Week 07 : Nucleic acids
Week 08 : Lipids and Membranes
Week 09 : Vitamins and Coenzymes
Week 10 : Carbohydrates
Week 11 : Bioenergetics
Week 12 : Metabolism

EXPERIMENTAL BIOCHEMISTRY

CHEMISTRY AND BIOCHEMISTRY

PROF. SWAGATA DASGUPTA
Department of Chemistry
IIT Kharagpur

PROF. SOUMYA DE
School of Bioscience
IIT Kharagpur

TYPE OF COURSE : New | Core | UG
INTENDED AUDIENCE : Chemistry, Biochemistry
PRE-REQUISITES : Biochemistry desirable

COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 28 April 2019

INDUSTRIES APPLICABLE TO : Biotech & Pharma companies

COURSE OUTLINE :

For undergraduate students in the discipline of biochemistry, molecular biology, chemistry and other related biological sciences, the biochemistry laboratory course has become an integral part. It is necessary for students to acquire skills in working with biomolecules in the laboratory. This course is designed to train students with the basic biochemistry laboratory techniques and also introduce some higher level concepts that will prepare them for future research and development projects. The course outline is given for each week. We will introduce each topic and give an overview of the topic and underlying theory. This will be followed by actual demonstration of the experiment. Weekly assignments will be provided and graded.

ABOUT INSTRUCTOR :

Swagata Dasgupta did her B.Sc. (Hons) from Presidency College, Calcutta, M.Sc. from IIT Kanpur and Ph.D. from Rensselaer Polytechnic Institute, USA. Her research interests in Protein Chemistry encompass protein–protein and protein-small molecule interactions and protein structure analyses. She has contributed to teaching and research at IIT Kharagpur for the past 20 years, guided 21 students to date with 130+ publications. The main focus of research includes the study of polyphenols and their interactions with biomacromolecules.

Soumya De did his BSc. (Hons) and MSc from IIT Kharagpur. He completed his PhD from Cornell University, USA followed by postdoctoral research at University of British Columbia, Canada. He joined IIT Kharagpur as Assistant Professor in 2015.

COURSE PLAN :

Week 01 : Basics of Experimental Biochemistry
Week 02 : Amino Acid Titration and pI determination
Week 03 : Spectroscopic techniques
Week 04 : Protein folding and denaturation studies
Week 05 : Chromatographic techniques
Week 06 : Gel electrophoresis of DNA and proteins
Week 07 : Isolation and characterization of proteins
Week 08 : Enzyme Kinetics
Week 09 : Isolation and characterization of DNA
Week 10 : Basics of rDNA technology
Week 11 : Protein ligand interactions
Week 12 : Immunoassay techniques

CHEMISTRY AND BIOCHEMISTRY

ADVANCED TRANSITION METAL ORGANOMETALLIC CHEMISTRY

PROF. P. GHOSH
Department of Chemistry
IIT Bombay

TYPE OF COURSE : New | Core| UG/PG
INTENDED AUDIENCE : All of Chemistry and possibly some of Chemical Engg students
PRE-REQUISITES : Basic undergraduate inorganic and organic chemistry courses
COURSE DURATION : 12 weeks (28 Jan'19 -19 Apr'19)
EXAM DATE : 27 April 2019

INDUSTRIES APPLICABLE TO : BASF, Dow Chemicals, GE, Reliance, DuPont, BAYER and other petrochemical & polymer companies.

COURSE OUTLINE :

The course would cover various application aspects of organometallic compounds in industrial processes. The course would also highlight the concepts behind these blockbuster industrial processes that have directly impacted our society at large over the last century. Not to mention of the fact that nine Nobel prizes have been attributed to the field for original discoveries over the last century, and which too, along with their far reaching implications, would be covered in this course.

ABOUT INSTRUCTOR :

Dr. Prasenjit Ghosh is a Professor of Inorganic Chemistry at Indian Institute of Technology Bombay (IIT Bombay), India. He received his PhD in bioinorganic chemistry from Columbia University, New York, in 1998. Following two post-doctoral stints. He joined the Department of Chemistry at IIT Bombay as an Assistant Professor in 2003. He received the CRSI Bronze Medal (2014) of the Chemical Research Society of India and The Distinguished Lectureship Award (2011) of the Chemical Society of Japan among many others in the recent years. He is an Editorial Advisory Board member of the ACS journal Organometallics from 2017 for a three-year period and of Polyhedron since 2011.

COURSE PLAN :

Week 01 : Transition Metal Allyl and Enyl Complexes, Preparation - I, II, Reactivity and Transition Metal Sandwich Complexes, Types of Transition Metal Sandwich Complexes
Week 02 : Transition Metal Cyclobutadiene Complexes, Preparations, Reactivity, Transition Metal Cyclopentadiene Complexes, Preparation and Properties
Week 03 : Transition Metal Cyclopentadiene Complexes: Bonding Properties, Molecular Orbital Diagram, Reactivity of Metallocene, Reactivity of Ferrocene, Transition Metal Cyclopentadienyl Carbonyl Complexes: Preparation
Week 04 : Transition Metal Cyclopentadienyl Carbonyl Complexes: Reactivity, Transition Metal Cyclopentadienyl Nitrosyl Complexes, Hydride Complexes, Hydride and Halide Complexes, Halide Complexes
Week 05 : Transition Metal Cyclopentadienyl Halide and Transition Metal Arene Complexes, Transition Metal Arene Complexes: Preparation, Structure and Bonding, Structure and Bonding, Reactivity I, II
Week 06 : Transition Metal Arene Carbonyl Complexes: Reactivity I, II, Transition Metal Arene Cyclopentadienyl Complexes, C_7H_7 Complexes, Transition Metal C_7H_7 Complexes: Preparation
Week 07 : Transition Metal C_7H_7 Complexes: Reactivity, Transition Metal C_8H_8 and C_7H_7 Complexes, Transition Metal C_8H_8 Complexes: Properties, Transition Metal π- complexes of heterocycles, C–C Cross Coupling Reactions
Week 08 : C–C Cross Coupling Reactions: Allylic Alkylation, Heck Reaction, Suzuki Reaction I, II, Stille Reaction
Week 09 : C–C Cross Coupling Reactions: Stille Coupling, Sonogashira Coupling, Hydrocyanation Reactions, C–heteroatom Coupling, Arylamination
Week 10 : C–Heteroatom Coupling: Hydroamination, Hydroboration, Hydrosilation, Organometallic Catalysis Reactions: Olefin oxidation I, II
Week 11 : Organometallic Catalysis Reactions: Enantioselective Sharpless Epoxidation, Water Gas Shift Reaction, Fisher Tropsch Synthesis, Fisher Tropsch Mechanism, Carbonylation of alcohols
Week 12 : Organometallic Catalysis Reactions: Hydrogenation of Alkenes, Asymmetric Hydrogenation of Alkenes I, II, Hydroformylation, Summary

CHEMICAL PRINCIPLES II

CHEMISTRY AND BIOCHEMISTRY

PROF. ARNAB MUKHERJEE
Department of Chemistry
IISER Pune

TYPE OF COURSE : New | Core| UG

COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)

INTENDED AUDIENCE : Chemistry, Physics and UG students of Engineering

EXAM DATE : 28 Apr 2019

PRE-REQUISITES : 12th standard mathematics, knowledge of calculus (differentiation)

INDUSTRIES APPLICABLE TO : This course will be helpful for all students across discipline as it is one of the most fundamental subject.

COURSE OUTLINE :

In this course, we will now find out the reason for changes in matters (Chemical Principles II). The earlier course, Chemical Principles I, deals with the matter itself, and the understanding of it comes from quantum mechanics. However, for the change of matter, thermodynamics says the final word. The most critical quantity in thermodynamics is the entropy, and this course is all about understanding entropy and related thermodynamic potentials. Although classical thermodynamics was developed from observations and heuristic understanding, statistical thermodynamics provides a microscopic basis of it.

ABOUT INSTRUCTOR :

Arnab Mukherjee did his B. Sc from Jadavpur university, Kolkata in 1998. He then joined Indian Institute of Science, Bangalore as an integrated PhD student in chemical sciences. He completed his Ph. D. from S. S. C. U. department of IISc Bangalore in 2005 under the supervision of Professor Biman Bagchi. Dr. Mukherjee then went for his postdoctoral research in Ecole Normale Superierure, Paris, France from 2005 to 2007 and then to University of Colorado, Boulder from 2007 to 2009. He then joined IISER Pune as an assistant professor in November, 2009.

COURSE PLAN :

Week 01 : Thermodynamics in everyday life, timeline of thermodynamics -- a brief history, System and surroundings, different types of systems (isolated, closed, open) and variables (intensive and extensive) -- macroscopic and microscopic systems, different kinds processes -- exact and inexact differentials

Week 02 : Probability, Distribution, and Equilibrium.Recapitulation of basic probability – distribution of energy – equilibrium – Le Chateli-er's principle from probability

Week 03 : Heat and Work (First Law of Thermodynamics)Macroscopic and microscopic understanding of temperature (zero-th law), internal energy, heat and work -- Conversion of internal energy into work and heat (first law) -- microscopic understanding of heat and work -- Joule's coefficient, Joule-Thomson effect,

Week 04 : Heat and Work (First Law of Thermodynamics)Macroscopic and microscopic understanding of temperature (zero-th law), internal energy, heat and work -- Conversion of internal energy into work and heat (first law) -- microscopic understanding of heat and work -- Joule's coefficient, Joule-Thomson effect,

Week 05 : Entropy as the driving force of the change (Classical Second law)Everything is about entropy --- Entropy as the arrow of time -- Entropy statements of Kelvin and Clausius and their variations – Connection between different entropy statements

Week 06 : Entropy as the driving force of the change (Classical Second law)Everything is about entropy --- Entropy as the arrow of time -- Entropy statements of Kelvin and Clausius and their variations – Connection between different entropy statements

Week 07 : Maximum Work and Engines Maximum Work – Carnot Cycle – Engine efficiency ,Tutorial on the different cycles

Week 08 : Statistical Formulation of the Second Law (Statistical Thermodynamics)Microscopic definition of entropy – distribution of energy – microstates and macrostates -- most probable distribution and its importance –

Week 09 : Boltzmann distribution – understanding increase in microstates in heat flow and other applications – partition function – connection between microscopic and thermodynamic properties – Average Property Measurement,

Week 10 : Fundamental equation and entropy postulate Fundamental equation of thermodynamics – entropy postulates – different spontaneity conditions (energy decrease, entropy increase, etc.) – thermodynamic potential

Week 11 : introduction to free energies (focusing on the system now) –Maxwell Relations Maxwell relations – thermodynamic derivatives – Jacobian method –applications of thermodynamics,Tutorial on derivation various thermodynamic derivatives

Week 12 : Application of Free energy Application of free energy in various chemical and biological systems

CHEMISTRY AND BIOCHEMISTRY

INDUSTRIAL INORGANIC CHEMISTRY

PROF. DEBASHIS RAY
Department of Chemistry
IIT Kharagpur

TYPE OF COURSE : New| Elective | UG/PG
INTENDED AUDIENCE : B. Sc and M. Sc Chemistry
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 27 April 2019

INDUSTRIES APPLICABLE TO : Indian Chemical Council; National Peroxide Ltd.; All Chemicals & Fertilizers Companies; All Dyes & Chemicals Companies; BASF India Ltd.; Tata Chemicals etc

COURSE OUTLINE :

Chemical Industries are the prime factors to convert the raw materials into desired products that we use in our day-to-day life. This has brought a tremendous change in the way the things operate. It is very important for us to understand the importance of the chemical industry which has touched all our facets of life.Chemical Industries are the principal areas of any country used to convert the raw materials into desired products that we use in our day-to-day life. This has brought an enormous change in the way the things operate. It is very important for us to understand the importance of the chemical industry which has touched all our aspect of life like agriculture, environment, food, hygiene, catalysis, construction etc.

ABOUT INSTRUCTOR :

The Instructor is an M. Sc. (Gold Medalist) from Burdwan University and did his Ph. D. from Indian Association for the Cultivation of Science, Kolkata and in faculty of IIT Kharagpur since 1990. He is skilled and specialized in synthetic and structural coordination, model bioinorganic chemistry, analytical chemistry and coordination triggered self-assemblies. Recipient of INSA-YS medal, CRSI bronze medal. Visiting fellow in Indiana University, Oxford University and MPI, Muelheim, Germany.

COURSE PLAN :

Week 01 : Introduction; Importance of the chemical industry; Primary inorganic materials; Bulk and comodities chemicals; Fine and speciality chemicals; Water and hydrogen; H_2O_2 and inorganic peroxido compounds.
Week 02 : Nitrogen and nitrogen compounds; Phosphorus and its compounds; Sulfur and sulfur compounds.
Week 03 : Halogen and halogen compounds; Applications of iodine and iodine compounds.
Week 04 : Mineral fertilizers; Nitrogen fertilizers, ammonium nitrate and urea; Phosphorous containing fertilizers.
Week 05 : Potassium containing fertilizers; Economic importance of fertilizers.
Week 06 : Metals and their compounds; Metallic lithium and its compounds; Metallic sodium, sodium borates; Potassium and its compounds, KOH and K_2CO_3.
Week 07 : Alkaline earth metals and its compounds; Beryllium and magnesium; Calcium, strontium and barium; Manganese, manganese compounds and their applications.
Week 08 : Industry important organo-silicon compounds, industrial silicone products.
Week 09 : Inorganic solid, zeolites and catalysts, inorganic fibers; Construction materials; Enamel and ceramics.
Week 10 : Carbon modifications, diamond, graphite, carbonization and graphitization; Glassy and foamed carbon; carbon black.
Week 11 : Fillers - synthetic and natural, applications; Metallic hard materials.
Week 12 : Inorganic pigments; TiO_2, lithopone, ZnS, ZnO and Fe_2O_3; Corrosion protection pigments; Luminescent and magnetic pigments; Conclusions.

CHEMISTRY AND BIOCHEMISTRY

ELECTROCHEMICAL IMPEDANCE SPECTROSCOPY

PROF. S. RAMANATHAN
Department of Chemical Engineering
IIT Madras

TYPE OF COURSE : New| Elective | PG

INTENDED AUDIENCE : PG, working on electrochemical research

PRE-REQUISITES : B.Sc. or B.E.

COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)

EXAM DATE : 27 April 2019

INDUSTRIES APPLICABLE TO : Battery and electric vehicle (EV) companies, those where corrosion is a key problem, or those working in electroplating, will find this useful.

COURSE OUTLINE :

This course will introduce electrochemical impedance spectroscopy technique and illustrate its use to characterize electrochemical processes. Details regarding correct method of data acquisition and analysis, along with pitfalls to watch out for, will be discussed

ABOUT INSTRUCTOR :

S. Ramanathan is a Professor in Dept. Chem. Engg. IIT Madras. His research interests include general electrochemistry (corrosion, electrodeposition etc.) and mechanistic analysis of electrochemical reactions using of electrochemical impedance spectroscopy (EIS). In addition, he has developed new experimental tools and simulation methods to extend the EIS to nonlinear regime.

COURSE PLAN :

Week 01 : Introduction to electrochemistry, electrode-electrolyte interface, reference electrode, three electrode cell, supporting electrolyte, rate constant, EIS basics, electrical elements, differential impedance, time domain results, graphical representation of impedance data in Bode and Complex plane plots, other techniques

Week 02 : Experimental details: Instrumentation, single and multi-sine inputs, FFT details, frequency range and resolution, cross correlation, multi sine: odd harmonics and non-harmonic choices, crest factor, spectral leakage, windowing

Week 03 : Data validation: Kramers Kronig Transforms (KKT), Linearity, causality, stability, impedance vs. admittance, applications and limitations, Alternatives – measurement model analysis and linear KKT

Week 04 : Data analysis: Electrical Equivalent Circuits, choice of circuits, confidence intervals, AIC, initial values, distinguishability, zeros and poles representation, charge transfer resistance and polarization resistance, Maxwell, Ladder and Voigt circuits

Week 05 : Reaction mechanism analysis, linearization of governing equations, derivation of impedance expression for a simple electron transfer reaction; two step reactions with one adsorbed intermediate

Week 06 : Reaction mechanism analysis (continued), development of impedance expression for multiple reactions, an example reaction exhibiting negative resistance, an example three step reaction with 2 adsorbed intermediates

Week 07 : Reaction mechanism analysis (continued), development of impedance expression for a catalytic reaction exhibiting negative resistance, reactions with Frumkin isotherm practical challenges in extraction of kinetic information, list of various patterns of complex plane plots reported in literature

Week 08 : Diffusion effects, Warburg Impedance, finite and semi-infinite cases, effect of change in dc potential and boundary layer thickness.

Week 09 : Constant phase elements (CPE), porous electrodes

Week 10 : Passivation and film formation, point defect model (PDM) and extensions. Description of a few selected applications of EIS: Corrosion, biosensors, fuel cells, mechanistic analysis

Week 11 : Nonlinear EIS (NLEIS), introduction, mathematical background (Taylor series, Fourier series, modified Bessel functions), NLEIS for a simple electron transfer reaction, reaction with adsorbed intermediates, Nonlinear charge transfer and polarization resistances

Week 12 : Effect of instabilities in traditional EIS- calculation using NLEIS methodology, solution resistance effects, Detection of nonlinearities using KKT, NLEIS with Frumkin and Temkin isotherm, evaluation of related technique: electrochemical frequency modulation (EFM)

CHEMISTRY AND BIOCHEMISTRY

SOLID STATE CHEMISTRY

PROF. MADHAV RANGANATHAN
Department of Chemistry
IIT Kanpur

TYPE OF COURSE : New | UG/PG

COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)

EXAM DATE : 28 Apr 2019

PRE-REQUISITES : Basic physical chemistry including thermodynamics, kinetics and quantum chemistry, basic vector analysis and coordinate geometry

COURSE OUTLINE :

This course will go over the basics of solid state materials,primarily crystalline solids and describe features and properties of certain specific materials. Some of the basic topics included will be thermodynamics of solids, unit cells, lattice, crystals, symmetry, symmetry groups, defects, x-ray diffraction,microscopy. Following this, the discussion will move to specific materials like binary alloys, oxides, nitrides and sulphides, perovskites, spinels. The course will conclude with a discussion of band theory, band structure, electronic and optical properties.

ABOUT INSTRUCTOR :

Prof. Madhav Ranganathan has been a faculty in the Department of Chemistry, IIT Kanpur since 2007. His research interests are statistical mechanics of crystal growth and theoretical biophysics. His main teaching interests are in Physical Chemistry, especially more theoretically inclined courses. He has taught several courses at IIT Kanpur at undergraduate, masters and doctorate levels. He has taught Mathematics for Chemistry at IIT Kanpur several times and this has influenced the material for this course.

COURSE PLAN :

Week 01 : Crystalline and amorphous solids, thermodynamics of solids,crystallization kinetics, nucleation.

Week 02 : Unit Cell, Conventional unit cell, primitive unit cell, lattice and basis, Bravais lattices, lattice translation vectors.

Week 03 : Symmetry in crystals, rotations, reflections, inversions,rotoinversions. Schonflies and Hermann-Mauguin notations.

Week 04 : Translational symmetry elements, glide plane, screw axis,relevance of symmetries.

Week 05 : Crystal systems, point groups, space groups.

Week 06 : Group notations, Schonflies notations, Hermann-Mauguin notations.

Week 07 : Coordination number, defects and voids in crystals, Schottky and Frenkel defects, interstitials.

Week 08 : Lattice planes, Miller indices, X-ray diffraction, Bragg's law, X-ray difraction, indexing of peaks

Week 09 : Powder X-ray diffractometers, single crystal X-ray diffractometers, X-ray crystallography, electron density maps, electron microscopy techniques.

Week 10 : Crystal structures of elements, alloys, binary compounds,nitrides, sulphides, perovskites, spinels.

Week 11 : Electronic structure of solids, origin of bands, band structure,density of states.

Week 12 : Band structure and electrical conductivity, band gap, optical properties.

CHEMISTRY AND BIOCHEMISTRY

SYMMETRY AND STRUCTURE IN THE SOLID STATE

PROF. T.N. GURU ROW
Department of Chemistry
IISc Bangalore

TYPE OF COURSE : New | Core| PG
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
INTENDED AUDIENCE : Research students, Scientists from Pharmaceutical and materials industry and teachers (faculty) at Universities
EXAM DATE : 28 Apr 2019
PRE-REQUISITES : Basic Mathematics
INDUSTRIES APPLICABLE TO : Pharmaceutical and Materials Industry

COURSE OUTLINE :

Symmetry, point groups and space groups, crystal lattices. Scattering, diffraction, reciprocal lattice. powder diffraction. Single crystal methods. Data collection and processing synchrotron radiation, phase problem in crystallography. Patterson and direct methods, Rietveld refinement, intermolecular interactions electron density analysis. Basics of neutron diffraction, electron diffraction.

ABOUT INSTRUCTOR :

T. N. Guru Row Professor and Dean (Science Faculty) Solid State and Structural Chemistry Unit Indian Institute of Science, Bangalore. [B.Sc(Hons) Physics,Bangalore University, Bangalore , India.] [M.Sc :Solid state physics, Bangalore University, Bangalore, India.] [Ph.D :Indian Institute of Science, Bangalore, India.]

COURSE PLAN :

Week 01 : Basics of symmetry, 2 Point groups
Week 02 : Space groups, Equivale3nt points, Wycoff notation
Week 03 : Basics of diffraction, Laue's conditions and Bragg's Law
Week 04 : Reciprocal lattice concepts, data collection and reduction
Week 05 : Phase problem
Week 06 : Patterson Synthesis
Week 07 : Direct methods
Week 08 : Single crystal and powder XRD
Week 09 : Refinement protocols
Week 10 : Bond lengths, angles and conformation
Week 11 : Intermolecular interactions
Week 12 : Applications in Pharmaceutical and materials industry

CIVIL ENGINEERING

CIVIL ENGINEERING

04 weeks

01. Electronic Waste Management - Issues And Challenges
02. Introduction to Remote Sensing
03. Advanced Topics in the Science and Technology of Concrete

08 weeks

01. Earth Sciences For Civil Engineering (Part - I & II)
02. Hydration, Porosity & Strength of Cementitious Materials
03. Plastic Waste Management
04. Digital Land Surveying And Mapping(DLS&M)
05. Subsurface exploration : importance and techniques involved
06. Natural Hazards (Part-1)

12 weeks

01. Applied Environmental Microbiology
02. Environmental Remediation of Contaminated Sites
03. Geotechnical Engineering II/Foundation Engineering
04. Geosynthetics And Reinforced Soil Structures
05. Energy Efficiency, Acoustics and daylighting in Building
06. Infrastructure Planning and Managements
07. Soil Mechanics/Geotechnical Engineering - I

CIVIL ENGINEERING

ELECTRONIC WASTE MANAGEMENT - ISSUES AND CHALLENGES

PROF. BRAJESH KR. DUBEY
Environmental Engineering and Management
IIT Kharagpur

TYPE OF COURSE : Rerun | Elective | UG/PG

COURSE DURATION : 4 weeks (28 Jan'19 - 22 Feb'19)

PRE-REQUISITES : Environmental Science
Introduction to Environmental Engineering

EXAM DATE : 31 Mar 2019

INDUSTRY SUPPORT : E Parisaraa – Bangalore, Ecoreco Recycling – Mumbai Earth Sense – Telangana, Attero Recycling – Noida, EWRI-Bangalore, WEEE Recycle – New Delhi, J. S. Pigments Limited – Kolkata.

INTENDED AUDIENCE : Disciplines of Engineering, Science, Humanities and Management

COURSE OUTLINE :

This course will discuss the overall scenario of E-Waste management in India in comparison with other countries around the globe. At first, the present scenario of E-Waste management in India (mostly informal) will be discussed along with the role of various stakeholders. Then, the effects of recycling and management of Electronic Waste on human health, environment and society will also be presented. This will be followed by the risk assessment owing to pollutants released from E-Waste recycling in soil, air and water. The possible option of extraction of Rare-Earth Minerals will also be discussed in this course.

ABOUT INSTRUCTOR :

Prof. Brajesh Kr. Dubey is an Associate Professor in the Division of Environmental Engineering and Management at Indian Institute of Technology (IIT), Kharagpur, India. Dr. Dubey has more than a decade of research, teaching, training and industrial outreach experience in the areas of Integrated Solid and Hazardous Waste Management, Life Cycle Assessment (LCA) and Sustainable Engineering. He has collaborated with UN agencies, World Bank, National Science foundation, Ontario Ministry of Environment and Auckland Regional Council on various projects including that in the area of LCA. He has been resource person for several municipal solid waste management training programs including that for electronics waste and has delivered lectures on this subject at several universities in USA, Canada, New Zealand, China and India. Dr. Dubey has authored/co-authored more than 160 publications in his area of expertise and has presented at several national and international conferences.

COURSE PLAN

Week 1 : Overview of the course

Week 2 : Exposure pathway of pollutants emitted from Recycling of E-Waste

Week 3 : E-Waste Management Rules of India (2011 and 2016 Rules)

Week 4 : E-waste Management: Case Studies and Unique Initiatives from around the World

INTRODUCTION TO REMOTE SENSING

CIVIL ENGINEERING

PROF. ARUN K. SARAF
Department of Earth Sciences
IIT Roorkee

COURSE DURATION : 4 weeks (28 Jan'19 - 22 Feb'19)
EXAM DATE : 31 Mar 2019

TYPE OF COURSE : Rerun| Elective | UG/PG

INDUSTRIES APPLICABLE TO : Geoinformatics companies, e.g NIIT, ESRI India, Leica Geoinformatics, MapmyIndia etc.

COURSE OUTLINE :

The proposed course provides basic understanding about satellite based Remote Sensing technology. Presently, remote sensing datasets available from various earth orbiting satellites are being used extensively in various domains including in civil engineering, water resources, earth sciences, transportation engineering, navigation etc. Google Earth has further made access to high spatial resolution remote sensing data available to non-experts with great ease.

ABOUT INSTRUCTOR :

Dr. Arun K. Saraf is Ph. D. (Remote Sensing) from University of Dundee, United Kingdom. Presently he is working as Professor in the Department of Earth Sciences, Indian Institute of Technology, Roorkee, and teaches courses on Remote Sensing, Digital Image Processing, Geographic Information Systems (GIS), Advanced GIS, Geomorphology, Geohydrology etc. to under- and post-graduate students of Geological Technology and Applied Geology. He was also Head of Department of Earth Sciences between Jan. 2012 – Feb. 2015. He was first in the country to introduce GIS course to post-graduate students in the year 1990. In 1986, he was awarded "National Fellowship to Study Abroad" by Govt. of India for his doctoral degree.

COURSE PLAN :

Week 01 : What is satellite based remote sensing? | Development of remote sensing technology and advantages | Different platforms of remote sensing | EM spectrum, solar reflection and thermal emission remote sensing | Interaction of EM radiation with atmosphere including atmospheric scattering, absorption and emission.

Week 02 : Interaction mechanisms of EM radiation with ground, spectral response curves | Principles of image interpretation | Multi-spectral scanners and imaging devices | Salient characteristics of LANDSAT, IRS, Cartosat, ResourceSat etc. sensors | Image characteristics and different resolutions in Remote Sensing.

Week 03 : Image interpretation of different geological landforms, rock types and structures | Remote Sensing integration with GIS and GPS | Georeferencing Technique | Basic image enhancement techniques | Spatial filtering techniques.

Week 04 : Image classification techniques | InSAR Technique and its applications | Hyperspectral Remote Sensing | Integrated applications of RS and GIS in groundwater studies | Limitations of Remote Sensing Technique.

CIVIL ENGINEERING

ADVANCED TOPICS IN THE SCIENCE AND TECHNOLOGY OF CONCRETE

PROF. RAVINDRA GETTU
Department of Civil Engineering
IIT Madras

PROF. MANU SANTHANAM
Department of Civil Engineering
IIT Madras

TYPE OF COURSE : New| Elective | PG
INTENDED AUDIENCE : Research scholars and scientists working in the areas of concrete science and technology
COURSE DURATION : 4 weeks (28 Jan'19 - 22 Feb'19)
EXAM DATE : 31 March 2019
PRE-REQUISITES : Courses in Concrete Technology, and preferably Advanced Concrete Technology
INDUSTRIES APPLICABLE TO : Industry with R&D in the area of cement and concrete

COURSE OUTLINE :

International experts on the science and technology of concrete will give brief lectures to highlight advanced topics based on their own research. This will introduce the student to new fields of research and give them an opportunity to learn more than what is usually covered in courses on concrete technology.

ABOUT INSTRUCTOR :

Prof. Ravindra Gettu is the Prof. V.S. Raju Chair Professor in the Department of Civil Engineering at IIT Madras, where he has worked since 2004. He has co-authored more than 400 scientific and technical publications in the areas of concrete technology, effective use of admixtures, self compacting concrete, sustainability and fibre reinforced concrete. He is the President of RILEM, the International Union of Laboratories and Experts in Construction Materials, Structures and Systems, based in France, and the past Chairman of the Indian Concrete Institute Chennai Centre.

Dr Manu Santhanam is a Professor in the Department of Civil Engineering at IIT Madras, where he has worked since October 2001. His primary research interests are in Cement Chemistry, Durability of Concrete and Non-Destructive Evaluation. He has published more than 75 refereed journal papers, and has guided 10 PhD theses, in addition to being lead investigator on several sponsored projects.

COURSE PLAN :

Week 01 : Guest lecture on Calcium Sulphoaluminate Cement, by Prof. Piyush Chaunsali, IIT Madras. Guest lectures on Micro-structural characterisation of cementitious materials, Prof. Karen Scrivener, EPFL, Switzerland

Week 02 : Closed-loop testing of concrete. Guest lectures on Performance of Fiber reinforced materials: Historic prospective and glance into the future, by Prof. Surendra P. Shah, Northwestern University

Week 03 : Durability parameters of concrete. Sulphate attack. Guest lectures on Development and performance approach for durability and service life production for structures, by Prof. Mark Alexander, Univ. of Cape Town

Week 04 : Corrosion of steel reinforcement in concrete. Life cycle assessment of concrete.

EARTH SCIENCES FOR CIVIL ENGINEERING PART - I & II

CIVIL ENGINEERING

PROF. JAVED MALIK
Department of Civil Engineering
IIT Kanpur

TYPE OF COURSE : Rerun | Core | UG/PG
PRE-REQUISITES : Basic knowledge of geology is recommended.
INTENDED AUDIENCE : UG/PG students of Science and Engineering (especially Earth Sciences).
COURSE DURATION : 8 weeks (28 Jan'19 - 22 Mar'19)
EXAM DATE : 31 Mar 2019

COURSE OUTLINE :

The course introduces the student to basic principles of geosciences, geological hazards and their applications in civil engineering. The first 4-week modules of this course will help the student to have better understanding towards interior of the earth, earth system and its process. The next 4 week modules will cover geological hazards and environmental impact, active faults and its related hazard in India, importance of geological structures in dams and tunnels, fluvial geomorphology and ground water, tsunami, landslide and flood hazard, mapping, monitoring and management of hazards.

ABOUT INSTRUCTOR :

Prof. Javed Malik earned his Ph. D in 1998 from M. S. University Baroda, Vadodara, Gujarat (Geology), did Post-Doctorate (Japan Society for Promotion of Science) from (1999-2001) Hiroshima University, Japan. Joined IIT Kanpur in 2001. Area of Specialization: Active Tectonics, Paleoseismology and Paleo-tsunami, Current Areas of Research: Active fault mapping and Paleoseismological studies along NW Himalaya and Kachchh, Paleo-Tsunami studies in Andaman & Nicobar Islands Collaboration with Japan, US and France – related to earthquake and tsunami studies. Research Projects: Active tectonic investigation along northwestern Himalayan foothill zone, sponsored by DST, Active fault mapping and paleoseismic investigations in Kachchh region. Gujarat, by OYO International Japan. Active Tectonic investigations around South-Middle Andaman and Car Nicobar Islands, A&N Islands, sponsored by INCOIS, Hyderabad, MoES.

COURSE PLAN

Week 1 : Introduction to Geosciences in Civil Engineering,Introduction to Geosciences in Civil Engineering,Plate Tectonics and Continental Drift,Plate Tectonics and Continental Drift,Rock-forming Minerals and their properties

Week 2 : Rock-forming Minerals and their properties,Rock types and their properties,Rock types and their properties,Rock types and their properties,Rock types and their properties

Week 3 : Seismology and the internal Structure of the Earth,Seismology and the internal Structure of the Earth,Geological Structure Geological Structures,Geological Structures

Week 4 : Introduction to Geological Hazards,Introduction to Geological Hazards,Introduction to Geological Hazards, Environmental impacts of Geological hazards,Environmental impacts of Geological hazards

Week 5 : Active faults and its related hazard in India,Active faults and its related hazard in India,Active faults and its related hazard in India,Active faults Mapping and Applications,Active faults Mapping and Applications

Week 6 : Tsunami and related hazard,Tsunami and related hazard,Tsunami and related hazard,Landslide and Subsidence, Landslide and Subsidence

Week 7 : Landslide and Subsidence,Flood and related hazard,Flood and related hazard,Flood and related hazard, Groundwater

Week 8 : Applications of Earth Sciences in Civil Engineering,Applications of Earth Sciences in Civil Engineering, Civil Engineering applications – geological considerations in Rivers,Civil Engineering applications – geological considerations in Dams, Civil Engineering applications – geological considerations in Tunnels

HYDRATION, POROSITY & STRENGTH OF CEMENTITIOUS MATERIALS

CIVIL ENGINEERING

PROF. SUDHIR MISHRA
Department of Civil Engineering
IIT Kanpur

PROF. K.V. HARISH
Dept. of Civil Engineering
IIT Kanpur

TYPE OF COURSE : Rerun | Core | UG
COURSE DURATION : 8 weeks (28 Jan'19 - 22 Mar'19)
EXAM DATE : 31 Mar 2019
INDUSTRY SUPPORT : Cement, concrete and construction industry
INTENDED AUDIENCE : Students of civil engineering in colleges and practicing professionals in the area of cement, concrete and construction industry

COURSE OUTLINE :

Cement and concrete is the backbone of infrastructure development and it is important that engineers have a clear understanding of issues involved not only with cement, hydration and strength development, but also porosity, permeability and durability. With the basic framework using Ordinary Portland Cement, the course focuses on developing the subject in light of advances in chemical and mineral admixtures. Though the subject matter is approached from the point of view of the concrete science, the fact that paste made with OPC alone or in combination with other cementitious materials, is almost never used in the field. Illustrative examples from actual applications will be included to show the applications of the scientific principles.

ABOUT INSTRUCTOR :

Prof. Sudhir Misra is Professor at the Department of Civil Engineering, Indian Institute of Technology Kanpur and has a keen interest in concrete materials, construction and engineering. He has worked with consulting and construction companies also during his 35 years of professional experience, and also led the effort to initiate a graduate programme in Infrastructure Engineering and Management at IIT Kanpur. He has been a member of committees of the BIS and also worked with professional organizations in Japan and India. His research interests include durability and non-destructive testing of concrete and development and utilization of special concretes.

Prof. K.V. Harish is currently working as an Assistant Professor at the Department of Civil Engineering, IIT Kanpur. He completed his Ph. D in 2011 at the Glenn Department of Civil Engineering, Clemson University, South Carolina, USA. During his doctoral studies, he was a recipient of ACI-BASF Foundation Student Fellowship for the academic year 2010-2011. He completed his Bachelors and Masters studies in India and is a University Rank Holder in both degrees. After Masters education, he worked as a Scientist in Structural engineering research center, CSIR Campus for 2 years. His research interests include microstructure of cement based materials, development of high- and ultra-high performance concretes, repair and rehabilitation of concrete structures, sustainable concretes.

COURSE PLAN

Week 1 : General

Week 2 : Introduction

Week 3 : Portland Cement Based Paste System

Week 4 : Portland Cement Based Paste System (Contd.)

Week 5 : Mineral Admixtures

Week 6 : Mineral Admixtures (Contd.)

Week 7 : Paste & Concrete

Week 8 : Paste & Concrete (Contd.)

CIVIL ENGINEERING

PLASTIC WASTE MANAGEMENT

PROF. BRAJESH KUMAR DUBEY
Department of Civil Engineering
IIT Kharagpur

TYPE OF COURSE : New | Elective | UG/PG

COURSE DURATION : 8 weeks (25 Feb'19 - 19 Apr'19)

INTENDED AUDIENCE : Civil and Chemical Engineering BTech programs, Environmental Engineering and Environmental Science Masters and Doctoral Programs

EXAM DATE : 28 April 2019

PRE-REQUISITES : Basic Environmental Science, Basic Differential Equations, Basic Chemistry

INDUSTRIES APPLICABLE TO : AECOM, Ramky, Environmental Resource Management (ERM), SENES/ARCADIS. Waste Management related companies, Govt. Agencies

COURSE OUTLINE :

This course will focus on:
1. Introduction of Plastic pollution as a global problem today.
2. What is Plastic Waste? The Magnitude of the problem on global scale and in Indian context. Plastic in Ocean and impact on sea life and economy.
3. What is the nature and complexity of this problem and what could be the best way to manage the plastic waste and how to mitigate the risk from plastic waste.
4. Plastic Waste Management Rules 2016, Recent Plastic Bans and the use of Extended Producer Responsibilities (EPR) concepts in managing Plastic waste in India.
5. Best Practices of Managing Plastic Waste from around the World including use of Plastic waste in road (experience from Indian context and other countries)
6. Way forward – how to manage this waste stream applying state of the art technologies

ABOUT INSTRUCTOR :

Professor Brajesh Kr. Dubey has his Bachelors degree in Civil Engineering (Hons) from Indian Institute of Technology (IIT) Kharagpur, India and PhD in Environmental Engineering Sciences, University ofFlorida, Gainesville, Florida, USA. He is presently Associate Professor (Integrated Waste Management and Sustainable Engineering) in the Division of Environmental Engineering and Management at Indian Institute of Technology (IIT), Kharagpur, India. Dr. Dubey has more than 17 years of research, teaching, training and industrial outreach experience in the areas of Integrated Solid and Hazardous Waste Management, and Sustainable Engineering and Application of Life Cycle Assessment techniques. He also works in the area of Life Cycle Analysis and Sustainable Engineering.

COURSE PLAN :

Week 01 : Plastics – What it is? Types, Uses and Global Statistics

Week 02 : Plastic Waste – Sources, Production, Global and Indian Context

Week 03 : Plastic Waste Management Rules 2016 (India) and Global Rules and Regulations

Week 04 : Plastic Bans including China Sword Policy implication on global plastic waste management

Week 05 : Impact of Plastics on Marine Life, Effect on Wildlife, Human Health and Environment

Week 06 : Plastic Waste Management Practices – Use of Plastic waste in roads, issues and challenges

Week 07 : Possible Alternate Materials to Plastics –Greener Alternatives

Week 08 : Plastics Resource Recovery and Circular Economy

DIGITAL LAND SURVEYING AND MAPPING(DLS&M)

CIVIL ENGINEERING

PROF. J .K GHOSH
Department of Civil Engineering
IIT Kanpur

TYPE OF COURSE : Rerun | Core | UG

COURSE DURATION : 8 weeks (25 Feb'19 - 19 Apr'19)

EXAM DATE : 27 Apr 2019

PRE-REQUISITES : Basics of Physics and mathematics upto 12th standard and familiarity with use of computer

INDUSTRY SUPPORT : http://dir.indiamart.com/impcat/topographic-survey-services.html

INTENDED AUDIENCE : Diploma/Degree students in Civil Engineering/Geo-spatial technology, Master/Doctoral students in Geomatics/Geo- spatial technology, Field surveyors, Professional persons dealing with Land surveying. It is an application based Course. It is a core course for Civil Engineering, Geo-spatial Technology, Geography etc and an elective course for all domains in which Land surveying may be applied.

COURSE OUTLINE :

The objective of the course is to provide basics of digital surveying and mapping of earth surface using total station, GPS and mapping software. The course starts with introduction to land surveying followed by fundamentals of total station and its working & measurements for land surveying. Then, fundamentals, working & measurements using GPS for land surveying will be discussed. Followed by mapping fundamentals, digital surveying procedure, working, data reduction etc. Finally, the course will deals with working and demonstration of a digital land surveying and mapping of an area.

ABOUT INSTRUCTOR :

Prof. Jayanta Kumar Ghosh is working as Associate Professor in the Civil Engineering Department (Geomatics Engineering Group) of Indian Institute of Technology Roorkee. He is engaged in teaching, research and consultancy works in Geomatics engineering for more than 31 years. He is pioneer in introducing courses on GPS surveying in the UG & PG curriculum of Engineering education in India, since 1999. He has conducted many short term courses on Surveying for the building professionals as early as 2000. He has published TWO books on Surveying – Elementary Engineering Surveying and Introduction to GPS Surveying. He is member of different National and International technical associations.

COURSE PLAN

Week 1 : Fundamentals of Land Surveying & GPS

Week 2 : Global Positioning System (GPS)

Week 3 : Global Positioning System (GPS)

Week 4 : Total station(ts)

Week 5 : Ts & digital land surveying (dls)

Week 6 : Dls& digital mapping (dm)

Week 7 : Dm & digital data manipulation (ddm)

Week 8 : Digital land surveying and mapping (dls&m)

CIVIL ENGINEERING

SUBSURFACE EXPLORATION : IMPORTANCE AND TECHNIQUES INVOLVED

PROF. ABHISHEK KUMAR
Department of Civil Engineering
IIT Guwahati

COURSE DURATION : 8 weeks (25 Feb'19 - 19 Apr'19)
EXAM DATE : 28 April 2019

TYPE OF COURSE : New | Elective | PG
INTENDED AUDIENCE : B.Tech, M.Tech,PhD students, industrial engineer, designers & people from field investigation firms
PRE-REQUISITES : Engineering would be minimum qualification to know basic soil mechanics.
INDUSTRIES APPLICABLE TO : Larsen and Toubro/Risk management solution/Gammon/other construction companies.

COURSE OUTLINE :

This course covers the requirement of thorough subsurface investigation, its importance in planning and execution of the project, classification of investigation to be adopted and challenges faced during many of the most complex civil engineering projects across the globe.Detailed discussion on methodologies starting with borehole drilling, rock drilling to advanced methods such as electrical resistivity, geophysical tests, sounding, magnetic anamoly,dilatometer test, pressuremeter tests, ground penetrating radar will be covered along with numerical problems at various stages. In addition, testing on piles which is a very hot topic these days, will be covered in the course.

ABOUT INSTRUCTOR :

Dr Abishek Kumar did his Diploma and Bachelor in Civil Engineering from Aligarh Muslim University, Aligarh 2007. He then joined for ME in Dept of Civil Engineering at IISc Bangalore where he converted to PhD in 2008, In August 2013 after defending his PhD thesis, Dr Abhishek joined Larsen and Toubro as Assistant Engineering Manager where he was involved in developing guidelines for field investigations particularly related to seismic aspects. Later, in May 2014, Dr Kumar joined Dept of Civil Engineering, IIT Guwahati as Assistant Professor. He has so far guided 5 MTech, & one PhD while two more are under progress. He is recipient of Young Engineers Award 2015 from India National Academy of Engineering

COURSE PLAN :

Week 01 : Subsurface exploration: Need and objectives

Week 02 : Geotechnical investigations - I

Week 03 : Geotechnical investigations - II

Week 04 : Geophysical Investigations - I

Week 05 : Geophysical Investigations - II

Week 06 : Offshore investigations - I

Week 07 : Dynamic Testing of Piles - I

Week 08 : Dynamic Testing of Piles - II

CIVIL ENGINEERING

NATURAL HAZARDS (PART-1)

PROF. JAVED MALIK
Department of Earth Sciences
IIT Kanpur

TYPE OF COURSE : New| Elective | UG/PG
INTENDED AUDIENCE : UG/PG students of Science/Engg
COURSE DURATION : 8 weeks (28 Jan'19 - 22 Mar'19)
EXAM DATE : 31 Mar 2019

PRE-REQUISITES : Basic knowledge of Earth Science or Natural Disasters is recommended.

COURSE OUTLINE :

The course introduces students to natural disasters and their phenomenon, ground deformations, land-level changes, event recurrence intervals, associated environmental and depositional changes, sedimentation patterns, and all the related hazards. Some of the well-known natural disasters are earthquakes, landslides, floods, tsunamis, volcanic eruptions, storms, and cyclones etc. which cause different types of natural hazards in the associated environment and landscape. This course will emphasize their mechanism, origin, and impacts in the associated regions such as mainland, hilly terrain, floodplain/alluvial plain, and coastal regions etc., and also focus on the approaches for mitigating and minimizing hazards along with related hazard assessment.

ABOUT INSTRUCTOR :

Prof. Javed Malik earned his Ph.D in 1998 from M.S. University Baroda, Vadodara, Gujarat (Geology), did Post-Doctorate (Japan Society for Promotion of Science) from (1999-2001) Hiroshima University, JAPAN. He joined IIT Kanpur in 2001 and his areas of Specialization are Active Tectonics, Paleoseismology and Paleo-tsunami

COURSE PLAN :

Week 01 : Natural Hazards and Disasters ,Natural Hazards and Disaster,Human Impact on Natural Disaster,Predicting Catastrophe,Mitigating Hazards
Week 02 : Mitigating Hazards,Plate Tectonics and related Hazards,Plate Tectonics and related Hazards,Plate Tectonics and related Hazards,Earthquakes and their causes
Week 03 : Earthquakes and their causes,Earthquakes and their causes,Ground Motion and Failures,Ground Motion and Failures,Ground Motion and Failures
Week 04 : Tsunami: Gaint Tsunamis,Tsunami: Gaint Tsunamis,Tsunami: Generation and Movement,Tsunami: Generation and Movement,Tsunami: Generation and Movement
Week 05 : Tsunami Hazard Assessment,Tsunami Hazard Assessment,Volcanic Hazard: Eruption-Type of Volcanoes and Tectonic environment,Volcanic Hazard: Eruption-Type of Volcanoes and Tectonic environment,Volcanic Hazard: Eruption-Type of Volcanoes and Tectonic environment
Week 06 : Landslide and their causes, Type of downslope movement, associated hazard,Landslide and their causes, Type of downslope movement, associated hazard,Landslide and their causes, Type of downslope movement, associated hazard,Land Subsidence and associated hazard,Land Subsidence and associated hazard
Week 07 : Floods and Human Interaction,Flood Frequency and Recurrence Interval,Flood Frequency and Recurrence Interval,Human intervention and mitigation,Human intervention and mitigation
Week 08 : Storms: Tropical Cyclone,Storms: Tropical Cyclone,Hurricane, Tornado, Storm damage and safety, Wildfires: Fire Process and Secondary effects,Wildfires: Fire Process and Secondary effects

CIVIL ENGINEERING

APPLIED ENVIRONMENTAL MICROBIOLOGY

PROF. GARGI SINGH
Dept of Microbiology and Environmental Engineering
IIT Roorkee

TYPE OF COURSE : Rerun | Elective | UG

COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)

EXAM DATE : 27 Apr 2019

INDUSTRY SUPPORT : GMBH, Thermax India, GE Water, Siemens Water, SFC, Environmental Technologies Pvt. Ltd., Voltas Ltd

INTENDED AUDIENCE : Students of Civil Engineering, Chemical Engineering, and related sciences.

COURSE OUTLINE :

This course prepares the student to address pressing environmental challenges by developing a fundamental understanding of the microbial communities and processes in natural and built environments. It lays and builds upon the foundation of basic microbiology, microbial energetics, and diversity, to applying tools provided by microbiology ranging from traditional to state of art for addressing relevant environmental concerns.

ABOUT INSTRUCTOR :

Prof. Gargi Singh is currently working at the interface of microbiology and environmental engineering at IIT Roorkee to address environmental challenges of pathogen ingress in water distribution network and environmental proliferation of antibiotic resistance. In her doctoral research, she applied molecular biology tools including quantitative polymerase chain reaction, isolation, selection, high-throughput sequencing on pyrosequencing and Illumina based platforms, and metagenomics to investigate biodegradation of petroleum and nanocellulose, and sequestration of heavy metals.

COURSE PLAN

Week 1 : Cell elements and composition, cytoplasmic membrane Prokaryotic cell division Microbes and their environmental niches Nucleic acids and amino acids DNA structure, replication, and manipulation, Protein and its structur, Regulation Microbial nutrition Microscopy: Light microscopy, 3D Imaging, AFM, Confocal scanning laser microscopy.

Week 2 : Microbial energetics and diversity, Stoichiometry and bioenergetics Oxidation-reduction NAD, energy-rich compounds and energy storage Mathematics of microbial growth Glycolysis Respiration Citric-acid cycle Catabolic Alternatives Phototrophy, Chemolithotrophy, anaerobic respiration (Nitrate and Sulfate reduction; Acetogenesis; Methanogenesis; Metal, Chlorate, and organic electron acceptors).

Week 3 : Microbial metabolism and functional diversity of bacteria Classical taxonomy, Origin of life Tree of life Major catabolic pathways Catalysis and enzymes Energy conservation Sugars and polysaccharides, amino acids, nucleotides, lipids.

Week 4 : Microbial ecosystems Population, guilds, and communities Environments and microenvironments Microbial growth on surfaces Environmental effects on microbial growth.

Week 5 : Environmental genomics and microbial ecology; genetic exchange, Environmental genomics, Microbial ecology Horizontal and vertical gene transfer: Replication, Transformation Transduction.

Week 6 : Microbial symbiosis and virus, Mutation and its rate, Genetic recombination, Population dynamics ,Virus ,Viroid, Prion, Application of environmental microbes.

Week 7 : Investigations in environmental microbiology: sampling, detection, isolation, taxonomic and functional annotation and quantification; Introductory bioinformatics and data analysis Microbial sampling Culture based and culture independent tools Molecular biology tools: Cloning, amplification, sequencing, Case study.

Week 8 : Bioremediation and wastewater microbiology, Bioremediation and examples, Acid mine drainage, Enhanced metal recovery, Wastewater microbiology.

Week 9 : Drinking water microbiology, Drinking water microbiome and treatment, Microbial instability ,Water borne microbial diseases.

Week 10 : Solid waste microbiology and antimicrobial resistance, Landfills, Leachate, Anaerobic degradation phases, Antimicrobial resistance.

Week 11 : Epidemiology and biosensors , Public health, Epidemics, Biosensors, Wearable biosensors.

Week 12 : Built microbiology, exposomes and bioinformatics, Exposure routes, Microbes living around us, Exposomes Basic bioinformatics, Bioinformatics tools available online.

CIVIL ENGINEERING

ENVIRONMENTAL REMEDIATION OF CONTAMINATED SITES

PROF. BHANU PRAKASH VELLANKI
Department of Civil Engineering
IIT Roorkee

TYPE OF COURSE : New | Elective| UG/PG

COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)

INTENDED AUDIENCE : Environmental Engineering professionals and students pursuing degree with emphasis in Environmental Engineering.

EXAM DATE : 28 April 2019

PRE-REQUISITES : Entry level chemistry course, and understanding of chemical, physical and biological processes on Environmental Engineering

INDUSTRY SUPPORT : CPCB, SPCB, Degremont, ERM, Ramky Enviro Engineers, Veolia Water, SFC Environmental Technologies Pvt. Ltd., Nalco Water, VA Tech Wabag, Thermax

COURSE OUTLINE :

The course details the usual remediation techniques practiced worldwide and provide an understanding of the relevant theoretical concepts. The current course will enable a student to:
Develop understanding of integrated approaches to remediating contaminated sites.
Develop the ability to screen, choose and design appropriate technologies for remediation.

ABOUT INSTRUCTOR :

Dr. Bhanu Prakash Vellanki, is an Assistant Professor at IIT Roorkee. He holds a PhD in Civil Engineering with a specialization in Environmental Engineering from Texas A&M University. During the course of his doctoral work, Dr. Vellanki developed a new class of treatment processes, called the Advanced Reduction Processes. His research interests include Advanced Redox Processes, industrial/hazardous waste treatment, and emerging contaminants.

COURSE PLAN :

Week 01 : Introduction, Laws, Regulations and Remediation, Legal Concepts, Types of Law, Regulations, Federal

Week 02 : Laws/ Regulations, History, Objectives, Remediation Process, Definition of hazardous waste, Waste Classification, Corrective Action

Week 03 : Risk Assessment, Introduction, Terminology, History, Steps in Human Health Risk Assessment,Data Collection and Evaluation, Exposure Assessment, Toxicity Assessment, Risk Characterization, Risk Management, Risk Communication, Ecological Risk Assessment, Risk-based Corrective Action.

Week 04 : Remedial Options, Introduction, Administrative Options, Groundwater, Plume Containment, introduction, extraction wells, extraction trenches, injection wells/ trenches, wells/ barriers

Week 05 : Pump and Treat, Introduction, Contaminant behavior, Design considerations, Source Control, Philosophy, Options

Week 06 : Permeable Reactive Barriers, Introduction, Redox reactions, Kinetics, Design considerations, Monitored Natural Attenuation, Introduction, Evaluation, Monitoring, Mechanisms, Plume Types, Lines of Evidence, Case Study

Week 07 : Soils/Sediments, Excavation, Use,Techniques, Control of contaminant transport, Typical costs, Landfill, Hazardous waste landfill, Solid waste landfill

Week 08 : Containment, characteristics of barrier materials, alternatives,Solidification/ Stabilization, Introduction, Fundamentals, Chemical, physical, Leaching, single-component, multi-component, Design Considerations, TCLP-based approach, Risk-based approach

Week 09 : Chemical Treatment, Non-redox reactions, Reductive processes, Oxidative processes (ISCO), Surfactant extraction, Introduction, Surfactant properties, Configurations, Soil Vapor Extraction,Introduction, Fundamentals, Design considerations

Week 10 : Bioremediation, Introduction, Fundamentals, Important processes, Examples

Week 11 : Phytoremediation, Mechanisms, Examples

Week 12 : Thermal Processes,Introduction, Incineration, Thermal Desorption, Aqueous Oxidation, Soil Washing, Introduction, Process Description, Design Considerations

CIVIL ENGINEERING

GEOTECHNICAL ENGINEERING II/ FOUNDATION ENGINEERING

PROF. DILIP KUMAR BAIDYA
Department of Civil Engineering
IIT Kharagpur

TYPE OF COURSE : New | Core | UG/PG
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
INTENDED AUDIENCE : Civil Engineering
EXAM DATE : 28 April 2019
PRE-REQUISITES : Soil Mechanics/Geotechnical Engineering I
INDUSTRIES APPLICABLE TO : Most of the Civil Engineering companies

COURSE OUTLINE :

Broadly Geotechnical Engineering encompasses two distinct segments: Geotechnical engineering I (Soil Mechanics) and Geotechnical Engineering II (Foundation Engineering). Geotechnical Engineering I/Soil Mechanics deals with study of physical properties of soils, and the relevance of these properties as they affect soil strength, stability, and drainage. Geotechnical Engineering II/Foundation engineering deals with (i) selection of foundation type based on building site conditions and site constraints, (ii) determining size and reinforcement of the foundation and (iii) finally construction of foundation element. This course will focus on the second, Geotechnical Engineering II/Foundation Engineering. One week will be spent for quickly reviewing the soil mechanics and subsequently various topics of foundations will be covered. Although the objective is to select a safe and economical design, there is no unique design or method in foundation engineering. Therefore an attempt is made to connect the theoretical concepts with the practical aspects of foundation engineering. Every civil engineer has to learn basic principle of geotechnical engineering and its application through foundation engineering and both are core courses for civil engineering in every college/university across the globe. Every aspect of foundation as per GATE, Engineering Service and other important competitive examination will be covered with great detail under this course.

ABOUT INSTRUCTOR :

Presently Professor in Civil Engineering at IIT Kharagpur, graduated in Civil Engineering in 1987 from Bengal Engineering College Sibpur and obtained ME and Ph D from IISc Bangalore in the year 1989 and 93, respectively. Has 25 years of experience in teaching and research and guided more than 25 M Tech dissertations and 7 Ph D theses on Geotechnical Engineering. Published more than 100 papers in National/international journals and conferences out of which 3 papers received best paper award. Visited different countries for presenting papers in the international conferences and served 2 years as Faculty members in the University of West Indies, Trinidad and Tobago. Besides teaching and research, provided consultancy services to various industrial problems. Held several administrative positions at IIT Kharagpur which includes responsible position like Vice Chairman/Chairman JEE for IIT Kharagpur zone, Prof In-charge Examination etc.

COURSE PLAN :

Week 01 : Introduction and quick review of Soil Mechanics
Week 02 : Shallow Foundation and Bearing Capacity
Week 03 : Bearing Capacity theories and its application
Week 04 : Settlement of Footing
Week 05 : Soil Exploration and Geotechnical Investigation
Week 06 : Earth Pressure Theories
Week 07 : Stability Analysis of Retaining wall
Week 08 : Deep Foundations type, selection and load transfer mechanism
Week 09 : Pile capacity, pile load test and settlement
Week 10 : Sheet pile wall
Week 11 : Deep Excavation
Week 12 : Introduction to Machine foundation

CIVIL ENGINEERING

GEOSYNTHETICS AND REINFORCED SOIL STRUCTURES

PROF. K. RAJAGOPAL
Department of Civil Engineering
IIT Madras

TYPE OF COURSE : Rerun | Elective | PG
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
INTENDED AUDIENCE : BE/ME - Civil Engg
EXAM DATE : 27 Apr 2019
PRE-REQUISITES : Two basic courses in geotechnical engineering at UG level that covers fundamentals of soil mechanics and designs of retaining walls, slope stability analysis and foundations is the required background for this course.

COURSE OUTLINE :

This course will deal with geosynthetics as construction material in civil engineering projects. It will introduce the concept of geosynthetics, their manufacture, their behavior and their applications in different civil engineering designs. The support for the course will be in the form of pre-recorded videos, power point slides and supplementary reading materials given every week.

ABOUT INSTRUCTOR :

Dr. K. Rajagopal :Professor, Department of Civil Engineering, IIT Madras. He has more than 25 years of experience with teaching and research in geosynthetics and reinforced soil structures.

COURSE PLAN :

Week 01 : Introduction to Geosynthetics | Types of geosynthetics and their applications | Manufacture of geosynthetics.
Week 02 : Strength of reinforced soils | Testing of Geosynthetics.
Week 03 : Different Types of Soil Retaining Structures | Construction Aspects of Geosynthetic Reinforced Soil Retaining Walls | Design Codes for Reinforced Soil Retaining Walls.
Week 04 : External Stability Analysis of Reinforced Soil Retaining Walls | Seismic Loads and Internal Stability Analysis of Reinforced Soil Walls | Testing Requirements for Reinforced Soil Retaining Walls.
Week 05 : Design of Reinforced Soil Retaining Walls : simple geometry, sloped backfill soil, supporting a bridge abutment.
Week 06 : Stability analysis of soil slopes – infinite and finite slopes | Stability analysis of reinforced soil slopes resting on soft foundation soils | Stability analysis of reinforced soil slopes resting on strong foundation soil.
Week 07 : Stability analysis of reinforced soil slopes – bilinear wedge analysis | Design of soil slopes on geocell mattress | Design of Embankments supported on Load Transfer Platforms.
Week 08 : Reinforced soil for supporting shallow foundations.
Week 09 : Accelerated consolidation of soft clays using geosynthetics | Geosynthetic encased stone columns for load support.
Week 10 : Drainage application of geosynthetics | Filtration Applications of Geosynthetics.
Week 11 : Erosion control using geosynthetics | Natural geosynthetics and their applications.
Week 12 : Geosynthetics for construction of landfills.

CIVIL ENGINEERING

ENERGY EFFICIENCY, ACOUSTICS & DAYLIGHTING IN BUILDING

PROF. B. BHATTACHARJEE
Department of Civil Engineering
IIT Delhi

TYPE OF COURSE : Rerun | Elective | UG/PG
PRE-REQUISITES : BE/BSc. Physics/Math
INDUSTRY SUPPORT : All Industries involved in Building design and construction. L&T, TERI etc. CPWD and all other PWDs. Dr. Fixit Institute
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 28 Apr 2019

INTENDED AUDIENCE : Civil Engineering & Architecture students and professionals

COURSE OUTLINE :

The objective of this course is to expose the students to the concepts in functional design of building for thermal aspects and energy efficiency; especially in tropical climates i.e. in Indian context. Further objective is to make the student capable of performing fenestration design for natural ventilation and daylighting & design of space for external and internal noise control.

ABOUT INSTRUCTOR :

Prof. B. Bhattacharjee, Department of Civil Engineering, Indian Institute of Technology, Delhi, B.Tech(IIT KGP:1978), M.Tech. (IITD:1982) and Ph.D. (IITD:1990) Field Experience: M/s Gammon India Limited:1978-80. His research interests pertain to the domains of building science, sustainable construction, concrete technology, and health monitoring of structures etc. His publications in these areas are well cited. He is also a recipient of the Indian Concrete Institute's Life Time Achievement Award. He has been teaching a similar course in IITD for last 31 years (Building Science[3-0-0])

COURSE PLAN

Week 1 : Environmental Factors: Factors and their representation, tropical environments and site environments, etc.
Week 2 : Human response to environment: Factors affecting human comfort, Human response to thermal environment, noise, visual environment etc.; Comfort indices
Week 3 : Response of building to thermal environment: Processes of heat exchange of building with environment; Effect of solar radiation; Thermal properties of material and sections and their influence
Week 4 : Steady and periodic heat transfer in buildings
Week 5 : Heat flow computations: Transmission matrix, Admittance method, etc.-1
Week 6 : Heat flow computations: Transmission matrix, Admittance method, etc.-2
Week 7 : Structural control and design for energy efficiency: Selection of envelope elements, Orientations, shape, Glasses and shading devices
Week 8 : Natural ventilation: Purpose of ventilation, Mechanisms, Fenestration Design for natural ventilation
Week 9 : Noise and Building: Basic acoustics and noise, Planning, Sound in free field, protection against external noise
Week 10 : Internal noise sources and protection against air borne & structure borne noise.
Week 11 : Day lighting: Lighting principles and fundamentals
Week 12 : Sky, Indian sky, daylight prediction and design of fenestration.

CIVIL ENGINEERING

INFRASTRUCTURE PLANNING AND MANAGEMENTS

PROF. ASHWIN MAHALINGAM
Department of Civil Engineering
IIT Madras

TYPE OF COURSE : New | Elective | UG/PG
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
INTENDED AUDIENCE : B.E/M.E/MS/MBA/PhD
EXAM DATE : 27 April 2019

INDUSTRIES APPLICABLE TO : L&T IDPL, PwC, Deloitte, Quasi-Government Bodies such as TWIC, TNUIFSL etc

COURSE OUTLINE :

This course attempts to introduce students to 'real world' risks and challenges in managing infrastructure. After a brief introduction to the infrastructure planning process as well as the state of infrastructure across sectors in India, we systematically look at various risks that plague infrastructure projects. We then look at a variety of novel solutions or fixes that can help us execute infrastructure projects better. The course is replete with real-world case studies and guest lectures to ensure that what is being discussed is practically applicable.

ABOUT INSTRUCTOR :

Dr. Ashwin Mahalingam joined the faculty in the Building Technology and Construction Management division of the Civil engineering department at IIT-Madras in 2006. Ashwin received his B.Tech in Civil engineering from IIT-Madras and then proceeded to Stanford University for a Masters in Construction Engineering and Management. He then helped start up an internet based company in the USA called All Star Fleet, aimed at providing asset management services for construction companies. Following this he returned to Stanford University to pursue a PhD in the area of Infrastructure Project Management. Ashwin's research interests are in the areas of Public Private Partnerships (PPP) in Infrastructure, the management and governance of large engineering projects and the use of digital technologies in construction. Ashwin's current research focuses on institutional strengthening and post-award governance of PPP projects in India.

COURSE PLAN :

Week 01 : Class Introduction, Introduction to Infrastructure and to the Transportation, power and telecom sectors
Week 02 : Rural and Urban Infrastructure Sectors, Players and Phases in an Infrastructure Project
Week 03 : Project Finance and Public Private Partnerships
Week 04 : Construction and Economic Risks
Week 05 : Political and Social Risks
Week 06 : Stakeholder Management, Design Thinking and Negotiations
Week 07 : Socio-Economic Analysis and Good Governance for Infrastructure
Week 08 : Modeling Flexible Project Arrangements
Week 09 : Tales from the Field: Guest Lectures from Infrastructure Practitioners
Week 10 : Case Studies
Week 11 : Incomplete Design and Course Wrap-up
Week 12 : Exam

CIVIL ENGINEERING

SOIL MECHANICS / GEOTECHNICAL ENGINEERING - I

PROF. DILIP KUMAR BAIDYA
Department of Civil Engineering
IIT Kharagpur

TYPE OF COURSE : Rerun | Core | UG
PRE-REQUISITES : Engineering Mechanics, Solid Mechanics
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 27 Apr 2019
INDUSTRY SUPPORT : Most of the Civil Engineering companies
INTENDED AUDIENCE : B.E (Civil)

COURSE OUTLINE :

Broadly Geotechnical Engineering encompasses two distinct segments: Soil Mechanics and Foundation Engineering. Soil Mechanics deals with study of physical properties of soils, and the relevance of these properties as they affect soil strength, stability, and drainage. Foundation engineering deals with (i) selection of foundation type based on building site conditions and site constraints, (ii) determining size and reinforcement of the foundation and (iii) finally construction of foundation element. This course will focus on the first, soil mechanics. Soil Mechanics is the basis for all geotechnical applications.

ABOUT INSTRUCTOR :

Prof. Dilip Kumar Baidya presently Professor in Civil Engineering at IIT Kharagpur, graduated in Civil Engineering in 1987 from Bengal Engineering College Sibpur and obtained ME and Ph D from IISc Bangalore in the year 1989 and 93, respectively. Has 25 years of experience in teaching and research and guided more than 25 M Tech dissertations and 7 Ph D theses on Geotechnical Engineering. Published more than 100 papers in National/international journals and conferences out of which 3 papers received best paper award. Visited different countries for presenting papers in the international conferences and served 2 years as Faculty members in the University of West Indies, Trinidad and Tobago.

COURSE PLAN

Week 1 : Origin of soil and its Classification

Week 2 : Three-phase diagram & Weight volume relationship

Week 3 : Index properties

Week 4 : Soil Compaction

Week 5 : Seepage and Permeability

Week 6 : Effective stress concept

Week 7 : Boussinesq's theory and Vertical Stress distribution

Week 8 : Shear strength of soil I

Week 9 : Shear strength of soil II

Week 10 : Compressibility of soil

Week 11 : Consolidation settlement and time rate of settlement

Week 12 : Introduction to Stability of slopes

COMPUTER SCIENCE & ENGINEERING

COMPUTER SCIENCE & ENGINEERING

04 weeks

01. Real Time Operating System
02. Multimodal Interaction

08 weeks

01. Programming, Data Structures and Algorithms using Python
02. Programming In C++
03. Design and Analysis of Algorithms
04. Data Base Management System
05. Data Science for Engineers
06. Data Mining
07. Embedded System Design with ARM
08. Introduction to Soft Computing
09. Cloud Computing
10. Big Data Computing
11. Machine Learning,ML
12. Deep Learning – Part 2
13. Privacy and Security in Online Social Media
14. Information Security - 5 Secure Systems Engineering

12 weeks

01. Compiler Design
02. Foundations to Computer Systems Design
03. Computer Architecture and Organization
04. Computer Organization and Architecture: A Pedagogical Aspect
05. Discrete Mathematics
06. Problem solving through Programming In C
07. Programming in Java
08. The Joy of computing using Python
09. Machine learning for engineeringand science applications
10. Randomized Algorithms
11. Parallel Algorithms
12. AI:Knowledge Representation and Reasoning
13. Discrete Structures
14. Hardware Security
15. Blockchain Architecture and Use Cases
16. Cryptography and Network Security
17. Social networks
18. Introduction to Internet of Things
19. Introduction to Industry 4.0 and Industrial Internet of Things
20. Introduction to Automata, Languages and Computation

REAL TIME OPERATING SYSTEM

COMPUTER SCIENCE & ENGINEERING

PROF. RAJIB MALL
Dept. of Computer Science and Engineering
IIT Kharagpur

TYPE OF COURSE : Rerun | Elective | UG/PG
PRE-REQUISITES : C Programming, Operating Systems
INTENDED AUDIENCE : CSE, ECE, EE
COURSE DURATION : 4 weeks (25 Feb'19 - 22 Mar'19)
EXAM DATE : 27 Apr 2019

COURSE OUTLINE :

In several software applications, especially in embedded application, the operating system is required to support the application to meet the timing constraints. The operating system achieves this by deploying suitable scheduling algorithms. A major problem arises, when the real-time tasks share resources. Priority inversions can take place in this case, unless suitable techniques are deployed. Starting with a brief introduction to real-time operating systems, we first discuss the important real-time task/thread scheduling algorithms and resource sharing protocols. An effort towards standardization of real-time operating systems has come to be known as POSIX-RT. We review POSIX-RT requirements.

ABOUT INSTRUCTOR :

Prof. Rajib Mall is Professor, Department of Computer Science and Engineering, Indian Institute of Technology Kharagpur, West Bengal. He has more than two decades of teaching experience in the areas of program analysis and testing. He has written five text books and over 150 refereed research papers.

COURSE PLAN :

Week 01 : Introduction

Week 02 : Characteristics of real-time systems

Week 03 : Modelling time constraints

Week 04 : Basic concepts in real-time operating systems

MULTIMODAL INTERACTION

COMPUTER SCIENCE & ENGINEERING

PROF. DR. - ING. SEBASTIAN MOLLER
Technische Universitat Berlin
Quality and Usability Lab

DR. - ING. STEFAN HILLMANN
Technische Universitat Berlin
Quality and Usability Lab

TYPE OF COURSE : New | Elective | UG/PG
INTENDED AUDIENCE : Computer Science, Human Factors, and related to human-computer interaction
COURSE DURATION : 4 weeks (25 Feb'19 - 22 Mar'19)
EXAM DATE : 28 April 2019

INDUSTRIES APPLICABLE TO : Software development, gaming industry, industry related to interactive interfaces (e.g. smart home)

COURSE OUTLINE :

In this course we will set the basics for an understanding of multimodal communication between humans and multi-modal interaction between humans and machines. We will start with clarifying the basic principles of human-human communication and human-machine interaction. We will then describe the processes taking place in humans when perceiving auditory, visual and tactile signals, as well as how these perceptions are integrated in order to form a multimodal perception. The signals can be generated and received by machines which are able to interact with humans in limited domains. The set-up of such machines will be discussed, and limitations as well as potential solutions to overcome these limitations will be explained.

ABOUT INSTRUCTOR :

Sebastian Möller studied electrical engineering at the universities of Bochum (Germany), Orléans (France) and Bologna (Italy). From 1994 to 2005, he held the position of a scientific researcher at the Institute of Communication Acoustics (IKA), Ruhr-University Bochum, and worked on speech signal processing, speech technology, communication acoustics, as well as on speech communication quality aspects. From 2005 to 2015, he worked at Telekom Innovation Laboratories, an An-Institut of TU Berlin. He was appointed Full Professor for the subject "Quality and Usability" at TU Berlin in April 2007. From 2015 to 2017, he was Vice Dean for Research of the Electrical Engineering and Computer Science at TU Berlin, and since April 2017, he serves as the Dean of this faculty. He also leads the research department "Language Technology" at the German Research Center for Artificial Intelligence, DFKI.

Stefan Hillmann studied computer science at the Technische Universität Berlin (Germany). In 2006 he was co-founder of a start-up about analysis and visualization of e-mail-based interactions and processes. Until 2010 he worked as a software developer of web applications for credit banks and insurances. Since 2010 he is a scientific researcher at the Quality and Usability Lab (Technische Universität Berlin). His main topic is the simulation-based usability evaluation of interactive spoken and multimodal dialog systems. He finished his PhD on this topic in 2017.

COURSE PLAN :

Week 01 : Multimedia and Multimodality; Hearing and Speech; Vision
Week 02 : Other Senses, Integration and Cognition; Multimodal Perception; Human Multimodal Interaction
Week 03 : Multimodal Input and Output Systems
Week 04 : Multimodal Interactive Systems, Virtual Environments

COMPUTER SCIENCE & ENGINEERING

PROGRAMMING, DATA STRUCTURES & ALGORITHMS USING PYTHON

PROF. MADHAVAN MUKUND
Dept. of Computer Science and Engineering
Chennai Mathematical Institute

TYPE OF COURSE : Rerun | Elective | UG/PG
PRE-REQUISITES : School level mathematics.
COURSE DURATION : 8 weeks (28 Jan'19 - 22 Mar'19)
EXAM DATE : 31 Mar 2019

INDUSTRIES APPLICABLE TO : This course should be of value to any company requiring programming skills.
INTENDED AUDIENCE : Students in any branch of mathematics/science/engineering, 1st year

COURSE OUTLINE :

This course is an introduction to programming and problem solving in Python. It does not assume any prior knowledge of programming. Using some motivating examples, the course quickly builds up basic concepts such as conditionals, loops, functions, lists, strings and tuples. It goes on to cover searching and sorting algorithms, dynamic programming and backtracking, as well as topics such as exception handling and using files. As far as data structures are concerned, the course covers Python dictionaries as well as classes and objects for defining user defined datatypes such as linked lists and binary search trees.

ABOUT INSTRUCTOR :

Prof. Madhavan Mukund, Department of Computer Science Engineering, Chennai Mathematical Institute, studied at IIT Bombay (BTech) and Aarhus University (PhD). He has been a faculty member at Chennai Mathematical Institute since 1992, where he is presently Professor and Dean of Studies. His main research area is formal verification. He has active research collaborations within and outside India and serves on international conference programme committees and editorial boards of journals. He is President of both the Indian Association for Research in Computing Science (IARCS) and the ACM India Council. He has been the National Coordinator of the Indian Computing Olympiad since 2002. He served as the Executive Director of the International Olympiad in Informatics from 2011-2014.

COURSE PLAN

Week 1 : Informal introduction to programmin, algorithms and data structures viagcd, Downloading and installing Python gcd in Python: variables, operations, control flow - assignments, condition-als, loops, functions

Week 2 : Python: types, expressions, strings, lists, tuples, Python memory model: names, mutable and immutable values List operations: slices etc, Binary search, Inductive function denitions: numerical and structural induction Elementary inductive sorting: selection and insertion sort, In-place sorting

Week 3 : Basic algorithmic analysis: input size, asymptotic complexity, O() notation, Arrays vs lists, Merge sort, Quicksort Stable sorting

Week 4 : Dictionaries, More on Python functions: optional arguments, default values, Passing functions as arguments Higher order functions on lists: map, lter, list comprehension

Week 5 : Exception handling, Basic input/output, Handling files, String processing

Week 6 : Backtracking: N Queens, recording all solutions, Scope in Python: local, global, nonlocal names, Nested functions Data structures: stack, queue ,Heaps

Week 7 : Abstract datatypes, Classes and objects in Python, "Linked" lists: find, insert, delete, Binary search trees: find, insert, delete Height-balanced binary search trees

Week 8 : Effcient evaluation of recursive denitions: memoization, Dynamic programming: examples, Other programming languages: C and manual memory management, Other programming paradigms: functional programming.

PROGRAMMING IN C++

COMPUTER SCIENCE & ENGINEERING

PROF. PARTHA PRATIM DAS
Dept. of Computer Science and Engineering
IIT Kharagpur

TYPE OF COURSE : Rerun | Core | UG/PG

COURSE DURATION : 8 weeks (28 Jan'19 - 22 Mar'19)

INTENDED AUDIENCE : BCA, MCA, B.Tech., M.Tech.

EXAM DATE : 31 Mar 2019

PRE-REQUISITES : Basic knowledge of programming & Data structure, C Programming, Attending a course on OOP with this course will help

INDUSTRIES APPLICABLE TO : Programming in C++ is so fundamental that all companies dealing with systems as well as application development (including web, IoT, embedded systems) have a need for the same. These include – Microsoft, Samsung, Xerox, Yahoo, Google, IBM, TCS, Infosys, Amazon, Flipkart, etc.

COURSE OUTLINE :

There has been a continual debate on which programming language/s to learn, to use. As the latest TIOBE Index for April 2016 indicates – Java (21%), C (14%), C++ (6%), C#(4%), and Python (3%) together control nearly half the programming community. Given this, it is still important to learn C and C++ because of the efficiency they offer. While we appreciate that Java is good for applications, for graphics; and we acknowledge that Python is appropriate for portable software, engineering problem solving, and graphics; it is worth bearing in mind that the JVM and Python interpreter are indeed written in C++, making C++ the father of all languages today. Well, hence, C++ is the systems language. Why should I learn it if my primary focus is on applications? This is where the recent updates of C++, namely, C++11, C++14, and C++17 offer excellent depths and flexibility for C++ that no language can match. These extensions attempt to alleviate some of the long-standing shortcomings for C++ including porous resource management, error-prone pointer handling, expression semantics and better readability. The present course builds up on the knowledge of C programming and basic data structure (array, list, stack, queue etc.) to create a strong familiarity with C++98 and C++03. Besides the constructs, syntax and semantics of C++ (over C), we also focus on various idioms of C++ and attempt to go to depth with every C++ feature justifying and illustrating them with several examples and assignment problems. On the way, we illustrate various OOP concepts.

ABOUT INSTRUCTOR :

Dr. Partha Pratim Das received his B.Tech, M.Tech and PhD degrees in 1984, 1985 and 1988 respectively from IIT Kharagpur. He served as a faculty in Department of Computer Science and Engineering, IIT Kharagpur from 1988 to 1998. In 1998, he joined Alumnus Software Ltd as a Business Development Manager. From 2001 to 2011, he worked for Interra Systems, Inc as a Senior Director and headed its Kolkata Center. In 2011, he joined back at Department of Computer Science and Engineering, IIT Kharagpur as Professor. Dr. Das has also served as a Visiting Professor with Institute of Radio Physics and Electronics, Calcutta University from 2003 to 2013.

COURSE PLAN :

Week 01 : Programming in C++ is Fun : Build and execute a C program in C++, Write equivalent programs in C++.
Week 02 : C++ as Better C : Procedural Extensions of C.
Week 03 : Overview of OOP in C++ : Classes and basic Object-Oriented features (encapsulation).
Week 04 : Overview of OOP in C++ : More OO features, overloading, namespace and using struct and union.
Week 05 : Inheritance : Generalization / Specialization of Object Modeling in C++.
Week 06 : Polymorphism : Static and Dynamic Binding.
Week 07 : Type Casting & Exceptions : C++ cast operators; C++ Exceptions & standard exception classes.
Week 08 : Templates & STL – Function and Class templates and using STL like containers, algorithms.

COMPUTER SCIENCE & ENGINEERING

DESIGN AND ANALYSIS OF ALGORITHMS

PROF. MADHAVAN MUKUND
Dept. of Computer Science and Engineering
Chennai Mathematical Institute

TYPE OF COURSE : Rerun | Core | UG
COURSE DURATION : 8 weeks (28 Jan'19 - 22 Mar'19)
INTENDED AUDIENCE : B.E/B.Tech
EXAM DATE : 31 Mar 2019
PRE-REQUISITES : Exposure to introductory courses on programming and data structures.
INDUSTRIES APPLICABLE TO : This course should be of value to any company working in the area of software services and products.

COURSE OUTLINE :

This course will cover basic concepts in the design and analysis of algorithms:
Asymptotic complexity, O() notation | Sorting and search | Algorithms on graphs: exploration, connectivity, shortest paths, directed acyclic graphs, spanning trees | Design techniques: divide and conquer, greedy, dynamic programming | Data structures: heaps, union of disjoint sets, search trees | Intractabiliy.

ABOUT INSTRUCTOR :

Madhavan Mukund studied at IIT Bombay (BTech) and Aarhus University (PhD). He has been a faculty member at Chennai Mathematical Institute since 1992, where he is presently Professor and Dean of Studies. His main research area is formal verification. In addition to the NPTEL MOOC programme, he has been involved in organizing IARCS Instructional Courses for college teachers. He is a member of ACM India's Education Committee. He has contributed lectures on algorithms to the Massively Empowered Classroom (MEC) project of Microsoft Research and the QEEE programme of MHRD.

COURSE PLAN :

Week 01 : Introduction, Examples and motivation, Asymptotic complexity: informal concepts, formal notation, examples.
Week 02 : Searching in list: binary search, Sorting: insertion sort, selection sort, merge sort, quicksort, stability and other issues.
Week 03 : Graphs: Motivation, Graph exploration: BFS, DFS; DFS numbering and applications, Directed acyclic graphs.
Week 04 : Shortest paths: unweighted and weighted, Single source shortest paths:Dijkstra, Minimum cost spanning trees: Prim's algorithm, Kruskal's Algorithm; Union-Find data structure.
Week 05 : Divide and conquer: counting inversions, nearest pair of points; Priority queues, heaps,Dijstra/Prims revisited using heaps, Search Trees: Introduction.
Week 06 : Search Trees: Traversals, insertions, deletions, Balancing; Greedy : Interval scheduling, Proof strategies, Huffman coding; Dynamic Programming: weighted interval scheduling.
Week 07 : Dynamic Programming: Memoization, Edit distance, Longest ascending subsequence, Matrix multiplication; Shortest paths: Bellman Ford, shortest Floyd Warshall
Week 08 : Intractability: NP completeness, Reductions, Examples; Misc topics.

DATA BASE MANAGEMENT SYSTEM

COMPUTER SCIENCE & ENGINEERING

PROF. PARTHA PRATIM DAS
Dept. of Computer Science and Engineering
IIT Kharagpur

TYPE OF COURSE : Rerun | Core | UG/PG
COURSE DURATION : 8 weeks (25 Feb'19 - 19 Apr'19)
INTENDED AUDIENCE : B.E/B.Tech, M.E/M.Tech, BCA, MCA
EXAM DATE : 27 Apr 2019
PRE-REQUISITES : Knowledge of Programming, Data Structure and Algorithms
INDUSTRIES APPLICABLE TO : Microsoft, Samsung, Xerox, Yahoo, Google, IBM, TCS, Infosys, Amazon, Flipkart

COURSE OUTLINE :

Databases form the backbone of all major applications today – tightly or loosely coupled, intranet or internet based, financial, social, administrative, and so on. Structured Database Management Systems (DBMS) based on relational and other models have long formed the basis for such databases. Consequently, Oracle, Microsoft SQL Server, Sybase etc. have emerged as leading commercial systems while MySQL, PostgreSQL etc. lead in open source and free domain. While DBMS's differ in details, they share a common set of models, design paradigms and a Structured Query Language (SQL). In this background the course would examine data structures, file organizations, concepts and principles of DBMS's, data analysis, database design, data modeling, database management, data & query optimization, and database implementation. More specifically, the course introduces relational data models; entity-relationship modeling, SQL, data normalization, and database design. It would also introduce query coding practices using MySQL (or any other open system) through various assignments. Design of simple multi-tier client/server architectures based and Web-based database applications will also be introduced.

ABOUT INSTRUCTOR :

Prof. Partha Pratim Das received his BTech, MTech and PhD degrees in 1984, 1985 and 1988 respectively from IIT Kharagpur. He served as a faculty in Department of Computer Science and Engineering, IIT Kharagpur from 1988 to 1998. In 1998, he joined Alumnus Software Ltd as a Business Development Manager. From 2001 to 2011, he worked for Interra Systems, Inc. as a Senior Director and headed its Kolkata Center. In 2011, he joined back at Department of Computer Science and Engineering, IIT Kharagpur as Professor. Dr. Das has also served as a Visiting Professor with Institute of Radio Physics and Electronics, Calcutta University from 2003 to 2013.

COURSE PLAN :

Week 01 : Course Overview. Introduction to RDBMS.
Week 02 : Structured Query Language (SQL).
Week 03 : Relational Algebra. Entity-Relationship Model .
Week 04 : Relational Database Design.
Week 05 : Application Development. Case Studies. Storage and File Structure.
Week 06 : Indexing and Hashing. Query Processing.
Week 07 : Query Optimization. Transactions (Serializability and Recoverability) .
Week 08 : Concurrency Control. Recovery Systems. Course Summarization.

DATA SCIENCE FOR ENGINEERS

COMPUTER SCIENCE & ENGINEERING

PROF. RAGUNATHAN RENGASAMY
Dept. of Chemical Engineering
IIT Madras

PROF. SHANKAR NARASIMHAN
Dept. of Chemical Engineering
IIT Madras

TYPE OF COURSE : Rerun | Elective | UG/PG
PRE-REQUISITES : 10 hrs of pre-course material on R will be provided. Participants need to practice this.
COURSE DURATION : 8 weeks (28 Jan'19 - 22 Mar'19)
EXAM DATE : 31 Mar 2019

INDUSTRIES APPLICABLE TO : Honeywell, ABB, Ford, Gyan Data pvt. Ltd.

COURSE OUTLINE :

Learning Objectives :

1. Introduce R as a programming language
2. Introduce the mathematical foundations required for data science
3. Introduce the first level data science algorithms
4. Introduce a data analytics problem solving framework
5. Introduce a practical capstone case study

Learning Outcomes:

1. Describe a flow process for data science problems (Remembering)
2. Classify data science problems into standard typology (Comprehension)
3. Develop R codes for data science solutions (Application)
4. Correlate results to the solution approach followed (Analysis)
5. Assess the solution approach (Evaluation)
6. Construct use cases to validate approach and identify modifications required (Creating)

ABOUT INSTRUCTOR :

Prior to joining IIT Madras as a Professor, Prof. Rengasamy was a Professor of Chemical Engineering and Co-Director of the Process Control and Optimization Consortium at Texas Tech University, Lubbock, USA. He was also a Professor and Associate Professor at Clarkson University, USA and an Assistant Professor at IIT Bombay. His major research interests are in the areas of fault detection and diagnosis and development of data science algorithms for manufacturing industries.

Prof.Shankar Narasimhan is currently a Professor in the Department of Chemical Engineering at IIT Madras. His major research interests are in the areas of data mining, process design and optimization, fault detection and diagnosis and fault tolerant control. He has co-authored several important papers and a book titled Data Reconciliation and Gross Error Detection: An Intelligent Use of Process Data which has received critical appreciation in India and abroad.

COURSE PLAN :

Week 1 : Linear algebra for data science (algebraic view - vectors, matrices, product of matrix & vector, rank, null space, solution of over-determined set of equations and pseudo-inverse) ,

Week 2 : Linear algebra for data science (geometric view - vectors, distance, projections, eigenvalue decomposition)

Week 3 : Statistics (descriptive statistics, notion of probability, distributions, mean, variance, covariance, covariance matrix)

Week 4 : Optimization

Week 5 : Optimization; Typology of data Science problems and a solution framework

Week 6 : Univariate and multivariate linear regression Model assessment (including cross validation)

Week 7 : Verifying assumptions used in linear regression , Assessing importance of different variables, subset selection

Week 8 : Introduction to classification and classification using logistics regression ,Classification using various clustering techniques

DATA MINING

COMPUTER SCIENCE & ENGINEERING

PROF. PABITRA MITRA
Dept. of Computer Science and Engineering
IIT Kharagpur

TYPE OF COURSE : Rerun | Elective | UG/PG
PRE-REQUISITES : C Programming, Operating Systems
INDUSTRY SUPPORT : TCS, Infosys, CTS, Accenture
COURSE DURATION : 8 weeks (25 Feb'19 - 19 Apr'19)
EXAM DATE : 27 Apr 2019

COURSE OUTLINE :

Data mining is study of algorithms for finding patterns in large data sets. It is an integral part of modern industry, where data from its operations and customers are mined for gaining business insight. It is also important in modern scientific endeavors. Data mining is an interdisciplinary topic involving, databases, machine learning and algorithms. The course will cover the fundamentals of data mining. It will explain the basic algorithms like data preprocessing, association rules, classification, clustering, sequence mining and visualization. It will also explain implementations in open source software. Finally, case studies on industrial problems will be demonstrated.

ABOUT INSTRUCTOR :

Prof. Pabitra Mitra is an Associate Professor of Computer Science and Engineering at Indian Institute of Technology Kharagpur. He did his BTech in Electrical Engineering from IIT Kharagpur and PhD from ISI Calcutta. He was a Scientist at Centre for Artificial Intelligence and Robotics, Bangalore and an Assistant Professor at IIT Kanpur. He received the INAE Young engineer Award, IBM Faculty Award and Yahoo Faculty Award. He has authored a book on Data mining and about 50 papers in international journals.

COURSE PLAN :

Week 1 : Introduction, Data Preprocessing

Week 2 : Association Rule Mining, Classification Basics

Week 3 : Decision Tree, Bayes Classifier, K nearest neighbor

Week 4 : Support Vector Machine, Kernel Machine

Week 5 : Clustering, Outlier detection

Week 6 : Sequence mining

Week 7 : Evaluation, Visualization.

Week 8 : Case studies

EMBEDDED SYSTEM DESIGN WITH ARM

COMPUTER SCIENCE & ENGINEERING

PROF. INDRANIL SENGUPTA
Dept. of Computer Science and Engineering
IIT Kharagpur

PROF. KAMALIKA DUTTA
Dept. of Computer Science and Engineering
NIT Meghalaya

TYPE OF COURSE : New | Elective |UG/PG
INTENDED AUDIENCE : CS/EE/EC
COURSE DURATION : 8 weeks (28 Jan'19 - 22 Mar'19)
EXAM DATE : 31 March 2019
PRE-REQUISITES : Basic concepts in digital circuits and microprocessor
INDUSTRIES APPLICABLE TO : Intel, Texas Instruments, Cadence, Qualcomm, Samsung, ARM, TCS, HP

COURSE OUTLINE :

This course will discuss about the basic concepts of embedded system design, with particular emphasis on hands-on and demonstration sessions on system design using ARM microcontrollers. Keeping in view of the recent developments, this course will be based on state-of-the-art microcontroller boards and programming environments. This course will also help the participants to understand the developmental aspects of Internet of Things (IoT) based designs. Starting from the basics, the participants will be introduced to various interfacing issues with sensors and actuators. It is highly recommended that the participants procure some of the low cost microcontroller development boards and actually carry out the experiments that would be demonstrated.

ABOUT INSTRUCTOR :

Prof. Indranil Sengupta has obtained his B.Tech., M.Tech. and Ph.D. degrees in Computer Science and Engineering from the University of Calcutta. He joined the Indian Institute of Technology, Kharagpur, as a faculty member in 1988, in the Department of Computer Science and Engineering, where he is presently a full Professor. He has served as Heads of the Department of Computer Science and Engineering and also the School of Information Technology of the Institute. He has over 29 years of teaching and research experience and he has guided 21 PhD students, and has more than 200 publications to his credit in international journals and conferences.

Dr. Kamalika Dutta completed her Master of Science (M.S.) degree from Indian Institute of Technology, Kharagpur, India in 2010. She completed her Ph.D. from Indian Institute of Engineering Science and Technology, Shibpur, India in 2014. She is presentlyworking as an Assistant Professor in the Department of Computer Science and Engineering at National Institute of Technology Meghalaya, India since August 2014. She is currently guiding four PhD students, handling three sponsored projects, and has published more than 50 papers in peer reviewed journals and conferences.

COURSE PLAN :

Week 01 : Introduction to Embedded Systems and Microcontrollers
Week 02 : Instruction set architecture of ARM microcontroller, and assembly language programming
Week 03 : D/A and A/D converter, sensors, actuators and their interfacing
Week 04 : Microcontroller development boards and embedded programming platforms
Week 05 : Hands-on and demonstration I: Temperature sensing unit, Light sensing unit, Sound sensing unit
Week 06 : Hands-on and demonstration II: Feedback control system, relay control unit, driving electrical appliances like motors, bulb, pump, etc.
Week 07 : Hands-on and demonstration III: Object tracking using GPS and GSM
Week 08 : Hands-on and demonstration IV: Introduction to Internet of Things, smart home concepts, motion sensing using accelerometer, control of appliances over SMS

COMPUTER SCIENCE & ENGINEERING

INTRODUCTION TO SOFT COMPUTING

PROF. DEBASIS SAMANTA
Dept. of Computer Science and Engineering
IIT Kharagpur

TYPE OF COURSE : Rerun | Elective | UG/PG
COURSE DURATION : 8 weeks (28 Jan'19 - 22 Mar'19)
INDUSTRY SUPPORT : All IT companies, in general.
EXAM DATE : 31 Mar 2019
INTENDED AUDIENCE : The course is of interdisciplinary nature and students from CSE, IT, EE, ECE, CE, ME, etc. can take this course.

COURSE OUTLINE :

Soft computing is an emerging approach to computing which parallel the remarkable ability of the human mind to reason and learn in an environment of uncertainty and imprecision. Soft computing is based on some biological inspired methodologies such as genetics, evolution, ant's behaviors, particles swarming, human nervous systems, etc. Now, soft computing is the only solution when we don't have any mathematical modeling of problem solving (i.e., algorithm), need a solution to a complex problem in real time, easy to adapt with changed scenario and can be implemented with parallel computing. It has enormous applications in many application areas such as medical diagnosis, computer vision, hand written character recondition, pattern recognition, machine intelligence, weather forecasting, network optimization, VLSI design, etc.

ABOUT INSTRUCTOR :

Prof. Debasis Samanta holds a Ph.D. in Computer Science and Engineering from Indian Institute of Technology Kharagpur. His research interests and work experience span the areas of Computational Intelligence, Data Analytics, Human Computer Interaction, Brain Computing and Biometric Systems. Dr. Samanta currently works as a faculty member at the Department of Computer Science & Engineering at IIT Kharagpur.

COURSE PLAN :

Week 1 : Introduction to Soft Computing, Introduction to Fuzzy logic,Fuzzy membership functions,Operations on Fuzzy sets

Week 2 : Fuzzy relations, Fuzzy propositions, Fuzzy implications, Fuzzy inferences

Week 3 : Defuzzyfication Techniques-I, Defuzzyfication Techniques-II, Fuzzy logic controller-I, Fuzzy logic controller-II

Week 4 : Solving optimization problems, Concept of GA, GA Operators: Encoding,GA Operators: Selection-I

Week 5 : GA Operators: Selection-II, GA Operators: Crossover-I, GA Operators: Crossover-II, GA Operators: Mutation

Week 6 : Introduction to EC-I, Introduction to EC-II, MOEA Approaches: Non-Pareto, MOEA Approaches: Pareto-I

Week 7 : MOEA Approaches: Pareto-II, Introduction to ANN, ANN Architecture

Week 8 : ANN Training-I, ANN Training-II, ANN Training-III, Applications of ANN

CLOUD COMPUTING

COMPUTER SCIENCE & ENGINEERING

PROF. SOUMYA KANTI GHOSH
Dept. of Computer Science and Engineering
IIT Kharagpur

TYPE OF COURSE : Rerun | Elective | UG/PG
PRE-REQUISITES : Basics of computer architecture and Organisation
INDUSTRIES APPLICABLE TO : IT Industries

COURSE DURATION : 8 weeks (25 Feb'19 - 19 Apr'19)
EXAM DATE : 27 Apr 2019
INTENDED AUDIENCE : CSE, ECE, EE

COURSE OUTLINE :

Cloud computing is a scalable services consumption and delivery platform that provides on-demand computing service for shared pool of resources, namely servers, storage, networking, software, database, applications etc., over the Internet. It is a model for enabling ubiquitous, on-demand access to a shared pool of configurable computing resources, which can be rapidly provisioned and released with minimal management effort. This course will introduce various aspects of cloud computing, including fundamentals, management issues, security challenges and future research trends. This will help students (both UG and PG levels) and researchers to use and explore the cloud computing platforms.

ABOUT INSTRUCTOR :

Prof. Soumya Kanti Ghosh, received the Ph.D. and M.Tech. degrees from Department of Computer Science and Engineering, Indian Institute of Technology (IIT), Kharagpur, India. Before joining IIT Kharagpur, he worked for the Indian Space Research Organization in the area of satellite remote sensing and geographic information systems. He has more than 200 research papers in reputed journals and conference proceedings. His research interests include spatial data science, spatial web services and cloud computing.

COURSE PLAN :

Week 1 : Introduction to Cloud Computing

Week 2 : Cloud Computing Architecture

Week 3 : Service Management in Cloud Computing

Week 4 : Data Management in Cloud Computing

Week 5 : Resource Management in Cloud

Week 6 : Cloud Security

Week 7 : Open Source and Commercial Clouds, Cloud Simulator

Week 8 : Research trend in Cloud Computing, Fog Computing

BIG DATA COMPUTING

COMPUTER SCIENCE & ENGINEERING

PROF. RAJIV MISRA
Dept. of Computer Science and Engineering
IIT Patna

TYPE OF COURSE : New | Elective | UG/PG
COURSE DURATION : 8 weeks (25 Feb'19 - 19 Apr'19)
INTENDED AUDIENCE : UG/PG/PhD
EXAM DATE : 27 Apr 2019
PRE-REQUISITES : Data Structure, Algorithms, Computer Architecture, Operating System, Database Management Systems
INDUSTRIES APPLICABLE TO : Companies like Amazon, Microsoft, Google, IBM,Facebook

COURSE OUTLINE :

This course provides an in-depth understanding of terminologies and the core concepts behind big data problems, applications, systems and the techniques, that underlie today big data computing technologies. It provides an introduction to some of the most common frameworks such as Apache Spark, Hadoop, MapReduce, Large scale data storage technologies such as in-memory key/value storage systems, NoSQL distributed databases, Apache Cassandra, HBase and Big Data Streaming Platforms such as Apache Spark Streaming, Apache Kafka Streams that has made big data analysis easier and more accessible.

ABOUT INSTRUCTOR :

Dr. Rajiv Misra is working in Department of Computer Science and Engineering at Indian Institute of Technology Patna, India. He obtained his Ph.D degree from IIT Kharagpur, M.Tech degree in Computer Science and Engineering from the Indian Institute of Technology (IIT) Bombay, and BE in Computer Science from MNIT Allahabad. His research interests span a design of distributed algorithms for Mobile, Adhoc and Sensor Networks, Cloud Computing and Wireless Networks.

COURSE PLAN :

Week 01 : Introduction to Big Data: Why Big Data and Where did it come from?,Characteristics of Big Data- Volume, Variety, Velocity, Veracity, Valence, Value,Challenges and applications of Big Data

Week 02 : Introduction to Enabling Technologies for Big Data,Introduction to Big Data Stack,Introduction to some Big Data distribution packages

Week 03 : Introduction to Big Data Platforms,Overview of Apache Spark, HDFS, YARN,Introduction to MapReduce,MapReduce Programming Model with Spark,MapReduce Example: Word Count, Page Rank etc.

Week 04 : Introduction to Big Data Storage Platforms for Large Scale Data Storage,CAP Theorem, Eventual Consistency, Consistency Trade-Offs, ACID and BASE,Introduction to Zookeeper and Paxos,Introduction to Cassandra, Cassandra Internals,Introduction to HBase, HBase Internals

Week 05 : Introduction to Big Data Streaming Platforms for Fast Data,Introduction to Big Data Streaming Systems,Big Data Pipelines for Real-Time computing,Introduction to Spark Streaming,Kafka,Streaming Ecosystem

Week 06 : Introduction to Big Data Applications (Machine Learning),Overview of Big Data Machine Learning,Mahout Introduction,Big Data Machine learning Algorithms in Mahout- kmeans, Naïve Bayes etc.

Week 07 : Introduction of Big data Machine learning with Spark,Big Data Machine Learning Algorithms in Spark-Introduction to Spark MLlib,Introduction to Deep Learning for Big Data

Week 08 : Introduction to Big Data Applications (Graph Processing),Introduction to Pregel,Introduction to Giraph,Introduction to Spark GraphX

MACHINE LEARNING, ML

COMPUTER SCIENCE & ENGINEERING

PROF. CARL GUSTAF JANSSON
EECS, KTH Royal Institute of Technology
Sweden

PROF. FREDRIK KILANDER
EECS, KTH Royal Institute of Technology
Sweden

PROF. HENRIK BOSTROM
EECS, KTH Royal Institute of Technology
Sweden

TYPE OF COURSE : New | Elective | PG

COURSE DURATION : 8 weeks (25 Feb'19 - 19 Apr'19)

INTENDED AUDIENCE : ME/MS/MSc

EXAM DATE : 28 Apr 2019

PRE-REQUISITES : Relevant applied math and statistics, core computer science

INDUSTRIES APPLICABLE TO : Broad industrial interest at present, i.e. for autonomous vehicles, robots, intelligent assistants and general datamining

COURSE OUTLINE :

The scientific discipline of Machine Learning focuses on developing algorithms to find patterns or make predictions from empirical data. It is a classical sub-discipline within Artificial Intelligence (AI). The discipline is increasingly used by many professions and industries to optimize processes and implement adaptive systems. The course places machine learning in its context within AI and gives an introduction to the most important core techniques such as decision tree based inductive learning, inductive logic programming, reinforcement learning and deep learning through decision trees.

ABOUT INSTRUCTOR :

Carl Gustaf Jansson is tenured Professor in Artificial Intelligence at the School of Electrical Engineering and Computer Science, KTH Royal Institute of Technology, Stockholm, Sweden. His research contributions are mostly in artificial intelligence, in particular Knowledge Representation and Machine Learning. Particular research interests are intelligent interfaces and ubiquitous computing.

Henrik Boström is tenured professor in computer science and data science at the School of Electrical Engineering and Computer Science, KTH Royal Institute of Technology, Stockholm. His research focuses on machine learning algorithms and applications, in particular ensemble learning and interpretable models, including decision trees and rules, and conformal predictio. He is also a senior researcher at the Swedish institute RISE SICS.

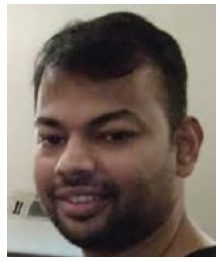
Fredrik Kilander is Associate Professor in Computer Science at the School of Electrical Engineering and Computer Science, KTH Royal Institute of Technology, Stockholm. His PhD was in Machine Learning in particular Conceptual Clustering. A particular research interest is ubiquitous computing. Dr Kilander has a broad experience from teaching in Computer Science in particular Programming Methodology.

COURSE PLAN :

Week 01 : Introduction to Artificial Intelligence and the role of Machine Learning (ML)
Week 02 : Decision tree based inductive learning
Week 03 : Conceptual clustering
Week 04 : Inductive logic programming
Week 05 : Deep learning through Neural networks
Week 06 : Applications of machine learning - data mining
Week 07 : Reinforcement learning
Week 08 : ML Toolboxes and dedicated hardware

COMPUTER SCIENCE & ENGINEERING

DEEP LEARNING – PART 2



PROF. MITESH M. KHAPRA
Dept. of Computer Science and Engineering
IIT Madras

TYPE OF COURSE : New | Elective | UG/PG/PhD
INTENDED AUDIENCE : BE/BTech/ME/MTech/MS/PhD
PRE-REQUISITES : Deep Learning
COURSE DURATION : 8 weeks (25 Feb'19 - 19 Apr'19)
EXAM DATE : 28 Apr 2019

INDUSTRIES APPLICABLE TO : Google, Microsoft, Amazon, Adobe, IBM

COURSE OUTLINE :

In this course, we will cover topics which lie at the intersection of Deep Learning and Generative Modeling. We will start with basics of joint distributions and build up to Directed and Undirected Graphical Models. We will then make a connection between Graphical Models and Deep Learning by having an in-depth discussion on Restricted Boltzmann Machines, Markov Chains and Gibbs Sampling for training RBMs. Finally, we will cover more recent Deep Generative models such as Variational Autoencoders, Generative Adversarial Networks and Autoregressive Models.

ABOUT INSTRUCTOR :

Mitesh M. Khapra is an Assistant Professor in the Department of Computer Science and Engineering at IIT Madras. While at IIT Madras he plans to pursue his interests in the areas of Deep Learning, Multimodal Multilingual Processing, Dialog systems and Question Answering. Prior to that he worked as a Researcher at IBM Research India. During the four and half years that he spent at IBM he worked on several interesting problems in the areas of Statistical Machine Translation, Cross Language Learning, Multimodal Learning, Argument Mining and Deep Learning. This work led to publications in top conferences in the areas of Computational Linguistics and Machine Learning. Prior to IBM, he completed his PhD and M.Tech from IIT Bombay in Jan 2012 and July 2008 respectively. His PhD thesis dealt with the important problem of reusing resources for multilingual computation. During his PhD he was a recipient of the IBM PhD Fellowship and the Microsoft Rising Star Award. He is also a recipient of the Google Faculty Research Award, 2018.

COURSE PLAN :

Module 01 : A brief introduction to Directed Graphical Models

Module 02 : A brief introduction to Markov Networks, Using joint distributions for classification and sampling, Latent variables

Module 03 : Restricted Boltzmann Machines, Unsupervised Learning, Motivation for Sampling, Markov Chains, Gibbs Sampling for training RBMs, Contrastive Divergence for training RBMs

Module 04 : Variational Autoencoders, Autoregressive models, GANs

COMPUTER SCIENCE & ENGINEERING

PRIVACY AND SECURITY IN ONLINE SOCIAL MEDIA

PROF. PONNURANGAM KUMARAGURU
Hemant Bharat Ram Faculty Research Fellow
IIIT Delhi

TYPE OF COURSE : Rerun | Elective | UG/PG
COURSE DURATION : 8 weeks (28 Jan'19 - 19 Apr'19)
INTENDED AUDIENCE : Anyone can take this course.
EXAM DATE : 28 Apr 2019
PRE-REQUISITES : Basic / Intermediate programming course. Understanding of Python will be necessary for the course. Should be able to quickly learn APIs, and to collect data from social networks

INDUSTRIES APPLICABLE TO : Any company which is interested in social media / networks data will be interested in recruiting the students finishing the course.

COURSE OUTLINE :

With increase in the usage of the Internet, there has been an exponential increase in the use of online social media and networks on the Internet. Websites like Facebook, YouTube, LinkedIn, Twitter, Flickr, Instagram, Google+, FourSquare, Pinterest, Tinder, and the likes have changed the way the Internet is being used. However, widely used, there is a lack of understanding of privacy and security issues on online social media. Privacy and security of online social media need to be investigated, studied and characterized from various perspectives (computational, cultural, psychological, etc.). Student completing the course will be able to appreciate various privacy and security concerns (spam, phishing, fraud nodes, identity theft) on Online Social Media and Student will be able to clearly articulate one or two concerns comprehensively on one Online Social Media; this will be achieved by homework.

ABOUT INSTRUCTOR :

Prof. Ponnurangam Kumaraguru ("PK") Associate Professor, is currently the Hemant Bharat Ram Faculty Research Fellow at the Indraprastha Institute of Information Technology (IIIT), Delhi, India. PK is the Founding Head of Cybersecurity Education and Research Centre (CERC). PK is one of ACM India Eminent Speakers. He received his Ph.D. from the School of Computer Science at Carnegie Mellon University (CMU). His research interests include Privacy, e-Crime, Online Social Media, and Usable Security, in particular. These days he has been dabbling with complex networked systems (e.g. social web systems like Twitter, Facebook, and telephone logs). Government of India has been funding PK for the last 6 years for studying Online Social Media. He manages research projects of about 2 Crores INR. PK has received research funds from Government of India, National Science Foundation (NSF), USA, industry bodies in India, and International funding agencies. He frequently speaks about Privacy and Security in Online Media at various Government of India organisations, private & industry.

COURSE PLAN :

Week 01 : What is Online Social Networks, data collection from social networks, challenges, opportunities, and pitfalls in online social networks, APIs
Week 02 : Collecting data from Online Social Media.
Week 03 & 04 : Trust, credibility, and reputations in social systems - I, II
Week 05 : Online social Media and Policing
Week 06 : Information privacy disclosure, revelation and its effects in OSM and online social networks
Week 07 : Phishing in OSM & Identifying fraudulent entities in online social networks
Week 08 : Refresher for all topics

INFORMATION SECURITY - 5
SECURE SYSTEMS ENGINEERING

COMPUTER SCIENCE & ENGINEERING

PROF. CHESTER ROBEIRO
Dept. of Computer Science and Engineering
IIT Madras

TYPE OF COURSE : New | Elective | UG/PG
COURSE DURATION : 8 weeks (25 Feb'19 - 19 Apr'19)
INTENDED AUDIENCE : BE/ME/MS/MCA/BCA
EXAM DATE : 28 Apr 2019
PRE-REQUISITES : C programming must be strong
Minimum understanding of digital logic /operating systems / computer organization
INDUSTRIES APPLICABLE TO : All companies developing embedded products /IoT etc.

COURSE OUTLINE :

With increase in the threat of cyber-security attacks, it is important to write software code that is not only efficient but also secure. In this course we will discuss varioussecurity vulnerabilities in software code that, if left unfixed, can potentially lead to majorcyber-attacks. We will see how these vulnerabilities can arise from simple programmingflaws like a buffer that overflows, to complex application runtime characteristics that getmanifested in the program's execution time and power consumption. We will look at somerecent cyber-attacks such as Meltdown and Spectre, Heartbleed, and Stagefright.The pre-requisites are a good understanding of C and a basic understanding of computer organization and operating systems.

ABOUT INSTRUCTOR :

Chester Robeiro is an Assistant Professor at the Indian Institute of Technology Madras. Prior to this he was a post-doctoral researcher at Columbia University. He has a PhD from IIT Kharagpur in the area of hardware security. Before joining IIT Kharagpur for his PhD studies, he worked as a member technical staff at CDAC, Bangalore. His area of interests includes security aspect in the operating system, computer architecture, and VLSI. He is particularly interested in applying learning algorithms and formal methods to analyze the security of systems.

COURSE PLAN :

Week 01 : Introduction / gdb / buffer overflow

Week 02 : Preventing buffer overflow based malware

Week 03 : Integer overflow and buffer overread and heap overflow

Week 04 : More on heap overflow; software isolation and enclaves

Week 05 : Review of cryptography; fault injection attacks

Week 06 : Cache timing attacks and covert channels; Meltdown and Spectre

Week 07 : Power analysis attacks; Rowhammer

Week 08 : Hardware Trojans

COMPILER DESIGN

COMPUTER SCIENCE & ENGINEERING

PROF. SANTANU CHATTOPADHYAY
Dept. of Electronics and Electrical Communication Engineering
IIT Kharagpur

TYPE OF COURSE : New | Core | UG
INTENDED AUDIENCE : CSE, IT, B.Sc (CS), MCA, MS (CS)
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 27 April 2019
INDUSTRIES APPLICABLE TO : All software industries

COURSE OUTLINE :

Compilers have become part and parcel of today's computer systems. They are responsible for making the user's computing requirements, specified as a piece of program, understandable to the underlying machine. There tools work as interface between the entities of two different domains – the human being and the machine. The actual process involved in this transformation is quite complex. Automata Theory provides the base of the course on which several automated tools can be designed to be used at various phases of a compiler. Advances in computer architecture, memory management and operating systems provide the compiler designer large number of options to try out for efficient code generation. This course on compiler design is to address all these issues, starting from the theoretical foundations to the architectural issues to automated tools. Being primarily targeted to a one - semester course for the undergraduate students, the course will follow the current GATE syllabus, enabling the students to prepare well for the same. It can also help all other participatants looking for an intrduction to the domain of complier designs and code translators

ABOUT INSTRUCTOR :

Santanu Chattopadhyay received his BE (CS), Calcutta University in 1990. He received M.Tech in Computer and Information Technology and PhD where from Indian Institute of Technology Kharagpur in 1992 and 1996, respectively. He is currently a Professor Prior to this, he had been a faculty member in the IIEST Sibpur and IIT Guwahati where he has taught the subject of Compiler Design several times. His research interests include Digital Design, Embedded Systems, System-on-Chip (SoC) and Network-on-Chip (NoC) Design and Test, Power- and Thermal-aware Testing of VLSI Circuits and Systems. He has published more than 150 papers in reputed international journals and conferences.

COURSE PLAN :

Week 01 : Introduction
Week 02 : Lexical Analysis
Week 03 - 5 : Parsing – Part I, II, III
Week 06 : Syntax Directed Translation
Week 07 : Type Checking and Symbol Tables
Week 08 & 09: Runtime Environment Management – Part I,II
Week 10 - 12 : Intermediate Code Generation – Part I,II,III

FOUNDATIONS TO COMPUTER SYSTEMS DESIGN

COMPUTER SCIENCE & ENGINEERING

PROF. V. KAMAKOTI
Dept. of Computer Science and Engineering
IIT Madras

TYPE OF COURSE : New | Core | UG
INTENDED AUDIENCE : B.E/B.Tech, M.E/M.Tech etc,
COURSE DURATION : 12 weeks (28 Jan'19-19 Apr' 19)
EXAM DATE : 27 April 2019

INDUSTRIES APPLICABLE TO : All core computer science and engineering and computer hardware company – Intel, AMD, NVidia, Redhat, etc

COURSE OUTLINE :

The Computer Architecture and Organization, Operating Systems, and Compilers are three fundamental pillar courses for both Computer Science and Engineering; and, Electrical and Electronics engineering students. The current course presents a cross-layer view of the three pillars, which help the student appreciate the contributions, interactions and challenges related to each of these pillars from the view of the total systems engineering.

ABOUT INSTRUCTOR :

V. Kamakoti is a Professor at Department of Computer Science and Engineering, IIT Madras. He specializes in the area of Computer Architecture and embedded systems, VLSI design and Information Security.

COURSE PLAN :

Week 01 : Introduction to Boolean Logic
Week 02 : Introduction to Boolean Algebra
Week 03 : Introduction to Sequential Logic
Week 04 : Machine Language Specification
Week 05 : HACK – A Simple Computer Microarchitecture
Week 06 : Assembly Language Fundamentals
Week 07 : Introduction to Stack Based Virtual Machine
Week 08 : Language and Interpreter for Virtual Machines
Week 09 : Introduction to JACK – High Level Language
Week 10 : Front-end JACK Compiler: Meet your favourites | Image Processing : Fun with images.
Week 11 : Back-end JACK Compiler
Week 12 : Introduction to Operating Systems

COMPUTER SCIENCE & ENGINEERING

COMPUTER ARCHITECTURE AND ORGANIZATION

PROF. INDRANIL SENGUPTA
Dept. of Computer Science and Engineering
IIT Kharagpur

PROF. KAMALIKA DUTTA
Dept. of Computer Science and Engineering
NIT Meghalaya

TYPE OF COURSE : Rerun | Core | UG
INTENDED AUDIENCE : CSE, IT, ECE, EE
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 28 Apr 2019
PRE-REQUISITES : Basic concepts in digital circuit design, Familiarity with a programming language like C or C++
INDUSTRIES APPLICABLE TO : TCS, Wipro, CTS, Google, Microsoft, HP, Intel

COURSE OUTLINE :

This course will discuss the basic concepts of computer architecture and organization that can help the participants to have a clear view as to how a computer system works. Examples and illustrations will be mostly based on a popular Reduced Instruction Set Computer (RISC) platform. Illustrative examples and illustrations will be provided to convey the concepts and challenges to the participants. Starting from the basics, the participants will be introduced to the state-of-the-art in this field.

ABOUT INSTRUCTOR :

Prof. Indranil Sengupta has obtained his B.Tech., M.Tech. and Ph.D. degrees in Computer Science and Engineering from the University of Calcutta. He joined the Indian Institute of Technology, Kharagpur, as a faculty member in 1988, in the Department of Computer Science and Engineering, where he is presently a full Professor. He had been the former Heads of the Department of Computer Science and Engineering and also the School of Information Technology of the Institute. He has over 28 - 30 years of teaching and research experience.

Dr. Kamalika Dutta completed her B.Sc. (Computer Science) from Ravenshaw College, Cuttack, India in the year 2003, Master of Computer Application from Biju Pattanaik University of Technology, Bhubaneswar, India in the year 2006, and then Master of Science degree from Indian Institute of Technology, Kharagpur, India in 2010. She completed her Ph.D. from Indian Institute of Engineering Science and Technology, Shibpur, India. She is presently working as an Assistant Professor in the Department of Computer Science and Engineering at National Institute of Technology (NIT), Meghalaya, India.

COURSE PLAN :

Week 01 : Evolution of Computer Systems
Week 02 : Instruction Set Architecture
Week 03 : Quantitative Principles of Computer Design
Week 04 : Control Unit Design
Week 05 : Memory System Design
Week 06 : Design of Cache Memory Systems
Week 07 : Design of Arithmetic Unit
Week 08 : Design of Arithmetic Unit (contd.)
Week 09 : Input-Output System Design
Week 10 : Input-Output System Design (contd.)
Week 11 : Instruction Set Pipelining
Week 12 : Parallel Processing Architectures

COMPUTER SCIENCE & ENGINEERING

COMPUTER ORGANIZATION & ARCHITECTURE : A PEDAGOGICAL ASPECT

PROF. SANTOSH BISWAS
Department of Computer Science Engg
IIT Guwahati

PROF. ARNAB SARKAR
Dept of Computer Science Engg
IIT Guwahati

PROF. JATINDRA KUMAR DEKA
Dept of Computer Science Engg
IIT Guwahati

TYPE OF COURSE : Rerun | Elective | UG/PG
PRE-REQUISITES : Digital Design
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 28 Apr 2019
INTENDED AUDIENCE : BE (CS, EE, EC, IT)
INDUSTRY SUPPORT : Processor design industry like Intel, AMD, etc.

COURSE OUTLINE :

Computer Organization and Architecture (COA) is a core course in the curricula of Computer Sciences as well as Electronics and Electrical Engineering disciplines at the second-year level in most of the Indian universities and technical institutions. This is the first course in COA and the course would provide students with an understanding of the design of fundamental blocks used for building a computer system and interfacing techniques of these blocks to achieve different configurations of an "entire computer system".

ABOUT INSTRUCTOR :

Prof. Santosh Biswas is an Associate Professor in the Dept. of CSE IIT Guwahati. He has an experience of 8 years in teaching. His research interests are Fault Tolerance, VLSI Testing, Embedded Systems.

Prof. J K Deka is a Professor in the Dept. of CSE IIT Guwahati. He has an experience of more than 20 years in teaching. His research interests are Formal Modelling and Verification, CAD for VLSI and Embedded Systems (Design, Testing and Verification), Data Mining.

Prof. Arnab Sarkar is an Asst. Professor in the Dept. of CSE IIT Guwahati. He has an experience of 3 years in teaching and about 2 years in industry. His research interests Real-Time and Embedded Systems, Computer Architecture, Algorithms.

COURSE PLAN :

Week 01 : Basics: Functional Blocks in a Computer System, Number system and Computer Arithmetic

Week 2, 3 & 4 : Addressing Modes, Instruction Set and Instruction Execution Flow

Week 5, 6 & 7 : Hardware and Micro-program based control Unit Design

Week 8 & 9 : Memory Architecture

Week 10 & 11 : Peripherals and Input-Outpu

Week 12 & 13 : Performance Enhancement of Processor

DISCRETE MATHEMATICS

COMPUTER SCIENCE & ENGINEERING

PROF. SUDARSHAN IYENGAR
Dept. of Computer Science and Engineering
IIT Ropar

TYPE OF COURSE : Rerun | Core | UG/PG
INTENDED AUDIENCE : B.E/B,Tech, M.E,M.Tech
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 27 Apr 2019
INDUSTRIES APPLICABLE TO : Every industry expects candidates to have good aptitude. This course sharpens the overall Quant skills.

COURSE OUTLINE :

The course will be an introduction to Discrete Mathematics which comprises of the essentials for a computer science student to go ahead and study any other topics in the subject. The emphasis will be on problem solving as well as proofs. We will be providing motivational illustrations and applications through out the course. The course doesnt assume any pre-requisites except for high school level arithmetic and algebra.

ABOUT INSTRUCTOR :

Sudarshan Iyengar, has a Ph.D. from the Indian Institute of Science and is currently working as an Assistant Professor at IIT Ropar and has been teaching this course for the past 5 years. Apart from this course, he has offered several other courses in IIT Ropar like Discrete Mathematics, Theory of Computation, Cryptography, Probability and Computing etc. His research interests include social networks, crowd sourced knowledge building and computational social sciences. His current research proects are "Predicting a Viral meme" (Yayati Gupta), "Understanding Crowd sourced Knowledge building" (Anamika Chhabra - Scientist), "Secure Computation" (Varsha Bhat) and "Network Sampling" (Akrati Saxena). After research, teaching makes the major component of his academic life. He enjoys experimenting with different teaching methodologies.

COURSE PLAN :

Week 1 : Counting
Week 2 : Set Theory
Week 3 : Logic
Week 4 : Relations
Week 5 : Functions
Week 6 : Mathematical Induction
Week 7 : Pigeonhole Principle
Week 8 : Graph Theory - 01
Week 9 : Graph Theory - 02
Week 10 : Generating Functions
Week 11 : Principle of Inclusion-Exclusion
Week 12 : Recurrence Relations

PROBLEM SOLVING THROUGH PROGRAMMING IN C

COMPUTER SCIENCE & ENGINEERING

PROF. ANUPAM BASU
Dept. of Computer Science and Engineering
IIT Kharagpur

TYPE OF COURSE : Rerun | Core | UG
INTENDED AUDIENCE : BE/B.Tech, BCA/MCA, M.Sc
INDUSTRIES APPLICABLE TO : All IT Industries
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 27 Apr 2019

COURSE OUTLINE :

This course is aimed at enabling the students to, formulate simple algorithms for arithmetic and logical problems, translate the algorithms to programs (in C language), test and execute the programs and correct syntax and logical errors, implement conditional branching, iteration and recursion, decompose a problem into functions and synthesize a complete program using divide and conquer approach, use arrays, pointers and structures to formulate algorithms and programs, apply programming to solve matrix addition and multiplication problems and searching and sorting problems, apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration.

ABOUT INSTRUCTOR :

Anupam Basu is Professor in the Dept. of Computer Science & Engineering, IIT Kharagpur, and has been an active researcher in the areas of Cognitive and Intelligent Systems, Embedded Systems and Language Processing, Presently he is acting as the Chairman and Head of the Center for Educational Technology, IIT Kharagpur. He has developed several embedded system based tools empowering the physically challenged and has led several national projects in the area.

COURSE PLAN :

Week 01 : Introduction to Problem Solving through programs, Flowcharts/Pseudo codes, the compilation process, Syntax and Semantic errors, Variables and Data Types

Week 02 : Arithmetic expressions,Relational Operations,Logical expressions;Introduction to Conditional Branching.

Week 03 : Conditional Branching and Iterative Loops

Week 04 : Arranging things : Arrays

Week 05 : 2-D arrays, Character Arrays and Strings

Week 06 : Basic Algorithms including Numerical Algorithms

Week 07 : Functions and Parameter Passing by Value

Week 08 : Passing Arrays to Functions, Call by Reference

Week 09 : Recursion

Week 10 : Structures and Pointers

Week 11 : Self-Referential Structures and Introduction to Lists

Week 12 : Advanced Topics

COMPUTER SCIENCE & ENGINEERING

PROGRAMMING IN JAVA

PROF. DEBASIS SAMANTA
Dept. of Computer Science and Engineering
IIT Kharagpur

TYPE OF COURSE : New | Elective | UG
INTENDED AUDIENCE : CSE, IT, ECE, EE
PRE-REQUISITES : Familiar with programming language such as C/C++ and data structures, algorithms.

COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 28 April 2019

INDUSTRIES APPLICABLE TO : All IT companies.

COURSE OUTLINE :

With the growth of Information and Communication Technology, there is a need to develop large and complex software. Further, those software should be platform independent, Internet enabled, easy to modify, secure, and robust. To meet this requirement object-oriented paradigm has been developed and based on this paradigm the Java programming language emerges as the best programming environment. Now, Java programming language is being used for mobile programming, Internet programming, and many other applications compatible to distributed systems. This course aims to cover the essential topics of Java programming so that the participants can improve their skills to cope with the current demand of IT industries and solve many problems in their own filed of studies.

ABOUT INSTRUCTOR :

Dr. Debasis Samanta holds a Ph.D. in Computer Science and Engineering from Indian Institute of Technology Kharagpur. His research interests and work experience spans the areas of Computational Intelligence, Data Analytics, Human Computer Interaction, Brain Computing and Biometric Systems. Dr. Samanta currently works as a faculty member at the Department of Computer Science & Engineering at IIT Kharagpur.

COURSE PLAN :

Week 01 : Overview of Object-Oriented Programming and Java
Week 02 : Java Programming Elements
Week 03 : Input-Output Handling in Java
Week 04 : Encapsulation
Week 05 : Inheritance
Week 06 : Exception Handling
Week 07 : Multithreaded Programming
Week 08 : Java Applets and Servlets
Week 09 : Java Swing and Abstract Windowing Toolkit (AWT)
Week 10 : Networking with Java
Week 11 : Java Object Database Connectivity (ODBC)
Week 12 : Interface and Packages for Software Development

THE JOY OF COMPUTING USING PYTHON

COMPUTER SCIENCE & ENGINEERING

PROF. SUDARSHAN IYENGAR
Dept. of Computer Science and Engineering
IIT Ropar

TYPE OF COURSE : Rerun | Elective | UG/PG
INTENDED AUDIENCE : B.E/BCA/B.Sc/MCA
PRE-REQUISITES : 10th standard/high school

COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 28 Apr 2019

INDUSTRIES APPLICABLE TO : Every software company is aware of the potential of a first course in computer science. Especially of a first course in computing, done right.

COURSE OUTLINE :

A fun filled whirlwind tour of 30 hrs, covering everything you need to know to fall in love with the most sought after skill of the 21st century. The course brings programming to your desk with anecdotes, analogies and illustrious examples. Turning abstractions to insights and engineering to art, the course focuses primarily to inspire the learner's mind to think logically and arrive at a solution programmatically. As part of the course, you will be learning how to practice and culture the art of programming with Python as a language. At the end of the course, we introduce some of the current advances in computing to motivate the enthusiastic learner to pursue further directions.

ABOUT INSTRUCTOR :

Sudarshan Iyengar, has a Ph.D. from the Indian Institute of Science and is currently working as an Assistant Professor at IIT Ropar and has been teaching this course from the past 5 years. Apart from this course, he has offered several other courses in IIT Ropar like Discrete Mathematics, Theory of Computation, Cryptography, Probability and Computing etc. His research interests include social networks, crowd sourced knowledge building and computational social sciences. His current research proects are "Predicting a Viral meme" (Yayati Gupta), "Understanding Crowd sourced Knowledge building" (Anamika Chhabra - Scientist), "Secure Computation" (Varsha Bhat) and "Network Sampling" (Akrati Saxena). After research, teaching makes the major component of his academic life. He enjoys experimenting with different teaching methodologies.

COURSE PLAN :

- Motivation for Computing; Welcome to Programming!!; Variables and Expressions : Design your own calculator; Loops and Conditionals : Hopscotch once again; Lists, Tuples and Conditionals : Lets go on a trip; Abstraction Everywhere : Apps in your phone; Counting Candies : Crowd to the rescue
- Birthday Paradox : Find your twin; Google Translate : Speak in any Language
- Currency Converter : Count your foreign trip expenses; Monte Hall : 3 doors and a twist
- Sorting : Arrange the books; Searching : Find in seconds
- Substitution Cipher : What's the secret !!; Sentiment Analysis : Analyse your Facebook data
- 20 questions game : I can read your mind; Permutations : Jumbled Words
- Spot the similarities : Dobble game; Count the words : Hundreds, Thousands or Millions.
- Rock, Paper and Scissor : Cheating not allowed !!; Lie detector : No lies, only TRUTH
- Calculation of the Area : Don't measure.; Six degrees of separation : Meet your favourites
- Image Processing : Fun with images; Tic tac toe : Let's play
- Snakes and Ladders : Down the memory lane.; Recursion : Tower of Hanoi
- Page Rank : How Google Works !!

MACHINE LEARNING FOR ENGINEERING AND SCIENCE APPLICATIONS

COMPUTER SCIENCE & ENGINEERING

PROF. GANAPATHY KRISHNAMURTHI
Dept. of Engineering Design
IIT Madras

PROF. BALAJI SRINIVASAN
Dept. of Mechanical Engineering
IIT Madras

INTENDED AUDIENCE : Senior UG/PG in all engineering and science disciplines.
TYPE OF COURSE : New | Elective | Senior UG/PG/PhD
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 28 April 2019

PRE-REQUISITES : Familiarity with Multivariable Calculus, Linear Algebra, Probability
INDUSTRIES APPLICABLE TO : Should be of interest to companies trying to employ engineers familiar with Machine Learning

COURSE OUTLINE :

Recent applications of machine learning have exploded due to cheaply available computational resources as well as wide availability of data. Machine Learning (ML) techniques provides a set of tools that can automatically detect patterns in data which can then be utilized for predictions and for developing models. Developments in ML algorithms and computational capabilities have now made it possible to scale engineering analysis, decision making and design rapidly. This, however, requires an engineer to understand the limits and applicability of the appropriate ML algorithms.

ABOUT INSTRUCTOR :

Dr Ganapathy Krishnamurthi is a faculty member in the Engineering Design Department at IIT-Madras. His areas of research interest include Medical Image Analysis and Image Reconstruction.

Dr Balaji Srinivasan is a faculty member in the Mechanical Engineering Department at IIT-Madras. His areas of research interest include Numerical Analysis, Computational Fluid Dynamics and applications of Machine Learning.

COURSE PLAN :

Week 01 : Mathematical Basics 1 – Introduction to Machine Learning, Linear Algebra
Week 02 : Mathematical Basics 2 - Probability
Week 03 : Computational Basics – Numerical computation and optimization, Introduction to Machine Learning packages
Week 04 : Linear and Logistic Regression - Bias/Variance Tradeoff, Regularization, Variants of Gradient Descent, MLE, MAP, Applications
Week 05 : Neural Networks - Multilayer Perceptron, Backpropagation, Applications
Week 06 : Convolutional Neural Networks 1 - CNN Operations, CNN architectures
Week 07 : Convolutional Neural Networks 2 - Training, Transfer Learning, Applications
Week 08 : Recurrent Neural Networks - RNN, LSTM, GRU, Applications
Week 09 : Classical Techniques 1 - Bayesian Regression, Binary Trees, Random Forests, SVM, Naïve Bayes,
Week 10 : Applications
Week 11 : Classical Techniques 2 - k-Means, kNN, GMM, Expectation Maximization, Applications
Week 12 : Advanced Techniques 1- Structured Probabilistic Models, Monte Carlo Methods
Advanced Techniques 2 - Autoencoders, Generative Adversarial Networks

COMPUTER SCIENCE & ENGINEERING

RANDOMIZED ALGORITHMS

PROF. BENNY GEORGE K
Dept. of Computer Science and Engineering
IIT Guwahati

TYPE OF COURSE : New| Elective | UG/PG
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
INTENDED AUDIENCE : Senior UG/PG/Ph.D students Interested in computer science, combinatorics, etc.
EXAM DATE : 27 April 2019
PRE-REQUISITES : Basic Understanding of Algorithms and Probability
INDUSTRIES APPLICABLE TO : Google, Microsoft

COURSE OUTLINE :

Algorithms are required to be "correct" and "fast". In a wide variety of applications, these twin objectives are in conflict with each other. Fortunately, neither of these ideals are sacrosanct. Therefore we can often try to optimize one of these goals by incurring a small penalty on the other. This takes us to the field of Randomized Algorithms. Often, the randomized variants, in addition to being faster than their deterministic counterpart, are simpler to understand and implement. In this course, we will study this tradeoff between correctness and speed. We will be learning a number of methods to design and analyze randomized algorithms.

ABOUT INSTRUCTOR :

Dr Benny George K is an Assistant Professor in the Department of Computer Science and Engineering at IIT Guwahati. He is interested in theoretical aspects of computer science.

COURSE PLAN :

Week 01 : Introduction to Randomized Algorithms
Week 02 : Probability Review
Week 03 : Moments and Deviation
Week 04 : The Probabilistic Method
Week 05 : Markov Chains – I
Week 06 : Markov Chain – II
Week 07 : Number Theoretic Algorithms
Week 08 : Graph Algorithms
Week 09 : Approximate Counting
Week 10 : Data Structures
Week 11 : Computational Complexity
Week 12 : Summary

COMPUTER SCIENCE & ENGINEERING

PARALLEL ALGORITHMS

PROF. SAJITH GOPALAN
Dept. of Computer Science and Engineering
IIT Guwahati

TYPE OF COURSE : New | Elective| UG/PG
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
INTENDED AUDIENCE : B.E/B.Tech, M.E/M.Tech
EXAM DATE : 28 April 2019
PRE-REQUISITES : Courses in Data Structures, Algorithms and Discrete Mathematics

COURSE OUTLINE :

A conventional algorithm uses a single processing element. A parallel algorithm assumes that there are multiple processors. These processors may communicate with each other using a shared memory or an interconnection network. An algorithm designed for a large number (for example, a polynomial in the problem size) of processors can be simulated on a machine with a small number of processor for a trade off on time, and therefore is of practical value, while at the same time allowing us to test the limits of parallelism. Many algorithmic design techniques in the parallel setting will be explored. Parallel complexity theory will also be briefly studied.

ABOUT INSTRUCTOR :

Professor Sajith Gopalan has been in the faculty of Computer Science and Engineering, IIT Guwahati since 1997. PhD (IIT Kanpur, 1998), MTech (IIT Kanpur, 1993), BTech (REC Calicut, 1991)

COURSE PLAN :

Week 01 : Theoretical models of parallel computation: PRAM, interconnection networks
Week 02 : Performance of parallel algorithms,Basic techniques
Week 03 : Basic techniques (cont'd)
Week 04 : Comparator Networks. Odd Even Merge Sort.Bitonic Sort Merge Sort.
Week 05 : Optimal List ranking, applications
Week 06 : Algorithms for searching, merging and sorting. Cole's Merge Sort
Week 07 : Cole's Merge Sort(cont'd), Graph algorithms
Week 08 : Graph Algorithms (cont'd), Linear Array, Meshes
Week 09 : Sorting in meshes, Hypercube algorithms, Butterfly network, CCC, Benes network
Week 10 : Butterfly network, ccc, benes network
Week 11 : Limits to parallelizability. Lower bounds
Week 12 : Limits to parallelizability. NC-reductions, P-completeness.

AI:KNOWLEDGE REPRESENTATION AND REASONING

COMPUTER SCIENCE & ENGINEERING

PROF. DEEPAK KHEMANI
Department of Computer Science & Engineering
IIT Madras

TYPE OF COURSE : Rerun | Elective | UG/PG

PRE-REQUISITES : Some exposure to formal languages, logic and programming

COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)

EXAM DATE : 27 Apr 2019

INDUSTRY SUPPORT : Software companies dealing with knowledge and reasoning, including the semantic web and semantic search.

COURSE OUTLINE :

An intelligent agent needs to be able to solve problems in its world. The ability to create representations of the domain of interest and reason with these representations is a key to intelligence. In this course we explore a variety of representation formalisms and the associated algorithms for reasoning. We start with a simple language of propositions, and move on to first order logic, and then to representations for reasoning about action, change, situations, and about other agents in incomplete information situations.

ABOUT INSTRUCTOR :

Prof. Deepak Khemani is Professor at Department of Computer Science and Engineering, IIT Madras. He completed his B.Tech. (1980) in Mechanical Engineering, and M.Tech. (1983) and PhD. (1989) in Computer Science from IIT Bombay, and has been with IIT Madras since then. In between he spent a year at Tata Research Development and Design Centre, Pune and another at the youngest IIT at Mandi. He has had shorter stays at several Computing departments in Europe. Prof Khemani's long-term goals are to build articulate problem solving systems using AI that can interact with human beings. His research interests include Memory Based Reasoning, Knowledge Representation and Reasoning, Planning and Constraint Satisfaction, Qualitative Reasoning and Natural Language Processing.

COURSE PLAN

Week 1 : Introduction, Propositional Logic, Syntax and Semantics

Week 2 : Proof Systems, Natural Deduction, Tableau Method, Resolution Method

Week 3 : First Order Logic (FOL), Syntax and Semantics, Unification, Forward Chaining

Week 4 : The Rete Algorithm, Rete example, Programming Rule Based Systems

Week 5 : Representation in FOL, Categories and Properties, Reification, Event Calculus

Week 6 : Conceptual Dependency (CD) Theory, Understanding Natural Language

Week 7 : Deductive Retrieval, Backward Chaining, Logic Programming with Prolog

Week 8 : Resolution Refutation in FOL, FOL with Equality, Complexity of Theorem Proving

Week 9 : Semantic Nets, Frames, Scripts, Goals and Plans

Week 10 : Description Logic (DL), Structure Matching, Classification

Week 11 : Extensions of DL, The ALC Language, Inheritance in Taxonomies

Week 12 : Default Reasoning, Circumscription, The Event Calculus Revisited; Default Logic, Autoepistemic Logic, Epistemic Logic, Multi Agent Scenarios.

COMPUTER SCIENCE & ENGINEERING

DISCRETE STRUCTURES

PROF. DIPANWITA ROY CHOWDHURY
Dept. of Computer Science and Engineering
IIT Kharagpur

TYPE OF COURSE : New | Core | UG
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
INTENDED AUDIENCE : Computer Science, Mathematics
EXAM DATE : 27 April 2019
PRE-REQUISITES : Knowledge of Class 12 Mathematics and basics Computer Programming
INDUSTRIES APPLICABLE TO : All companies that work on research problems

COURSE OUTLINE :

This course builds the mathematical foundation of computer science. It introduces the elements of mathematics like sets, functions, relations that form the basics of almost the entirety of computer science. It gives a clear understanding about the formal statements and their proofs and the counting techniques. The course develops the concept of algebraic structures and how they are used in defining mathematical applications. All the topics are illustrated with a handful of problems to make the course interesting as well as easy to understand.

ABOUT INSTRUCTOR :

Prof. Dipanwita Roy Chowdhury has received her B.Tech and M.Tech degrees in Computer Science from University of Kolkata and the PhD degree from the Department of Computer Science and Engineering, Indian Institute of Technology, Kharagpur. She is a Professor in the Department of Computer Science and Engineering, IIT Kharagpur, India. Currently, she is also the Chairman of Kalpana Chawla Space Technology Cell at IIT Kharagpur. Her current research interests are in the field of Cryptography, Error Correcting Code, Cellular Automata, and VLSI Design and Testing. She has guided 15 PhD students and published more than 150 technical papers in International Journals and Conferences. Prof. Roy Chowdhury is the recipient of INSA Young Scientist Award and Associate of Indian Academy of Science. She is a Senior Member of IEEE and the fellow of Indian National Academy of Engineers (INAE).

COURSE PLAN :

Week 01 : Introduction to Propositional Logic
Week 02 : Predicate Logic
Week 03 : Methods of Proofs and Induction
Week 04 : Sets and Functions
Week 05 : Relations and their Properties
Week 06 : Recursion
Week 07 : Recurrence Relations
Week 08 : Counting Techniques and Pigeonhole Principle
Week 09 : Combinatorics
Week 10 : Algebraic Structures
Week 11 : Rings and Modular Arithmetic
Week 12 : Finite Fields and Applications

COMPUTER SCIENCE & ENGINEERING

HARDWARE SECURITY

PROF. DEBDEEP MUKHOPADHYAY
Dept. of Computer Science and Engineering
IIT Kharagpur

TYPE OF COURSE : New | Elective | UG/PG
PRE-REQUISITES : Cryptography
COURSE DURATION : 12 weeks (28 Jan' 19-19 Apr' 19)
EXAM DATE : 28 April 2019

INDUSTRIES APPLICABLE TO : Texas Instruments/ BOSCH/DRDO/HAL/Wipro/CDAC/ISRO/Rambus/Intel/Qualcomm/Synopsys/IBM/Microsoft/ Cadence/SecureIC/Riscure/Mentor Graphics/Xilinx/Nvidia

COURSE OUTLINE :

This course will focus on the importance of addressing different security threats on modern hardware design, manufacturing, installation, and operating practices. In particular, the threats would be shown to be relevant at scales ranging from a single user to an entire nation's public infrastructure. Through theoretical analyses and relevant practical world case studies, the threats would be demonstrated, and then state-of-the-art defense techniques would be described. The course would borrow concepts from diverse fields of study such as cryptography, hardware design, circuit testing, algorithms, and machine learning.

ABOUT INSTRUCTOR :

Debdeep Mukhopadhyay is currently a full Professor at the Department of Computer Science and Engineering, IIT-Kharagpur, India. He was previously visiting scientist at NTU Singapore, a visiting Associate Professor of NYU-Shanghai, Assistant Professor at IIT-Madras, and Visiting Researcher at NYU Tandon-School-of-Engineering, USA. He holds a PhD, an MS, and a B. Tech from IIT Kharagpur, India. At IIT Kharagpur he initiated the Secured Embedded Architecture Laboratory (SEAL), with a focus on Embedded Security and Side Channel Attacks

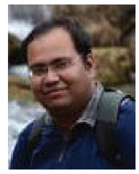
COURSE PLAN :

Week 01 : Introduction, Finite Fields, AES Hardware, S-Box
Week 02 : Algorithm to Hardware, Case Study on ECC, Intro to ECC
Week 03 : Implementation of ECC, Hardware Design of ECC
Week 04 : Introduction to Side Channel Analysis
Week 05 : Advanced SCA, Introduction to Fault Attacks
Week 06 : Advanced Fault Attacks, Algebraic Fault Analysis
Week 07 : Countermeasures-I
Week 08 : Countermeasures-II
Week 09 : Introduction to PUFs, Designs on FPGAs, Machine Learning of PUFs
Week 10 : Design-for-Testability for Cryptographic Designs
Week 11 : Protocols, Challenges, Introduction to Micro-architectural attacks
Week 12 : Advanced Micro-architectural attacks, Hardware monitoring for malwares using Hardware Performance Counters

BLOCKCHAIN ARCHITECTURE DESIGN AND USE CASES

COMPUTER SCIENCE & ENGINEERING

Technical Partner IBM



PROF. SANDIP CHAKRABORTY
Dept. of Computer Science and Engineering
IIT Kharagpur

Dr. PRAVEEN JAYACHANDRAN
Research Staff Member
IBM

TYPE OF COURSE : Rerun | Elective | UG/PG
INTENDED AUDIENCE : CSE, ECE, EE, Maths
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 28 Apr 2019

INDUSTRIES APPLICABLE TO : IT Industries

COURSE OUTLINE :

The widespread popularity of digital cryptocurrencies has led the foundation of Blockchain, which is fundamentally a public digital ledger to share information in a trustworthy and secure way. The concept and applications of Blockchain have now spread from cryptocurrencies to various other domains, including business process management, smart contracts, IoT and so on. This course is a joint venture from academia and industry, where the target is to cover both the conceptual as well as application aspects of Blockchain. This includes the fundamental design and architectural primitives of Blockchain, the system and the security aspects, along with various use cases from different application domains.

ABOUT INSTRUCTOR :

Prof. Sandip Chakraborty received his Ph.D. and M.Tech. degrees from Department of Computer Science and Engineering, Indian Institute of Technology (IIT), Guwahati, India. Presently, he is an Assistant Professor with Department of Computer Science and Engineering, IIT Kharagpur.

Dr. Praveen Jayachandran is a research staff member, master inventor and manager of the Blockchain and Smart Contracts team at IBM Research, India. His work spans different aspects of blockchain technology, including developing an enterprise-grade blockchain platform, development of smart contracts, and reimagining industry use cases in a blockchain world.

COURSE PLAN :

Week 01 : Introduction to Blockchain
Week 02 : Crypto Primitives and Bitcoin
Week 03 : Consensus
Week 04 : Permissioned Blockchain
Week 05 : Hyperledger Fabric
Week 06 : Fabric Demo
Week 07 : Blockchain Use Cases - Finance
Week 08 : Blockchain Use Cases - Industry
Week 09 : Blockchain in Government and Blockchain Security
Week 10 : Security and Research Aspects
Week 11 : Research Aspects in Blockchain
Week 12 : AI, Blockckahin and Big Data

CRYPTOGRAPHY AND NETWORK SECURITY

COMPUTER SCIENCE & ENGINEERING

PROF. SOURAV MUKHOPADHYAY
Department of Mathematics
IIT Kharagpur

TYPE OF COURSE : Rerun | Elective | UG/PG
PRE-REQUISITES : None
INDUSTRY SUPPORT : IT companies, DRDO, ISRO, NEVY.
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 27 Apr 2019

COURSE OUTLINE :

The aim of this course is to introduce the student to the areas of cryptography and cryptanalysis. This course develops a basic understanding of the algorithms used to protect users online and to understand some of the design choices behind these algorithms. Our aim is to develop a workable knowledge of the mathematics used in cryptology in this course. The course emphasizes to give a basic understanding of previous attacks on cryptosystems with the aim of preventing future attacks. A wide variety of basic cryptographic primitives will be discussed along with recent developments in some advanced topics like identity-based encryption, attribute-based encryption, functional encryption, two-party/multi-party computation, bitcoin and crypto-currency and postquantum cryptography. The cryptanalysis part will help us understanding challenges for cybersecurity that includes network security, data security, mobile security, cloud security and endpoint security.

ABOUT INSTRUCTOR :

Prof. Sourav Mukhopadhyay, is an Associate Professor Department of Computer Science & Engineering, IIT Kharagpur, He has completed his B.Sc (Honours in Mathematics) in1997 from University of Calcutta, India. He has done M.Stat (in statistics) and M.Tech (in computer science) from Indian Statistical Institute, India, in 1999 and 2001 respectively. He worked with Cryptology Research Group at Indian Statistical Institute as a PhD student and received his Ph.D. degree in Computer Science from there in 2007. He was a Research Assistant at the Computer Science department of School of Computing, National University of Singapore (NUS). He visited Inria Rocquencourt, project CODES, France and worked as a post-doctoral research fellows at the School of Computer Engineering, Nanyang Technological University (NTU), Singapore. He was a post-doctoral research fellows and a part time Lecturer with School of Electronic Engineering, Dublin City University (DCU), Ireland.

COURSE PLAN

Week 1: Introduction to cryptography, Classical Cryptosystem, Block Cipher.

Week 2: Data Encryption Standard (DES), Triple DES, Modes of Operation, Stream Cipher.

Week 3: LFSR based Stream Cipher, Mathematical background, Abstract algebra, Number Theory.

Week 4: Modular Inverse, Extended Euclid Algorithm, Fermat's Little Theorem, Euler Phi-Function, Euler's theorem.

Week 5: Advanced Encryption Standard (AES), Introduction to Public Key Cryptosystem, Diffie-Hellman Key Exchange, Knapsack Cryptosystem, RSA Cryptosystem.

Week 6: Primarily Testing, ElGamal Cryptosystem, Elliptic Curve over the Reals, Elliptic curve Modulo a Prime.

Week 7: Generalized ElGamal Public Key Cryptosystem, Rabin Cryptosystem.

Week 8: Message Authentication, Digital Signature, Key Management, Key Exchange, Hash Function.

Week 9: Cryptographic Hash Function, Secure Hash Algorithm (SHA), Digital Signature Standard (DSS).

Week 10: Cryptanalysis, Time-Memory Trade-off Attack, Differential and Linear Cryptanalysis.

Week 11: Cryptanalysis on Stream Cipher, Modern Stream Ciphers, Shamir's secret sharing and BE, Identity-based Encryption (IBE), Attribute-based Encryption (ABE).

Week 12: Side-channel attack, The Secure Sockets Layer (SSL), Pretty Good Privacy (PGP), Introduction to Quantum Cryptography, Blockchain, Bitcoin and Cryptocurrency.

SOCIAL NETWORKS

COMPUTER SCIENCE & ENGINEERING

PROF. SUDARSHAN IYENGAR
Dept. of Computer Science and Engineering
IIT Ropar

PROF. RISHI RANJAN SINGH
Dept. of Electrical Engineering and Computer Science
IIT Bhilai

TYPE OF COURSE : Rerun | Elective | UG/PG

COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)

PRE-REQUISITES : A first course in basic programming.

EXAM DATE : 28 Apr 2019

INDUSTRIES APPLICABLE TO : This is a much sought after field in computer science and many industries value/recognize this course.

COURSE OUTLINE :

The network of friendships on Facebook, road connections, terrorist networks and disease spreading networks are today available as a graph G(V,E). Social Network Analysis involves discerning this graph data and making sense out of it. The course will revolve around the study of some well-known theories of social and information networks and their applications on real world datasets.

ABOUT INSTRUCTOR :

Sudarshan Iyengar, has a Ph.D. from the Indian Institute of Science and is currently working as an Assistant Professor at IIT Ropar and has been teaching this course from the past 5 years. Apart from this course, he has offered several other courses in IIT Ropar like Discrete Mathematics, Theory of Computation, Cryptography, Probability and Computing etc. His research interests include social networks, crowd sourced knowledge building and computational social sciences. His current research proects are "Predicting a Viral meme" (Yayati Gupta), "Understanding Crowd sourced Knowledge building" (Anamika Chhabra - Scientist), "Secure Computation" (Varsha Bhat) and "Network Sampling" (Akrati Saxena). After research, teaching makes the major component of his academic life. He enjoys experimenting with different teaching methodologies.

COURSE PLAN :

Week 1: Introduction

Week 2: Handling Real-world Network Datasets

Week 3: Strength of Weak Ties

Week 4: Strong and Weak Relationships (Continued) & Homophily

Week 5: Homophily Continued and +Ve / -Ve Relationships

Week 6: Link Analysis

Week 7: Cascading Behaviour in Networks

Week 8: Link Analysis (Continued)

Week 9: Power Laws and Rich-Get-Richer Phenomena

Week 10: Power law (contd..) and Epidemics

Week 11: Small World Phenomenon

Week 12: Pseudocore (How to go viral on web)

INTRODUCTION TO INTERNET OF THINGS

COMPUTER SCIENCE & ENGINEERING

PROF. SUDIP MISRA
Dept. of Computer Science and Engineering
IIT Kharagpur

TYPE OF COURSE : Rerun | Core/Elective | UG/PG
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
PRE-REQUISITES : Basic programming knowledge
EXAM DATE : 27 Apr 2019
INTENDED AUDIENCE : CSE, IT, ECE, EE, Instrumentation Engg, Industrial Engineering
INDUSTRIES APPLICABLE TO : All Industrial sectors from NA

COURSE OUTLINE :

Internet of Things (IoT) is presently a hot technology worldwide. Government, academia, and industry are involved in different aspects of research, implementation, and business with IoT. IoT cuts across different application domain verticals ranging from civilian to defence sectors. These domains include agriculture, space, healthcare, manufacturing, construction, water, and mining, which are presently transitioning their legacy infrastructure to support IoT. Today it is possible to envision pervasive connectivity, storage, and computation, which, in turn, gives rise to building different IoT solutions. IoT-based applications such as innovative shopping system, infrastructure management in both urban and rural areas, remote health monitoring and emergency notification systems, and transportation systems, are gradually relying on IoT based systems.

ABOUT INSTRUCTOR :

Prof. Sudip Misra, is an Professor in the Department of Computer Science and Engineering at the Indian Institute of Technology Kharagpur. Prior to this he was associated with Cornell University (USA), Yale University (USA), Nortel Networks (Canada) and the Government of Ontario (Canada). He received his Ph.D. degree in Computer Science from Carleton University, in Ottawa, Canada. He has several years of experience working in the academia, government, and the private sectors in research, teaching, consulting, project management, architecture, software design and product engineering roles. Dr. Misra is the author of over 260 scholarly research papers, including 140+ reputed journal papers, and 9 books. He was awarded the prestigious Humboldt Fellowship, Germany and Fellow of the National Academy of Science, India. Dr. Misra is the author of over 260 scholarly research papers, including 140+ reputed journal papers, and 9 books. He was awarded the prestigious Humboldt Fellowship, Germany and Fellow of

COURSE PLAN :

Week 1: Introduction to IoT: (contd) Sensing, Actuation, Basics of Networking

Week 2: Basics of Networking: (contd) Communication Protocols:

Week 3: Communication Protocols: (contd) Sensor Networks:

Week 4: Sensor Networks: (contd) Machine-to-Machine Communications

Week 5: Interoperability in IoT, Introduction to Arduino Programming: Integration of Sensors and Actuators with Arduino.

Week 6: Introduction to Python programming: Introduction to Raspberry Pi.

Week 7: Implementation of IoT with Raspberry Pi:Introduction to SDN: SDN for IoT.

Week 8: (contd) Data Handling and Analytics: Cloud Computing:

Week 9: Cloud Computing: Sensor-Cloud:

Week 10: Fog Computing: (contd)Smart Cities and Smart Homes:

Week 11: Connected Vehicles: Smart Grid: Industrial IoT:

Week 12: Industrial IoT: (contd) Case Study: Agriculture, Healthcare, Activity Monitoring:

COMPUTER SCIENCE & ENGINEERING

INTRODUCTION TO INDUSTRY 4.0 AND INDUSTRIAL INTERNET OF THINGS

PROF. SUDIP MISRA
Dept. of Computer Science and Engineering
IIT Kharagpur

COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 28 April 2019

TYPE OF COURSE : New | Elective |UG/PG
INTENDED AUDIENCE : CSE, IT, ECE, EE, Instrumentation Engg, Industrial Engineering
PRE-REQUISITES : Basics of Internet of Things (IoT)

COURSE OUTLINE :

Industry 4.0 concerns the transformation of industrial processes through the integration of modern technologies such as sensors, communication, and computational processing. Technologies such as Cyber Physical Systems (CPS), Internet of Things (IoT), Cloud Computing, Machine Learning, and Data Analytics are considered to be the different drivers necessary for the transformation. Industrial Internet of Things (IIoT) is an application of IoT in industries to modify the various existing industrial systems. IIoT links the automation system with enterprise, planning and product lifecycle.

ABOUT INSTRUCTOR :

Dr. Sudip Misra is a Professor in the Department of Computer Science and Engineering at the Indian Institute of Technology Kharagpur. Prior to this he was associated with Cornell University (USA), Yale University (USA), Nortel Networks (Canada) and the Government of Ontario (Canada). He received his Ph.D. degree in Computer Science from Carleton University, in Ottawa, Canada. He has several years of experience working in the academia, government, and the private sectors in research, teaching, consulting, project management, architecture, software design and product engineering roles.

COURSE PLAN :

Week 1 : Introduction: Sensing & actuation, Communication-Part I, Part II, Networking-Part I, Part II

Week 2 : Industry 4.0: Globalization and Emerging Issues, The Fourth Revolution, LEAN Production Systems, Smart and Connected Business Perspective, Smart Factories

Week 3 : Industry 4.0: Cyber Physical Systems and Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Augmented Reality and Virtual Reality, Artifical Intelligence, Big Data and Advanced Analysis

Week 4 : Cybersecurity in Industry 4.0, Basics of Industrial IoT: Industrial Processes-Part I, Part II, Industrial Sensing & Actuation, Industrial Internet Systems.

Week 5 : IIoT-Introduction, Industrial IoT: Business Model and Referece Architerture: IIoT-Business Models-Part I, Part II, IIoT Reference Architecture-Part I, Part II.

Week 6 : Industrial IoT- Layers: IIoT Sensing-Part I, Part II, IIoT Processing-Part I, Part II, IIoT Communication-Part I.

Week 7 : Industrial IoT- Layers: IIoT Communication-Part II, Part III, IIoT Networking-Part I, Part II, Part III.

Week 8 : Industrial IoT: Big Data Analytics and Software Defined Networks: IIoT Analytics - Introduction, Machine Learning and Data Science - Part I, Part II, R and Julia Programming, Data Management with Hadoop.

Week 9 : Industrial IoT: Big Data Analytics and Software Defined Networks: SDN in IIoT-Part I, Part II, Data Center Networks, Industrial IoT: Security and Fog Computing: Cloud Computing in IIoT-Part I, Part II.

Week 10 : Industrial IoT: Security and Fog Computing - Fog Computing in IIoT, Security in IIoT-Part I, Part II, Industrial IoT- Application Domains: Factories and Assembly Line, Food Industry.

Week 11 : Industrial IoT- Application Domains: Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security (Including AR and VR safety applications), Facility Management.

Week 12 : Industrial IoT- Application Domains: Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries, Case studies. Self-Referential Structures and Introduction to Lists; Advanced Topics

INTRODUCTION TO AUTOMATA, LANGUAGES AND COMPUTATION

COMPUTER SCIENCE & ENGINEERING

PROF. SOURAV MUKHOPADHYAY
Department of Mathematics
IIT Kharagpur

TYPE OF COURSE : New | Core | UG/PG
INTENDED AUDIENCE : Computer Science
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 27 April 2019

COURSE OUTLINE :

Automata, Languages and Computation have been an important part of the curriculum in computer science department for several decades. The automata theory is the study of abstract machines and their application in solving computational problems. Automata is a major part of this course, and is explained elaborately throughout in easily comprehensible ways. Besides providing students with a detailed introduction to the theories related to computer science, this course also fully covers mathematical preliminaries which are essential to computation.

ABOUT INSTRUCTOR :

Dr. Sourav Mukhopadhyay is an Associate Professor at Indian Institute of Technology Kharagpur. He has completed his B.Sc (Honours in Mathematics) in 1997 from University of Calcutta, India. He has done M.Stat (in statistics) and M.Tech (in computer science) from Indian Statistical Institute, India, in 1999 and 2001 respectively. He worked with Cryptology Research Group at Indian Statistical Institute as a PhD student and received his Ph.D. degree in Computer Science from there in 2007. He was a Research Assistant at the Computer Science department of School of Computing, National University of Singapore (NUS). He visited InriaRocquencourt, project CODES, France and worked as a post-doctoral research fellows at the School of Computer Engineering, Nanyang Technological University (NTU), Singapore. He was a post-doctoral research fellows and a part time Lecturer with School of Electronic Engineering, Dublin City University (DCU), Ireland.

COURSE PLAN :

Week 01 : Finite automata and regular languages
Week 02 : Regular expressions
Week 03 : Equivalence of DFA and NFA
Week 04 : Minimization of finite automata
Week 05 : Pumping lemma and its application
Week 06 : Context-free grammars and context-free languages
Week 07 : Chomsky normal form, closure properties
Week 08 : Push down automata
Week 09 : Computability
Week 10 : Turing machines and variants
Week 11 : Time complexity of Turing machines
Week 12 : P and NP, NP- completeness

ELECTRICAL ENGINEERING

ELECTRICAL ENGINEERING

04 weeks

01. LDPC and Polar Codes in 5G Standard
02. Electric Vehicles - Part 1
03. Basics of software defined Radios and Practical Applications

08 weeks

01. Analog Circuits
02. Advance power electronics and Control
03. Evolution of Air Interface towards 5G
04. Electromagnetic compatibility, EMC
05. Electromagnetic Waves in Guided and Wireless Medium
06. Advances in UHV Transmission and Distribution
07. CMOS Digital VLSI Design
08. An Introduction to Coding Theory
09. Advanced IOT Applications
10. Electronic Modules for Industrial Applications using OP-Amps

12 weeks

01. Electrical Machines - II
02. Power System Engineering
03. Fundamentals of Power Electronics
04. Fundamentals of semiconductor devices
05. Principles of Digital Communications
06. Modern Digital Communication Techniques
07. Principles of Signals and Systems
08. Principles of Communication Systems - I
09. Digital Electronic Circuits
10. Microprocessors And Microcontrollers
11. Computer Aided Power System Analysis
12. Power System Dynamics, Control and Monitoring
13. Antennas
14. Introduction to Photonics
15. Biomedical Signal Processing
16. Control engineering
17. Multirate DSP
18. Mathematical Methods and Techniques in Signal Processing
19. Electronic Systems for Cancer Diagnosis

ELECTRICAL ENGINEERING

LDPC AND POLAR CODES IN 5G STANDARD

PROF. ANDREW THANGARAJ
Department of Electrical Engineering
IIT Madras

TYPE OF COURSE : New | Elective | PG

COURSE DURATION : 4 weeks (28 Jan'19-22 Feb'19)

INTENDED AUDIENCE : EE PG in communications area, Communication industry professionals

EXAM DATE : 31 March 2019

PRE-REQUISITES : Probability theory, Digital communications, MATLAB

INDUSTRIES APPLICABLE TO : Most communications companies.

COURSE OUTLINE :

This course will introduce the error control codes – Low Density Parity Check codes and Polar codes - that have been proposed for 5G cellular communication systems. The emphasis will be on implementing decoders for these codes.

ABOUT INSTRUCTOR :

Andrew Thangaraj received his B.Tech in Electrical Engineering from the Indian Institute of Technology (IIT), Madras, India in 1998 and a PhD in Electrical Engineering from the Georgia Institute of Technology, Atlanta, USA in 2003. He was a post-doctoral researcher at the GTL-CNRS Telecom lab at Georgia Tech Lorraine, Metz, France from August 2003 to May 2004. From June 2004, he has been with the Department of Electrical Engineering, IIT Madras, where he is currently a Professor. From Jan 2012 to Jan 2018, he served as Editor for the IEEE Transactions on Communications. Since July 2018, he has been serving as an Associate Editor for Coding Techniques for the IEEE Transactions on Information Theory.

COURSE PLAN :

Week 01 : Linear block codes: parameters, parity check matrix, generator matrix, puncturing, shortening, Soft decoding: BPSK-AWGN model, Log-Likelihood Ratio, bitwise MAP soft-decision decoding, successive cancellation soft-decision decoding, list decoding, Examples: Repetition code, Single parity check code, Hamming code

Week 02 : Low Density Parity Check codes: definition, Tanner graph, protograph LDPC code construction (base matrix, expansion), construction in 5G standard, encoding of LDPC codes, Message passing decoding on Tanner graph: column and row operations, minsum approximation, Threshold analysis

Week 03 : Polar code: generator matrix, frozen bits and information bits, butterfly representation, binary tree representation, Successive cancellation decoder for polar codes, Information-theoretic analysis

Week 04 : Simplified successive cancellation decoding of polar codes: REP, RATE1, RATE0, SPC nodes, Successive cancellation list decoding, Simplified successive cancellation list decoding, Fast simplified successive cancellation list decoding

ELECTRICAL ENGINEERING

ELECTRIC VEHICLES - PART 1

PROF. AMIT KUMAR JAIN
Department of Electrical Engineering
IIT Delhi

TYPE OF COURSE : New | Elective | UG/PG
INTENDED AUDIENCE : For All
PRE-REQUISITES : BE (Electrical)
COURSE DURATION : 4 weeks (25 Feb'19 -22 Mar '19)
EXAM DATE : 28 Apr 2019

COURSE OUTLINE :

This course will be a first level course on electric vehicles. Students will be able to understand the operation of battery driven electric vehicles. The course will start with introduction section which will enable the students to understand the focus areas that come under the umbrella of electric vehicles. Then the course will start covering these focus areas one by one such as vehicle dynamics, Motors, Power Electronics, Batteries,Charging etc. The most important part of this course will be that each topic will be analyzed and demonstrated through Matlab Simulink, so that the grip of the subject will be strong and the knowledge acquired will be useable in real time applications.

ABOUT INSTRUCTOR :

Amit Kumar Jain is presently working as Associate Professor in Department of Electrical Engineering, IIT Delhi. He has done his Ph.D and M.S from Department of Electrical Engineering, I.I.Sc, Bangalore and spent around two years in General Electric Global Research Center before joining IIT Delhi in 2012. His expertise includes electric drives for renewable and electric vehicle application. He has also started a course on Electric Vehicles in IIT Delhi which is now being converted to NPTEL video course.

COURSE PLAN :

Week 01 : Introduction to Electric Vehicle

Week 02 : Vehicle Dynamics: Modelling and Simulation

Week 03 : Fundamental of Drives and DC Machine Modeling

Week 04 : DC Machine Drives and Control of EV Using DC Machine

ELECTRICAL ENGINEERING

BASICS OF SOFTWARE-DEFINED RADIOS AND PRACTICAL APPLICATIONS

PROF. MEENAKSHI RAWAT
Department of Electronics & Communication Engineering
IIT Roorkee

TYPE OF COURSE : Rerun | Elective | UG/PG

COURSE DURATION : 4 weeks (28 Jan'19 - 22 Feb'19)

EXAM DATE : 31 Mar 2019

INDUSTRY SUPPORT : Telecommunication Industry (BEL), Defence Industry (DRDO), Aeronautical Industry, and Space Organization (ISRO).

INTENDED AUDIENCE : BE/ME - EE, EC, ECE, EI

COURSE OUTLINE :

Software-defined radio (SDR) is an inherent part of modern communication system, where many processes, which used to be implemented in hardware, are defined in software domain for flexibility and configurability. This course describes various components of software-defined-radios with the understanding of their limitation and application of 'software-defined-solutions' to overcome such limitations. Understanding the interplay of analog and digital signal processing for power as well as spectrum efficient transmission and reception of signal leads to an optimized, yet, practical radio solution. This course will allow students to understand (1) the terminology used in industrial data-sheets and (2) motivation for selecting appropriate commercial solutions for a practical transceiver design.

ABOUT INSTRUCTOR :

Prof. Meenakshi Rawat, Department of Electronics & Communication Engineering, Indian Institute of Technology, Roorkee received the BTech degree in electrical engineering from the GovindBallabh Pant University of Agriculture and Technology, Uttarakhand, India, in 2006, and the MSc and PhD degrees in electrical and computer engineering from the University of Calgary, Calgary, AB, Canada, in 2012. From September 2012 to June 2013, she was a Post-Doctoral Research Fellow with the University of Calgary. From July 2013 to June 2014, she was a Post-Doctoral Project Researcher/Scientist with the Ohio State University. She is currently an Assistant Professor with the Indian Institute of Technology (IIT), Roorkee, Uttarakhand, India.

COURSE PLAN

Week1: Basic components of software defined radios, Software defined radio architectures-Part A, Software defined radio architectures- Part B

Week2: Distortion parameters-Sources and metrics of distortion in a transceiver,Nonlinear distortion and nonlinearity specifications, Power amplifiers: Nonlinear Distortion in Transmitted Signals

Week3: Power amplifier Line-up for linearity & power requirement calculations,Linearization Techniques for nonlinear distortion in SDR, Predistortion Techniques for nonlinear distortion in SDR

Week4: Digital Predistortion Techniques for Linear/Nonlinear Distortion

ELECTRICAL ENGINEERING

ANALOG CIRCUITS

PROF. JAYANTA MUKHERJEE
Department of Electrical Engineering
IIT Bombay

TYPE OF COURSE : Rerun | Core | UG
INTENDED AUDIENCE : B.E/B.Tech,B.Sc
COURSE DURATION : 8 weeks (28 Jan'19 - 22 Mar'19)
EXAM DATE : 31 Mar 2019

COURSE OUTLINE :

This is designed as the introductory course on Analog Circuits for undergraduate students. It covers the basic components and methodologies used for Analog Design. Most of the portion deals with OPAMP based circuits. Later in the course some BJT based circuits are discussed.

ABOUT INSTRUCTOR :

Prof. Jayanta Mukherjee is a Professor in the Electrical Engineering Department of IIT Bombay. He did his PhD from The Ohio State University, Columbus Ohio in Electrical and Computer Engineering in 2006. His research interests lie in high frequency Passive and Active Circuit Design. He has published a number of papers in top ranked Journals and Conferences and also has a number of patents. He has taught the course "Analog Circuits" a number of times at IIT Bombay. The course material developed for this NPTEL MOOCS course are mainly derived from the teaching materials developed for the course that he has taught.

COURSE PLAN

Week 1 : Introduction, Poles and Zeros, Ideal Opamp, Applications of OPAMP – Inverting and Non Inverting ` Amplifier

Week 2 : Applications of OPAMP (..Contd) – Summer Amplifier, Difference Amplifier, Integrator, Differentiator

Week 3 : Non Idealities in an OPAMP – Finite Gain, Bandwidth, Slew Rate, Saturation, Offset Voltage, Bias Current

Week 4 : Bode Plots, Frequency Response, Millers Theorem, Feedback, Effect of Feedback

Week 5 : Stability, Nyquist Plot, Phase Margin, Gain margin, Frequency Compensation

Week 6 : Filter Design, Butterworth and Chebyshev Filters Non Linear Applications of Filters – Limiters, Oscillators, Multivibrators

Week 7 : Diodes, Basic BJT Circuits

Week 8 : Basic BJT based circuits

ELECTRICAL ENGINEERING

ADVANCE POWER ELECTRONICS AND CONTROL

PROF. AVIK BHATTACHARYA
Department of Electrical Engineering
IIT Roorkee

TYPE OF COURSE : New | Elective | UG/PG
COURSE DURATION : 8 weeks (28 Jan'19 - 22 Mar'19)
INTENDED AUDIENCE : B.Tech/M.Tech/from industry.
EXAM DATE : 31 March 2019
INDUSTRIES APPLICABLE TO : ABB, GE, STATCON ENERGIAA, BHEL

COURSE OUTLINE :

This course is suitable for UG (B.Tech) and M.Tech studying in Advance Power Electronics. This course describes modern topics of Power Electronics in terms of switches, topologies and control. More over the proposed course explains application of Power Electronics in drives, Power Systems and Renewable Energy and other utility. This application of the Power Electronics including all these fields has been discussed in detail with advanced switching topology and modern control techniques. Students of B.Tech and M.Tech and participants of industry will find this course beneficial not only for GATE and other competitive exams, but also help them to upgrade for the fast changing Power Electronics industry.

ABOUT INSTRUCTOR :

Dr Avik Bhattacharya joined in IIT Roorkee in February 2014. His fields of interest are FACTS, Power Quality, Solid state transformer, SIC and Gian devices. He has taught Power Electronics in IIT Roorkee for two years. Dr Bhattacharya, before joining IIT Roorkee, has worked in power electronics industries. His teaching thus has a proper blend of industry academic orientation.

COURSE PLAN :

Week 01 : Basic Concept of Switches and Device Physics
Week 02 : Device Physics, Application and Analysis of Switches and Single Phase Converter
Week 03 : Single Phase Converter, Three Phase Converter, Multipulse Converter and Effect of Source Inductance and PWM Rectifiers
Week 04 : PWM Rectifiers and Power Factor Improvement Techniques and non- isolated DC- DC converters
Week 05 : Non- isolated and isolated DC- DC Converters and Choppers
Week 06 : Isolated DC- DC Converters IV and VSI & CSI, MLI and ZSI
Week 07 : SVM, AC to AC Converters, Cycloconverter and Matrix Converter
Week 08 : Linear Control in Power Electronics, Nonlinear Control in Power Electronics, Applications and Conclusions

ELECTRICAL ENGINEERING

EVOLUTION OF AIR INTERFACE TOWARDS 5G

PROF.SUVRA SEKHAR DAS
Department of Electrical Engineering
IIT Kharagpur

TYPE OF COURSE	: New | Elective | PG	**COURSE DURATION**	: 8 weeks (25 Feb'19-19 Apr'19)
INTENDED AUDIENCE	: Senior undergraduate students, graduate level students, MS and PhD students	**EXAM DATE**	: 27 April 2019
PRE-REQUISITES	: Digital communications, Mobile Communications / Wireless Communications		
INDUSTRIES APPLICABLE TO	: All wireless telephony service providers and equipment manufactures.		

COURSE OUTLINE :

Air Interface is one of the most important elements that differentiate between 2G, 3G, 4G and 5G. While 3G was CDMA based, 4G was OFDMA based; this course reveals the contents of air interface for 5G.
While 4G brought in a deluge of infotainment services, 5G aims to provide extremely low delay services, great service in crowd, enhanced mobile broadband (virtual reality being made real), ultra reliable and secure connectivity, ubiquitous QoS, and highly energy efficient networks.

ABOUT INSTRUCTOR :

Dr. Suvra Sekhar Das, is currently serving as Associate Professor in the G. S. Sanyal School of Telecommunications at IIT Kharagpur. He has authored three books in the domain of Air Interface for 4G / 5G. He has 10 patents in the domain of wireless communications. He has more than 75 publications in International journals and conferences. He has developed several massive online open course ware and virtual laboratories which are widely used resources for developing expertise in the design and development of wireless communication systems.

COURSE PLAN :

Week 01 : Evolution of wireless communication towards 5G
Week 02 : Waveform in 5G, (W-OFDM, F-OFDM, UFMC, FBMC, GFDM, adaptive OFDM)
Week 03 : Modulation and coding in 5G
Week 04 : Propagation Characteristics of 5G Channel models
Week 05 : MIMO communication essentials
Week 06 : Massive MIMO in 5G (massive MIMO, pilot contamination, Beam forming)
Week 07 : Heterogeneous Ultra Dense networks in 5G, (Small cells, D2D, MIMO-NOMA)
Week 08 : Ubiquitous Quality of Service Provisioning for real time traffic

ELECTRICAL ENGINEERING

ELECTROMAGNETIC COMPATIBILITY, EMC

PROF. DANIEL MÅNSSON
EECS, KTH Royal Institute of Technology, Sweden

PROF. RAJEEV THOTTAPPILLIL
EECS, KTH Royal Institute of Technology, Sweden

TYPE OF COURSE : New | Elective | UG / PG
INTENDED AUDIENCE : ME/MS/MSc
COURSE DURATION : 8 weeks (25 Feb'19 - 19 Apr'19)
EXAM DATE : 28 Apr 2019
PRE-REQUISITES : Basic circuit analysis, basic electromagnetic field theory

INDUSTRIES APPLICABLE TO : ABB, Ericsson, Siemens, Nokia, Bombardier, Alstom, Volvo, SAAB, Lockheed Martin, Boeing etc.

COURSE OUTLINE :

All systems that generate or consume electrical energy can produce electromagnetic noise that may interfere with the operation of the system itself and/or other systems. Electromagnetic interference (EMI) is a potential threat to the present day electronic devices. The course shows the students how the principles of electricity and magnetism can be applied to design electrical and electronic systems that can co-exist harmoniously, that is, to design systems that are electromagnetically compatible with each other. The students will learn how electromagnetic disturbances are generated in systems, how they couple to other systems, and how systems can be protected.

ABOUT INSTRUCTOR :

Daniel Månsson is Associate Professor in Smart grid power system components at KTH Royal Institute of Technology, Sweden. His PhD is in EMC and Intentional Electromagnetic Interference (IEMI) and has contributed to research connected to IEMI and EMC in large distributed systems and effects as well as international standards and consulting projects for private companies and government bodies.

Rajeev Thottappillil is Professor at the School of Electrical Engineering and Computer Science, KTH Royal Institute of Technology, Stockholm, Sweden. His research contributions are mostly in electromagnetics of lightning, effects of lightning on electrified railways, and mitigation of intentional electromagnetic interference. He is a Fellow of IEEE.

COURSE PLAN :

Week 01 : Introduction to EMC - Relevant concepts from electromagnetic field theory

Week 02 : Non-ideal or high-frequency behavior of components

Week 03 : Crosstalk or near-field coupling

Week 04 : EM topology & grounding

Week 05 : EM Shielding

Week 06 : Surge protection and filters

Week 07 : Problem of Intentional electromagnetic interference, Lightning protection

Week 08 : EMC measurements and Standards

ELECTRICAL ENGINEERING

ELECTROMAGNETIC WAVES IN GUIDED AND WIRELESS MEDIUM

PROF. PRADEEP KUMAR K
Department of Electrical Engineering
IIT Kanpur

TYPE OF COURSE : New | Elective | UG/PG

COURSE DURATION : 8 weeks (25 Feb'19 -19 Apr'19)

INTENDED AUDIENCE : Undergraduate students and first year graduate students

EXAM DATE : 28 Apr 2019

PRE-REQUISITES : Vector analysis, Electrostatics, and Magnetostatics

INDUSTRIES APPLICABLE TO : Of interest to all companies that deal with electromagnetic waves and wireless communications. In addition, DRDO, ISRO, etc will value the course.

COURSE OUTLINE :

A thorough understanding of propagation and radiation of electromagnetic waves in both wired and wireless media is important in many fields such as microwave and RF engineering, antennas, wireless communications, and fiber-optics. In this course, we discuss guided electromagnetic wave propagation in transmission lines and metallic waveguides, light propagation in optical waveguides, fibers, and free-space. In the final part of the course, we cover basic concepts of antennas and channel models for wireless communications. Pre-requisites include familiarity with vector analysis and vector calculus, electrostatics, and magnetostatics. Assignments include both conceptual and computational problems.

ABOUT INSTRUCTOR :

Dr. K Pradeep Kumar is currently an Associate Professor in the Department of Electrical Engineering at IIT Kanpur. His research interests include Quantum key distribution, optical communications, and nonlinear fiber optics. He has taught several popular NPTEL courses on Electromagnetics and Fiber-Optics.

COURSE PLAN :

Week 01 : Transmission lines

Week 02 : Applications of transmission lines

Week 03 : EM waves in free-space

Week 04 : Diffraction of EM waves

Week 05 : Guided waves in metallic waveguides

Week 06 : Guided waves in dielectric waveguides

Week 07 : Fundamentals of radiation

Week 08 : Wireless channel modeling

ELECTRICAL ENGINEERING

ADVANCES IN UHV TRANSMISSION AND DISTRIBUTION

PROF. SUBBA REDDY B
Department of Electrical Engineering
IISc Bangalore

TYPE OF COURSE : Rerun | Elective | UG/PG
COURSE DURATION : 8 weeks (28 Jan'19 - 22 Mar'19)
INTENDED AUDIENCE : 3rd or 4th year UG, 1st year masters and research students
EXAM DATE : 31 Mar 2019
PRE-REQUISITES : Basic Electrical Engg

COURSE OUTLINE :

This course introduces the recent advances in EHV/UHV transmission and distribution systems. The course emphasizes learning and understanding the newer design criteria required for the UHV transmission systems viz: insulation design, protections, safety concerns etc. The course starts with an introduction to the importance of EHV /UHV transmission, its present and future growth. The discussion on the various components used for UHV transmission, design considerations for UHV substations etc are strengthened with the aid of lectures, practical video demonstrations and assignment exercises.

ABOUT INSTRUCTOR :

Dr Subba Reddy B is a Principal Research Scientist at the High Voltage Laboratory, Dept. of Electrical Engineering, Indian Institute of Science, Bangalore, India. He received Bachelor's in Electrical Engineering degree from Karnatak University, Dharwad, and M.Sc(Engg) and PhD from Indian Institute of Science, Bangalore, India. His research interests are high voltage engineering, transmission line insulators, numerical techniques for high voltage applications, condition monitoring and diagnostics of HV equipment, surge arresters, renewable energy systems etc. He has received national and international recognition for his research work. He is a Fellow of Institution of Engineers (India), Fellow, Society of Power Engineers (India) and Senior member at IEEE.

COURSE PLAN :

Week 01 : Introduction to the development of Power Transmission.
Week 02 : Recent advances in UHV power transmission systems; present status and future growth.
Week 03 : General Design Criteria for overhead transmission lines: Methodologies,reliability, wind/ice loading etc.
Week 04 : Major Components of HV transmission systems, types of conductor configurations, conductor accessories/clamps etc.
Week 05 : Towers for UHV transmission: calculations of clearances for power frequency, switching and lightning surges, right of way(ROW)etc.
Week 06 : Selection of insulators for light, medium and heavy polluted areas | Up-gradation of existing transmission lines.
Week 07 : Design consideration of UHV substations, Comparison of AIS, Hybrid-AIS and GIS electric and magnetic fields.
Week 08 : Insulation coordination for UHV systems | Earthling and safety measures for UHV substations.

ELECTRICAL ENGINEERING

CMOS DIGITAL VLSI DESIGN

PROF. SUDEB DASGUPTA
Dept of Electronics & Communication Engineering
IIT Roorkee

TYPE OF COURSE : New | Elective | UG/PG
COURSE DURATION : 8 weeks (25 Feb'19 -19 Apr'19)
INTENDED AUDIENCE : UG/ PG (EE/EC/CS)
EXAM DATE : 27 April 2019
PRE-REQUISITES : A basic course of Semiconductor Devices and Digital Electronics. A course on Computer Organization will be quite helpful.

INDUSTRIES APPLICABLE TO : Cadence, Synopsys, ST Microelectronics, NXP Semiconductors, SCL, Chandigarh

COURSE OUTLINE :

This course brings circuit and system level views on design on the same platform. The course starts with basic device understanding and then deals with complex digital circuits keeping in mind the current trend in technology. The course follows a design perspective, starts from basic specifications and ends with system level blocks. Eight Assignments are provided which will add/help in understanding the course in a better manner both at conceptual as well as hands-on level.

ABOUT INSTRUCTOR :

S. Dasgupta,is presently working as an Associate Professor, in Microelectronics and VLSI Group of the Department of Electronics and Communication Engineering at Indian Institute of Technology, Roorkee. He received his PhD degree in Electronics Engineering from Institute of Technology-Banaras Hindu University (currently IIT-BHU), Varanasi in 2000. During his PhD work, he carried out research in the area of effects of ionizing radiation on MOSFET. Subsequently, he was member of faculty of Department of Electronics Engg.,at Indian School of Mines, Dhanbad (currently IIT-Dhanbad). In 2006, he joined as an Assistant Professor in the Department of Electronics and Communication Engineering at Indian Institute of Technology, Roorkee.

COURSE PLAN :

Week 01 : MOS Transistor Basic-I; L2: MOS Transistor Basic-I; L3: MOS Transistor Basic-II; L4: MOS Parasitic & SPICE Model; L5: CMOS Inverter Basics-I

Week 02 : CMOS Inverter Basics-II; L2: CMOS Inverter Basics-III; L3: Power Analysis-I; L4: Power Analysis-II; L5: SPICE Simulation-I

Week 03 : SPICE Simulation-II; L2: Combinational Logic Design-I; L3: Combinational Logic Design-II; L4: Combinational Logic Design-III; L5: Combinational Logic Design-IV

Week 04 : Combinational Logic Design-V; L2: Combinational Logic Design-VI; L3: Combinational Logic Design-VII; L4: Combinational Logic Design-VIII; L5: Combinational Logic Design-IX

Week 05 : Combinational Logic Design-X; L2: Logical Efforts-I; L3: Logical Efforts-II; L4: Logical Efforts-III; L5: Sequential Logic Design-I

Week 06 : Sequential Logic Design-II; L2: Sequential Logic Design-III; L3: Sequential LogicDesign-IV; L4: Sequential Logic Design-V; L5: Sequential Logic Design-VI

Week 07 : Sequential Logic Design-VII; L2: Sequential Logic Design-VIII; L3: Clock Strategies for Sequential Design-I; L4: Clock Strategies for Sequential Design-II; L5: Clock Strategies for Sequential Design-III

Week 08 : Clock Strategies for Sequential Design-IV; L2: Sequential Logic Design-IX; L3: Clock Strategies for Sequential Design-V; L4: Concept of Memory & its Designing-I; L5: Concept of Memory & its Designing-II

ELECTRICAL ENGINEERING

AN INTRODUCTION TO CODING THEORY

PROF. ADRISH BANERJEE
Department of Electrical Engineering
IIT Kanpur

TYPE OF COURSE : Rerun | Elective | UG/PG
PRE-REQUISITES : Linear algebra, probability & digital communications theory
COURSE DURATION : 8 weeks (28 Jan'19 - 22 Mar'19)
EXAM DATE : 31 Mar 2019
INDUSTRY SUPPORT : Telecommunication Companies
INTENDED AUIDENCE : 3rd/4th year UG students, PG students & faculty in electronics and communications engineering

COURSE OUTLINE :

Error control coding is an indispensible part of any digital communication system. In this introductory course, we will discuss theory of linear block codes and convolutional codes, their encoding and decoding techniques as well as their applications in real world scenarios. Starting from simple repetition codes, we will discuss among other codes: Hamming codes, Reed Muller codes, low density parity check codes, and turbo codes. We will also study how, from simple codes by concatenation, we can build more powerful error correcting codes.

ABOUT INSTRUCTOR :

Prof. Adrish Banerjee, Department of Electrical Engineering Indian Institute of Technology, Kanpur received his Bachelors degree from Indian Institute of Technology, Kharagpur and Masters and Ph.D. degree from University of Notre Dame, Indiana. He is currently an Associate Professor in the Department of Electrical Engineering at Indian Institute of Technology, Kanpur. He is a recipient of Microsoft Research India young faculty award, Institute of Engineers India young engineer award, and IETE Prof. K. Sreenivasan memorial award. His research interests are in the physical layer aspects of wireless communications, particularly green communications, error control coding, and cognitive radio.

COURSE PLAN

Week 1 : Introduction to error control coding; Introduction to linear block codes, generator matrix and parity check matrix; Properties of linear block codes: Syndrome, error detection

Week 2 : Decoding of linear block codes; Distance properties of linear block codes

Week 3 : Some simple linear block codes: Repetition codes, Single parity check codes, Hamming codes, Reed Muller codes; Bounds on size of codes: Hamming bound, Singleton bound, Plotkin bound, Gilbert-Varshamov bound

Week 4 : Introduction to convolutional codes-I: Encoding, state diagram, trellis diagram; Introduction to convolutional codes-II: Classification, realization, distance properties; Decoding of convolutional codes-I: Viterbi algorithm

Week 5 : Decoding of convolutional codes-II: BCJR algorithm; Performance bounds for convolutional codes

Week 6 : Low density parity check codes; Decoding of low density parity check codes: Belief propagation algorithm on BSC and AWGN channels

Week 7 : Turbo codes; Turbo decoding

Week 8 : Distance properties of turbo codes; Convergence of turbo codes ; Automatic repeat request schemes Applications of linear codes

ELECTRICAL ENGINEERING

ADVANCED IOT APPLICATIONS

PROF. T V PRABHAKAR
Department of Electronic Systems Engineering
IISc Bangalore

TYPE OF COURSE : New | Elective | PG
INTENDED AUDIENCE : Practising IoT engineers.
COURSE DURATION : 8 weeks (28 Jan'19-22 Mar'19)
EXAM DATE : 31 March 2019

PRE-REQUISITES : Computer Network Basics, IoT protocols

INDUSTRIES APPLICABLE TO : Automotive, Industrial

COURSE OUTLINE :

A selected set of applications for the IoT world are introduced. In our topic on first responder networks, we try to build a system to detect human life under a building debris. The sensors and the algorithms designed will be described. Our topic on automotive sector includes sensors such as LiDARs and Cameras used for obstacle detection. Anomaly detection in streaming will be discussed. We also explain some of the current protocols from the Wi-Fi world which have been made suitable for the V2X communication.

ABOUT INSTRUCTOR :

Dr. Prabhakar works as Principal Research Scientist in the Department of Electronic Systems Engg, IISc, Bangalore. His area of work is in Networked Embedded Systems. His research interest is in Energy Harvesting and Power Management Algorithms for sensor networks. The broad spectrum comprises of Modeling, Virtual Prototyping,System Building and Performance evaluation. His current work in LED based communication won the best demo award in COMSNETS 2014. He is currently working on energy harvesting technologies in chip design, indoor localization applications, and other batteryless applications.

COURSE PLAN :

Week 01 : First responder IoT networks
Week 02 : Sensors and protocols for next generation automobiles
Week 03 : Automotive IoT
Week 04 : Speech to text processing
Week 05 : Air quality monitoring
Week 06 : Localization in IoT
Week 07 : Smart energy monitoring
Week 08 : Cargo monitoring

ELECTRONIC MODULES FOR INDUSTRIAL APPLICATIONS USING OP-AMPS

ELECTRICAL ENGINEERING

PROF. HARDIK J PANDYA
Department of Electronic System Engineering
IISc Bangalore

TYPE OF COURSE : New | Elective | UG/PG
INTENDED AUDIENCE : Engineering Students, Faculty from Engineering Colleges
PRE-REQUISITES : Basic Electronics
COURSE DURATION : 8 weeks (25 Feb'19- 19 Apr'19)
EXAM DATE : 28 April 2019

COURSE OUTLINE :

This course is a system design-oriented course aimed to provide exposure on industrial applications of op-amp and its importance in the real world. In this course, different applications/case-studies (including biomedical and industrial application) are considered and will be discussing in detail about the fundamentals of the system, its operation and its importance. Since analog circuits play a crucial role in the implementation of an electronic system, this course emphasis on complete system design with initial discussion on circuit design. As part of this course student can build analog systems using analog ICs and study their macro models.

ABOUT INSTRUCTOR :

Dr. Hardik J. Pandya is an Assistant Professor in the Department of Electronic Systems Engineering, Division of Electrical Sciences, IISc Bangalore where he is developing Advanced Microsystems and Biomedical Devices Facility for Clinical Research and Biomedical and Electronic (10-6-10-9) Engineering Systems Laboratory to carry out cutting-edge research on novel devices to solve unmet problems in biology and medicine. He is recipient of prestigious Early Career Research Award from Science and Engineering Research Board, Government of India as well as a start-up grant of 228 Lacs from IISc. He has taught Design for Analog Circuits, Analog Integrated Circuits, VLSI technology, and Semiconductor Devices to undergraduate and graduate students from Electronic Engineering, Instrumentation Engineering, and Applied Physics.

COURSE PLAN :

Week 01 : Understanding the Datasheet of Op-Amps
Week 02 : To design and build a speed control of a DC motor using op-amp
Week 03 : To design and build an op-amp based ECG signal acquisition and BPM measurement
Week 04 : Fundamentals of EEG and design a signal conditioning circuit to acquire EEG signal
Week 05 : Fundamentals of pulse oximeter and implementation of pulse oximeter using op-amp
Week 06 : Design and develop a signal conditioning circuit for operating heater voltage of a MQ 7 gas sensor
Week 07 : Electronic module for printing press machines
Week 08 : Electronic module for heating PT 100 and operating as a hot-wire anemometer to find the velocity of the air, Electronic module for delineating signal from background noise

ELECTRICAL ENGINEERING

ELECTRICAL MACHINES – II

PROF. TAPAS KUMAR BHATTACHARYA
Department of Electrical Engineering
IIT Kharagpur

TYPE OF COURSE : New | Core | UG
COURSE DURATION : 12 weeks (28 Jan'19 -19 Apr'19)
INTENDED AUDIENCE : UG Electrical Engineering
EXAM DATE : 27 April 2019
PRE-REQUISITES : Basic Electrical Technology: Circuit analysis, principle of working of transformer and its equivalent circuit representation.
INDUSTRIES APPLICABLE TO : BHEL, CESC, NTPC, WBPDCL

COURSE OUTLINE :

The course will begin with explaining basic underlying principles of working of various types of electrical rotating machines. The conditions to be fulfilled for the steady production of electromagnetic torque (Te). Motoring and generating mode of operation. Primary focus will be on the operation of 3-phase induction machine, single phase induction motor, and synchronous machines. A fair knowledge of distributed windings is essential in order to understand the working of rotating machines more effectively – few lectures will be devoted on this topic. Concept of electrical and mechanical angles will be explained

ABOUT INSTRUCTOR :

Tapas Kumar Bhattacharya has over thirty years of teaching experience at IIT Kharagpur. Area of research interest is in the field of electrical machines and special electrical machines.

COURSE PLAN :

Week 01 : Brief review of transformer. Rotating machine : general constructional features. Conditions for steady production ofelectromagnetic torque. Torque production can be explained in terms of interaction of two sets of magnetic poles – one produced by stator coil current and the other by rotor coil currents.
Week 02 : MMF and flux density distribution along the air-gap of a rotating machine by a single coil and by multiple coils. Basic winding terms and elementary balanced 3-phase winding. Idea of electrical and mechanical angle.
Week 03 : Production of rotating field by a 3-phase winding – iits speed and direction of rotation and its far reaching implications.
Week 04 : The expression of induced voltage in a coil when it moves relative to a field distribution – its rms value and frequency.
Week 05 : Types and constructional features of 3-phase induction motor. Slip and its importance. Development of equivalent circuit of the motor when it runs with a slip. Getting expression for torque in terms of equivalent circuit parameters and supply voltage.
Week 06 : Typical torque slip characteristic. Fixing operating point when load torque is present. Modification of the torque -slip characteristic by varying rotor resistance, supply voltage and frequency.
Week 07 : Estimation of equivalent circuit parameters from no load and locked (blocked) rotor tests. Problem solving.
Week 08 : Single phase induction motor: double revolving field theory and development of equivalent circuit and expression for torque.. Torque-slip characteristic. Expression for starting torque in presence of auxiliary winding. Estimation of starting capacitance for auxiliary coil using concept of phase splitting
Week 09 : Synchronous machine: Types and constructional features . EMF equation and concept of synchronous reactance. Synchronising an incoming generator (alternator) to the bus. Phasor diagram as generator. Regulation. Effect of excitation variation when generator is connected to bus. Power-angle characteristic. Steady state stabilty limit.
Week 10 : Synchronous machine connected to bus and operating as motor. Phasor diagram under various operating conditions. Effect of excitation variation.
Week 11 : Salient pole synchronous machine : concept of direct axis and quadrature axis reactances. Phasor diagrams under various operating conditions both for motoring and generating mode.
Week 12 : Swing equation under dynamic condition. Equal area criteria. Steady state and transient stability limits.

ELECTRICAL ENGINEERING

POWER SYSTEM ENGINEERING

PROF. DEBAPRIYA DAS
Department of Electrical Engineering
IIT Kharagpur

TYPE OF COURSE : Rerun | Core | UG
INTENDED AUDIENCE : BE/B.Tech, EE
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 27 Apr 2019
INDUSTRY SUPPORT : Power Grid, NTPC, NHEC, DVC and State Electricity Boards.

COURSE OUTLINE :

This course is mainly for undergraduate third-year as well as fourth year Electrical Engineering students, which will introduce and explain the fundamental concepts in the field of electrical power system engineering. The basic concepts of underground cables, overhead line insulators, transient overvoltages and insulation coordination will be covered in detail. In addition to that, corona, sag and tension of transmission line will also be covered.

ABOUT INSTRUCTOR :

Prof. Debapriya Das, Department of Electrical Engineering, Indian Institute of Technology, Kharagpur obtained his B.E. degree from Calcutta University (B.E. College (Presently known as IIEST), Shibpur, Howrah, WB), M.Tech. from I.I.T. Kharagpur and Ph.D. from I.I.T., Delhi. He has nearly thirty years of experience in teaching and research.

COURSE PLAN

Week 1 : Overhead Line Insulators

Week 2 : Underground Cables

Week 3 : Transient Overvoltages and Insulation Coordination

Week 4 : Corona

Week 5 : Sag and Tension

Week 6 : Distribution System Load Flow and Voltage Stability

Week 7 : Approximate Method of Distribution System Analysis

Week 8 : Application of Capacitors for Radial Distribution Systems

Week 9 - 10 : Load Frequency Control

Week 11 - 12: Unit commitment

ELECTRICAL ENGINEERING

FUNDAMENTALS OF POWER ELECTRONICS

PROF. VIVEK AGARWAL
Department of Electrical Engineering
IIT Bombay

TYPE OF COURSE : New | Core/Elective | UG/PG
COURSE DURATION : 12 weeks (28 Jan'19-19 Apr'19)
INTENDED AUDIENCE : BE/ME (EE/EC/EI)
EXAM DATE : 28 April 2019
PRE-REQUISITES : Electrical and electronic circuits basics, network theory & semiconductor physics basics
INDUSTRIES APPLICABLE TO : General Electric, ABB, Siemens, BHEL, BEL, etc.

COURSE OUTLINE :

The course introduces basics of power electronic devices and converters. Basic working principle, operating modes and analysis of DC-DC, DC-AC, AC-DC, and AC-AC converters would be covered. Control of power electronic converters is explained. Certain specialized concepts in power electronics like matrix converter, active rectifiers, space vector modulation would be included.

ABOUT INSTRUCTOR :

He received the B.Sc. degree (Hons.) in physics from St. Stephen's College, Delhi University, Delhi, India, in 1985; the M.E. degree in electrical engineering from the Indian Institute of Science, Bangalore, India, in 1990; and the Ph.D. degree in electrical engineering from the University of Victoria, Victoria, Canada, in 1994.

COURSE PLAN :

Week 01 : Power Electronics – Introduction : Definitions and applications, Basic building blocks | Power Converters - Introduction & Classification: Switching Matrix | PE Converter : Passive components (R, L, C), Active components (introduction to switches).

Week 02 : Review of basic concepts-Engineering Math, Elec. | Power Diodes | Thyristors (SCR) | Thyristors (GTO).

Week 03 : Power BJT : Introduction, Structure, Operation, Characteristics, Equations., Losses, Drawbacks | Power MOSFET : Introduction, Structure, Operation. Characteristic, Losses, Merits, Demerits, Applications | Power IGBT : Introduction, Structure, Operation. Characteristics. Losses, Applications, Merits, Demerits, SiC, GaN devices.

Week 04 : AC-DC Conv. 1-φ half-wave Uncontrolled. & Controlled Rectifiers (R, R-L, R-L-E, R-E and pure L loads) | AC-DC Conv. Commutation: Effect Of source Inductance (R-L and RLE loads only) | AC-DC Conv. 1-φ Full-wave Uncontrolled. & Controlled Rectifiers (R, R-L, R-L-E, R-E and pure L loads) | AC-DC Conv. 1-φ Full-wave Effect Of source Inductance (R-L and RLE loads only) | AC-DC Conv. 3-φ rectifiers Uncontrolled. & Controlled Rectifiers (R and R-L loads only) | AC-DC Conv. 3-φ rectifiers Effect Of source Inductance (R-L load only).

Week 05 : AC-DC Conv. 3-φ rectifiers 12-Pulse rectifier DC-Transmission | AC-AC Conv. 1-φ AC voltage controllers | AC-AC Conv. 1-φ AC voltage controllers | AC-AC Conv. 3-φ AC voltage controllers | AC-AC Conv. 3-φ AC voltage controllers | Cyclo-converters- 1- φ operation with R & R-L load.

Week 06 : Cyclo-converters- Circulation mode operation Waveforms and Equations | Matrix converters | Introduction and basic operation | DC-DC Conv.- Introduction, Types of DC/DC | DC-DC Conv.- Drawbacks of Linear Power Supplies Basic Switching Converter | DC-DC Conv.- Introduction and Buck conv.

Week 07 : DC-DC Conv.- Boost Conv. | DC-DC Conv.- Buck-Boost Conv. | Synchronous Buck Converter | DC-DC Conv.- Cuk Conv. | DC-DC Conv.- SEPIC Conv. | 1st, 2nd and 4th quadrant operation of DC-DC converters.

Week 08 : DC-DC Isolated Conv. : Forward and flyback Conv., Push-Pull Conv. | Resonant DC-DC converters. Intro & Basic Operation | Resonant DC-DC converters. ZVS & ZCS | DC-AC Conv Intro: Types and Working principles | 1- φ half bridge inverter: Topology & working.

Week 09 : 1- φ full bridge inverter: Topology & Working, Square wave & quasi wave operation | 1- φ half bridge inverter: Square wave & quasi wave operation | PWM operation: SPWM-Bipolar, Unipolar, Merits & demerits, Applications | 3- φ VSI Topology & working.

Week 10 : 3- φ VSI : Square wave operation, PWM operation (SPWM), Space vector modulation (SVPWM), etc. | Resonant Inverters : Basic Operation, Inverters Applications | CSI-Topology and Basic Operations | MLI – Topology: Operation and basic topologies.

Week 11 : MLI – Topology(NPC) Basic Operations | Gate Drive: Need for drives, examples | Gate Drive Circuits: SCR drive | Gate drive: MOSFET & IGBT drive | Snubbers: Need for Snubbers, Types and examples | Snubber: Design Equations.

Week 12 : Intro of basics of magnetic Concepts | Inductor Design: Area Product approach, Examples and Applications | Transformer Design: Area Product approach, Examples and Applications |Application of PE in Solar PV: Introduction, V-I Char.,Types and MPPT.

ELECTRICAL ENGINEERING

FUNDAMENTALS OF SEMICONDUCTOR DEVICES

PROF. DIGBIJOY N. NATH
Centre for Nano Science and Engineering
IISc Bangalore

TYPE OF COURSE	: New | Core | UG/PG
INTENDED AUDIENCE	: B.E./B.Tech in ECE/EE, or M. Sc Physics
PRE-REQUISITES	: High school physics & math, 10+2 physics
COURSE DURATION	: 12 weeks (28 Jan'19-19 Apr'19)
EXAM DATE	: 28 April 2019

COURSE OUTLINE :

This course seeks to cover the basics of semiconductor devices including the physics of energy bands, doping and carrier statistics and transport leading up to the understanding of common semiconductor devices including p-n junctions and their applications, BJTs and MOSFETs. The course will also give a flavour of the basics of compound semiconductors and their devices, and also touch base with opto-electronic devices such as solar cells, photodetectors and LEDs. The course will ensure that undergraduates, college teachers and other interested audience with no background in semiconductors are able to grasp the content.

ABOUT INSTRUCTOR :

Digbijoy N. Nath completed his B.E. (Hons) in Electrical and Electronics Engineering from BITS, Pilani (Rajasthan) and PhD in Electrical Engineering from Ohio State University, Columbus specializing in gallium nitride based semiconductor devices. He has been as Assistant Professor at Centre for Nano Science and Engineering (CeNSE) at Indian Institute of Science (IISc), Bangalore since Aug 2014.

COURSE PLAN :

Week 01 : Importance of semiconductor devices and their diverse applications. Introduction to semiconductors, concept of energy bands and how bands form. Effective mass of electrons, E-k diagram. Concept of holes. Concept of Fermi level, Fermi-Dirac distribution. Doping (extrinsic & intrinsic semiconductor), density of states.

Week 02 : Equilibrium electron-hole concentration, temperature-dependence. Carrier scattering and mobility, velocity saturation, Drift-diffusion transport

Week 03 : Excess carrier decay & recombination, charge injection, continuity equation, quasi-Fermi level

Week 04 : p-n junction: static behaviour (depletion width, field profile), p-n junction under forward & reverse bias, current equations, generation-recombination current and reference to typical devices.

Week 05 : Zener and avalanche breakdown, Capacitance-voltage profiling, metal/semiconductor junction – Ohmic and Schottky contacts, reference to device applications.

Week 06 : MOS capacitor, charge/field/energy bands, accumulation, inversion, C-V (high and low frequencies), deep depletion, Real MOS cap: Flat-band & threshold voltage, Si/SiO2 system.

Week 07 : MOSFET: structure and operating principle, derivation of I-V, gradual channel approximation, substrate bias effects, sub-threshold current and gate oxide breakdown. Control of threshold voltage, short channel effects. Moore's Law and CMOS scaling

Week 08 : Introduction to compound semiconductors & alloys, commonly used compound semiconductors, heterostructure band diagrams and basics of MODFET & HEMT, introduction to quantum well, applications of heterostructure device technologies

Week 09 : BJT: working principle, DC parameters and current components, base transport factor, Early Effect, charge control equation & current gain, need for HBT. Applications of BJTs/HBTs in real-life.

Week 10 : (Basics of) - transistors for high-speed logic, transistors for high frequency (RF), transistors for high power switching, transistors for memories, transistors for low noise, transistors for the future.

Week 11 : Solar cells: principle, efficiency, Fill factor, Shockley-Quiesser limit, silicon solar cells, multi-junction solar cell, Photodetectors: operation, figures of merit (responsivity, QE, bandwidth, noise, Detectivity), examples from IR to UV detectors.

Week 12 : LEDs: working principle, radiative/non-radiative recombination, various types of efficiencies (EQE, WPE, IQE), light extraction and escape cone. Blue LED and the Nobel Prize, visible LEDs and chromaticity.

ELECTRICAL ENGINEERING

PRINCIPLES OF DIGITAL COMMUNICATIONS

PROF. ABHISHEK DIXIT
Department of Electrical Engineering
IIT Delhi

TYPE OF COURSE : New | Core | UG/PG
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
INTENDED AUDIENCE : BE/EE, EC, EI
EXAM DATE : 27 April 2019
PRE-REQUISITES : Basic idea of Signals and Systems, and probability theory
INDUSTRIES APPLICABLE TO : Telecommunication Industry, e.g., Qualcomm,Ericson, Huawei

COURSE OUTLINE :

Digital communication is a fundamental course in the electronics and communication stream.The objectives of this course is to introduce the basic principles that underlie the analysis andsuccessful design of a digital communication system. Digital communication systems havebeen used in all modern communication systems. Emphasis is placed on understanding system design goals and to optimize the tradeoff among basic system parameters such as signal-to-noise ratio, bandwidth, etc.

ABOUT INSTRUCTOR :

Abhishek Dixit, did his M.Tech. from (IITD: 2010) and Ph.D. from(Ghent University, Belgium: in 2014). He is working with the Department of Electrical Engineering, Indian Institute of Technology Delhi, since December 2015. His research interests pertain to the domains of optical communications, optical networks, and fiber-wireless converged networks.

COURSE PLAN :

Week 01 : Introduction to digital communications: Interfaces and channels fordigital communications
Week 02 : Coding for discrete sources: Uncertainty, Information and Entropy,Source Coding theorem, Asymptotic Equipartition Property, Huffman and Lempel-Ziv algorithm
Week 03 : Quantization: Scalar and vector quantization, The Lloyd-Max algorithm
Week 04 : Sampling process: Sampling theorem, Quadrature sampling of band-pass signals, Pulse-amplitude modulation
Week 05 : Geometric representation of signals: Geometric representation ofsignals, Gram-Schmidt orthogonalization, Geometric interpretation of signals
Week 06 : Waveform coding: Pulse code modulation, Differential pulse code modulation, and delta modulation
Week 07 : Baseband shaping for data transmission: Nyquist criterion, raised cosine family of pulses, Intersymbol interference
Week 08 : Digital modulation techniques-I: Coherent binary modulation formats,Coherent QAM, M-ary modulation techniques
Week 09 : Digital modulation techniques-II: Non-coherent binary modulation formats, M-ary modulation techniques
Week 10 : Review of random process and noise
Week 11 : Detection: Matched filter and correlation
Week 12 : Estimation: Maximum likelihood estimation and Wiener filter

MODERN DIGITAL COMMUNICATION TECHNIQUES

ELECTRICAL ENGINEERING

PROF. SUVRA SEKHAR DAS
Department of Electrical Engineering
IIT Kharagpur

TYPE OF COURSE : Rerun | Elective | UG
PRE-REQUISITES : Analog/Digital communications Signals and systems
INTENDED AUDIENCE : BE (EE / EC / IT)
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 27 Apr 2019

INDUSTRIES APPLICABLE TO : All telecommunication equipment manufacturers and service providers. Defense officials, Research laboratories, ISRO, BEL etc.

COURSE OUTLINE :

Digital communications has had one of the most profound influences in the development of the mankind. It is behind the success of today's networked society. The objective of this course is to present the engineering principles, theories and practices, which are fundamental to the successful design of a digital communication system. The course will delve into the design principles of transmitter and receiver so as to establish a reliable communication link.

ABOUT INSTRUCTOR :

Dr. Suvra Sekhar Das is currently serving as Associate Professor at the G. S. Sanyal School of Telecommunictions in Indian Institute of Technology Kharagpur. He has completed Ph.D. from Aalborg University, Aalborg, Denmark. He has worked as Senior Scientist with the Innovation Laboratory of Tata Consultancy Services. His research interests include cross-layer optimization of mobile broadband cellular networks, 5G, Broadband Mobile Communications, 5G Waveform design GFDM FBMC UFMC, heteogeneous networks Femto Cells Device to Device communication, Multi objective optimization for radio access networks, Green radio network design Packet Scheduling and radio resource allocation with link adaptation, MIMO communications, base-band transceiver design for broadband wireless communication systems.

COURSE PLAN :

Week 01 : Introduction to digital communication systems
Week 02 : Source Coding
Week 03 : Characterization of Communication Signals & Systems
Week 04 : Signal space Representation
Week 05 : Representation of Memory less Modulation Methods
Week 06 : Nonlinear modulation methods
Week 07 : Optimal receivers of AWGN
Week 08 : Receiver for non-ideal channel
Week 09 : Probability of error of different modulation schemes
Week 10 : Fundamentals of estimation and detection theory used in digital communication
Week 11 : Carrier phase and symbol timing synchronization techniques
Week 12 : Channel estimation and equalization techniques, Power Adaptation methods for colored noise channel

PRINCIPLES OF SIGNALS AND SYSTEMS

ELECTRICAL ENGINEERING

PROF. ADITYA K. JAGANNATHAM
Department of Electrical Engineering
IIT Kanpur

TYPE OF COURSE : Rerun | Core | UG

COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)

PREREQUISITES : Basic knowledge of Integration, Differentiation Complex Numbers

EXAM DATE : 28 Apr 2019

INDUSTRY SUPPORT : Most companies in wireless communications area should find this useful. Qualcomm, Broadcom, Intel etc.

INTENDED AUDIENCE : Students in Electrical Engineering, Electronics and Communication Engineering Practicing engineers Technical and Non-technical managers of telecomm companies Students preparing for competitive exams with Signals and Systems subject

COURSE OUTLINE :

This course introduces the fundamental principles of signals and system analysis. These concepts form the building blocks of modern digital signal processing, communication and control systems. Hence, a sound understanding of these principles is necessary for all students of Electronics and Communication engineering (ECE), Electrical and Electronics Engineering (EEE), and Instrumentation Engineering (IE). The course will cover various basic tools of signal and system analysis such as signal classification, LTI systems, Properties of LTI Systems, Frequency Response, Laplace Transform, Z-Transform, Fourier Transform, Fourier Series, Discrete Time Fourier Transform (DTFT), Discrete Fourier Transform (DFT), Cascade/ Parallel structures and their various practical applications. Various concepts such as convolution, impulse/ frequency response, causality, stability of systems will be especially emphasized. Other additional topics such as state space techniques and solutions to state space equations will also be covered. This course is suitable for all UG/PG students and practicing engineers/ managers who are looking to build a solid grasp of the fundamental concepts of signals and systems as well as students/ professionals preparing for their college/ university/ competitive exams.

ABOUT INSTRUCTOR :

Prof. Aditya K. Jagannatham Department of Electrical Engineering Indian Institute of Technology,Kanpur, received his Bachelors degree from the Indian Institute of Technology, Bombay and M.S. and Ph.D. degrees from the University of California, San Diego, U.S.A.. From April '07 to May '09 he was employed as a senior wireless systems engineer at Qualcomm Inc., San Diego, California, where he worked on developing 3G UMTS/WCDMA/HSDPA mobile chipsets as part of the Qualcomm CDMA technologies division. His research interests are in the area of next-generation wireless communications and networking, sensor and ad-hoc networks, digital video processing for wireless systems, wireless 3G/4G cellular standards and CDMA/OFDM/MIMO wireless technologies.

COURSE PLAN

Week 1 : Introduction to Signals, Signal Classification, Continuous/ Discrete Time Signals
Week 2 : Definition and Classification of Systems, Linear Time Invariant (LTI) Systems
Week 3 : Properties of LTI Systems, Impulse Response, Convolution, Causality, Stability
Week 4 : Impulse Response of Discrete Time Systems, Discrete Time Convolution, Difference Equations and Analysis
Week 5 : Laplace Transform, Properties of Laplace Transform, Inverse Laplace Transform
Week 6 : Introduction to z-Transform, Properties of z-Transform, Region of Convergence, Inverse z-Transform
Week 7 : Introduction to Fourier Analysis, Fourier Series for Periodic Signals, Properties of Fourier Series
Week 8 : Introduction to Fourier Transform, Properties of Fourier Transform, Frequency Response of Continuous Time Systems, Examples of Frequency Response
Week 9 : Fourier Analysis of Discrete Signals, Discrete Time Fourier Transform (DTFT), Properties and examples of DFT
Week 10 : Frequency Response of Discrete Time Systems, Discrete Fourier Transform (DFT), Properties and examples of DFT
Week 11 : IIR/ FIR Filters, Direct Form Realization, Cascade and Parallel Form Realization, Problem Solving
Week 12 : Concept of State, State Space Analysis, State Space Representation of Continuous Time Systems, Solution of State Equations for Continuous Systems

PRINCIPLES OF COMMUNICATION SYSTEMS - I

ELECTRICAL ENGINEERING

PROF. ADITYA K. JAGANNATHAM
Department of Electrical Engineering
IIT Kanpur

TYPE OF COURSE : Rerun | Core | UG

COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)

PRE-REQUISITES : Basic knowledge of Probability, Calculus

EXAM DATE : 28 Apr 2019

INDUSTRY SUPPORT : Most companies in wireless communications area should find this useful. Qualcomm, Broadcom, Intel etc.

INTENDED AUDIENCE : Intended audience is students, practicing engineers, technical and non-technical managers of telecom companies, students preparing for competitive exams with communication engineering subject

COURSE OUTLINE :

This course covers fundamental concepts of communication systems, which are essential for the understanding of advanced courses in digital/ wireless communication systems. Beginning with various basic tools such as Fourier Series/ Transform, the course will also cover several important modulation techniques such as Amplitude Modulation, Frequency Modulation, Phase Modulation etc.

ABOUT INSTRUCTOR :

Prof. Aditya K. Jagannatham, Department of Electrical Engineering Indian Institute of Technology, Kanpur, received his Bachelors degree from the Indian Institute of Technology, Bombay and M.S. and Ph.D. degrees from the University of California, San Diego, U.S.A. from April '07 to May '09 he was employed as a senior wireless systems engineer at Qualcomm Inc., San Diego, California, where he worked on developing 3G UMTS/WCDMA/HSDPA mobile chipsets as part of the Qualcomm CDMA technologies division. His research interests are in the area of next-generation wireless communications and networking, sensor and ad-hoc networks, digital video processing for wireless systems, wireless 3G/4G cellular standards and CDMA/OFDM/MIMO wireless technologies.

COURSE PLAN

Week 1 : Basic tools for communication, Fourier Series/Transform, Properties, Autocorrelation, Energy Spectral Density, Parsevals Relation
Week 2 : Amplitude Modulation (AM), Spectrum of AM, Envelope Detection, Power Efficiency, Modulation Index
Week 3 : Double Sideband Suppressed Carrier (DSB-SC) Modulation, Quadrature Carrier Multiplexing (QCM), Demodulation, Costas Receiver
Week 4 : Single Sideband Modulation (SSB), Hilbert Transform, Complex Pre-envelope/ Envelope, Demodulation of SSB, Vestigial Sideband Modulation (VSB)
Week 5 : Angle Modulation, Frequency Modulation (FM), Phase Modulation (PM), Modulation Index, Instantaneous Frequency
Week 6 : Spectrum of FM Signals, Carsons Rule for FM Bandwidth, Narrowband FM Generation, Wideband FM Generation via Indirect Method, FM Demodulation
Week 7 : Introduction to Sampling, Spectrum of Sampled Signal, Aliasing, Nyquist Criterion, Signal Reconstruction from Sampled Signal, Pulse Amplitude Modulation
Week 8 : Quantization, Uniform Quantizers – Midrise and Midtread, Quantization noise, Lloyd Max Quantization Algorithm, Non uniform Quantizers, Delta Modulation, Differential Pulse Code Modulation (DPCM)
Week 9 : Basics of Probability, Conditional Probability, MAP Principle
Week 10 : Random Variables, Probability Density Functions, Applications in Wireless Channels
Week 11 : Basics of Random Processes, Wireless Fading Channel Modeling
Week 12 : Gaussian Random Process, Noise, Bit-Error and Impact on Wireless Systems

ELECTRICAL ENGINEERING

DIGITAL ELECTRONIC CIRCUITS

PROF. GOUTAM SAHA
Department of Electrical Engineering
IIT Kharagpur

TYPE OF COURSE : New | Core | UG
COURSE DURATION : 12 weeks (28 Jan'19-19 Apr'19)
INTENDED AUDIENCE : BE/ME(EE/CS/EC)
EXAM DATE : 27 April 2019

PRE-REQUISITES : Basic understanding of diode, transistor operation. If this is not covered in 10+2 Board of the students then the same may be studied from Basic Electronics or Analog Electronic Circuits course.

COURSE OUTLINE :

There is a flux of terms in recent times that starts with the word 'digital'. Examples are digital camera, digital watch, digital weighing machine, digital signature, digital payment, digital art and so on. The digital prefix associates a term with digital technology and is considered a step up in the delivered performance at a given cost. The world of digital provides easy storage and reproduction, immunity to noise and interference, flexibility in processing, different transmission options, and very importantly, inexpensive building blocks in the form of integrated circuits. Digital systems represent and manipulate digital signals. Such signals represent only finite number of discreet values. A signal can be discreet by nature whereas, a continuous signal can be discretized for digital processing and then converted back. Manipulation and storage of digital signal involves switching. This switching is done through electronic circuits. Basic gates made from electronic circuits are primary building blocks of digital systems. These gates combine in different ways to develop digital circuits that are associated with different functionalities.

ABOUT INSTRUCTOR :

Goutam Saha, BTech, PhD from IIT Kharagpur had a short Management Training at XLRI, Jamshedpur. During 1990-1994, he worked with Tata Steel. He joined as faculty member in the Dept. of Electronics and Electrical Communication Engineering at IIT Kharagpur in 2002. In 2006 fall semester, he served University of Southern California, USA. His research interest includes biomedical and speech signal processing with collaborations from India and abroad.

COURSE PLAN :

Week 01 : Introduction; Relation between switching and logic operation; Use of Diode and Transistor as switch; Concept of noise margin, fanout, propagation delay; TTL, Schottky TTL, Tristate; CMOS Logic,Interfacing TTL with CMOS

Week 02 : Basic logic gates, Universality of NAND, NOR gates, AND-OR-Invert gates, Positive and Negative Logic; Boolean Algebra axioms and basic theorems; Standard and canonical representations of logic

Week 03 : Minimization using Entered Variable Map, Minimization of multiple output functions, Minimization using QM algorithm

Week 04 : Multiplexer; Demultiplexer / Decoder, BCD to 7-segment decoder driver; Encoder, Priority encoder; Parity generator and checker

Week 05 : Number systems-binary, Signed binary, Octal, hexadecimal number; Binary arithmetic, One's and two's complements arithmetic

Week 06 : Carry look ahead adder; Magnitude comparator; ALU; Error detecting and correcting codes

Week 07 : Bistable latch, SR, D, JK, T Flip-Flop: level triggered, edge triggered, master – slave, Various representations of flip-flops

Week 08 : Register, Shift register, Universal shift register; Application of shift register: ring counter,

Week 09 : Up and down counter, Ripple (asynchronous) counters, Synchronous counters; Counter design using flip flops,

Week 10 : Design of synchronous sequential circuit using Mealy model and Moore model

Week 11 : Digital to analog converters: weighted resistor/converter, binary ladder, converter, accuracy and resolution; Analog to digital converter

Week 12 : Memory organization and operation, Memory expansion; Memory cell; Different types of memory

ELECTRICAL ENGINEERING

MICROPROCESSORS AND MICROCONTROLLERS

PROF. SANTANU CHATTOPADHYAY
Department of Electrical Engineering
IIT Kharagpur

TYPE OF COURSE : Rerun | Core | UG
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
PRE-REQUISITES : Digital Design, Digital Logic
EXAM DATE : 27 Apr 2019
INDUSTRY SUPPORT : Companies involved in development of microprocessor and microcontroller based products
INTENDED AUDIENCE : CSE, ECE, EE

COURSE OUTLINE :

Microprocessors are used extensively in the design of any computing facility. It contains units to carry out arithmetic and logic calculations, fast storage in terms of registers and associated control logic to get instructions from memory and execute them. A number of devices can be interfaced with them to develop a complete system application.

ABOUT INSTRUCTOR :

Prof. Santanu Chattopadhyay, currently a Professor in the Department of Electronics and Electrical Communication Engineering, Indian Institute of Technology, Kharagpur, received his PhD from Indian Institute of Technology (IIT) Kharagpur in 1996. His research interests include Embedded Systems, System-on-Chip (SoC) and Network-on-Chip (NoC) Design and Test, Power- and Thermal-aware Testing of VLSI Circuits and Systems. He has published more than 150 papers in reputed international journals and conferences. He has published several text and reference books in the related areas. He is a senior member of IEEE and an editorial board member of IET Circuits Devices and Systems.

COURSE PLAN

Week 1 : Introduction: General processor architecture, Microprocessors, Microcontrollers

Week 2 : 8085 – Part I

Week 3 : 8085 – Part II

Week 4 : 8085 – Part III

Week 5 : 8085 – Part IV

Week 6 : 8051 – Part I

Week 7 : 8051 – Part II

Week 8 : PIC, AVR

Week 9 : ARM – Part I

Week 10 : ARM – Part II

Week 11 : Interfacing examples – Part I

Week 12 : Interfacing examples – Part II

ELECTRICAL ENGINEERING

COMPUTER AIDED POWER SYSTEM ANALYSIS

PROF. BISWARUP DAS
Department of Electrical Engineering
IIT Roorkee

TYPE OF COURSE : New | Elective | UG/PG
INTENDED AUDIENCE : BE/ME(EE/EC/EI)
PRE-REQUISITES : 2nd year/third year of B.Tech EE
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 28 April 2019

INDUSTRIES APPLICABLE TO : PGCIL, NHPC, all state power transmission companies

COURSE OUTLINE :

This course introduces the computational aspects of the power system analysis. The thrust of this course is description of the computer algorithms for analysis of any general power transmission system. Starting with load flow analysis, which is essentially the backbone of any power system analysis tool, this course further deals with computer algorithms for contingence analysis, state estimation and phase domain fault analysis method of any general power transmission system.

ABOUT INSTRUCTOR :

Dr. Biswarup Das has obtained his Ph.D from IIT Kanpur. He is presently a Professor with the Electrical Engineering Department, Indian Institute of Technology, Roorkee, India. His general area of teaching and research is Electrical power system.

COURSE PLAN :

Week 01 : Review of modeling of power system components and formulation of YBUS matrix
Week 02 : Basic power flow equations and Gauss-Seidel load flow method
Week 03 : Newton-Raphson load flow in polar co-ordinate
Week 04 : Newton-Raphson load flow in rectangular co-ordinate and introduction to Fast Decoupled load flow method
Week 05 : Fast Decoupled load flow method and AC-DC load flow method
Week 06 : Sparsity and optimal ordering methods
Week 07 : LU decomposition and contingence analysis
Week 08 : Line outage sensitivity factor and method of least square
Week 09 : Method of least square (contd..) and Introduction to AC state estimation
Week 10 : AC state estimation (contd..) and test for bad data detection
Week 11 : Formulation of YBUS matrix of three phase unbalanced system
Week 12 : Fault analysis in phase domain

ELECTRICAL ENGINEERING

POWER SYSTEM DYNAMICS, CONTROL AND MONITORING

PROF. DEBAPRIYA DAS
Department of Electrical Engineering
IIT Kharagpur

TYPE OF COURSE : New| Core | UG/PG
INTENDED AUDIENCE : Electrical Engineering
PRE-REQUISITES : Power System Analysis (UG)
COURSE DURATION : 12 weeks (28 Jan'19-19 Apr'19)
EXAM DATE : 28 April 2019

INDUSTRIES APPLICABLE TO : NTPC, DVC, BHEL, Powergrid, NHPC

COURSE OUTLINE :

This course is both for undergraduate and postgraduate Electrical Engineering students. This course will introduce and explain the concepts of synchronous machine modeling, reference frame transformation, automatic voltage regulation, power system stabilizer, transient stability for multimachine system, automatic generation control under deregulated environment, state estimation, eigenvalue and participation factor analysis. By the end of the course, the students should be able to gather high-quality knowledge on stability, operation and control of power systems.

ABOUT INSTRUCTOR :

Debapriya Das obtained his B.E. degree from Calcutta University (B.E. College (Presently known as IIEST), Shibpur, Howrah, WB), M.Tech. from I.I.T. Kharagpur and Ph.D. from I.I.T., Delhi. He has nearly thirty years of experience in teaching and research. For more information, one can visit his I.I.T KGP website. or https://scholar.google.co.in/citations?user=yZj2uFYAAAAJ.

COURSE PLAN :

Week 01 : Basic concepts of power system stability and synchronous machine
Week 02 : Synchronous machine modeling
Week 03 : Synchronous machine modeling in d-q reference frame
Week 04 : Per unit system for Synchronous machine
Week 05 : Steady state analysis : Voltage, current and flux linkage relationships
Week 06 : Generator representation by classical model, swing equation and block diagram development
Week 07 : Automatic voltage regulator (AVR) and Power system stabilizer (PSS)
Week 08 : Eigenvalue and participation factor analysis
Week 09 : Transient stability analysis
Week 10 : AGC under deregulated environment
Week 11 : AGC under deregulated environment
Week 12 : State Estimation

ANTENNAS

ELECTRICAL ENGINEERING

PROF. GIRISH KUMAR
Department of Electrical Engineering
IIT Bombay

TYPE OF COURSE : Rerun | Elective | UG/PG

PRE-REQUISITES : Basic knowledge of Electromagnetic Waves.

COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)

EXAM DATE : 28 Apr 2019

INDUSTRY SUPPORT : BE(EE/EC/EI)

INTENDED AUDIENCE : Telecom industry, defense industry and space organization.

COURSE OUTLINE :

This course will cover the fundamentals of Antennas, Dipole Antennas, Monopole Antennas, Loop Antennas, Slot Antennas, Linear and Planar Arrays, Microstrip Antennas (MSA), MSA Arrays, Helical Antennas, Horn Antennas, Yagi-Uda & Log-Periodic Antennas, Reflector Antennas.

ABOUT INSTRUCTOR :

Prof. Girish Kumar, Department of Electrical Engineering, Indian Institute of Technology, Bombay received the Ph.D. degree in Electrical Engineering from Indian Institute of Technology Kanpur, India, in 1983. From 1983 to 1985, he was a Research Associate with the Electrical Engineering Department, University of Manitoba, Winnipeg, Canada. From 1985 to 1991, he was an Assistant Professor with the Electrical Engineering Department, University of North Dakota, Grand Forks, ND, USA.

COURSE PLAN

Week 1 : Antenna Introduction-I, II, III; Antenna Fundamentals-I, II

Week 2 : Antenna Radiation Hazards-I, II; Dipole Antennas-I, II, III

Week 3 : Monopole Antennas-I, II; Loop Antennas; Slot Antennas

Week 4 : Linear Arrays-I, II, III; Planar Arrays

Week 5 : Microstrip Antennas(MSA); Rectangular MSA; MSA Parametric Analysis-I, II; Circular MSA

Week 6 : Broadband MSA-I, II, III, IV, V

Week 7 : Compact MSA-I, II, III; Tunable MSA-I, II

Week 8 : Circularly Polarized MSA-I, II, III; MSA Arrays-I, II,III

Week 9 : Helical Antennas-I, II, III, IV, V

Week 10 : Horn Antennas-I, II, III, IV, V

Week 11 : Yagi-Uda and Log-Periodic Antennas-I, II, III; IE3D Session TA-I, II, III

Week 12 : Reflector Antennas-I, II, III, IV; Lab Session

ELECTRICAL ENGINEERING

INTRODUCTION TO PHOTONICS

BALAJI SRINIVASAN
Department of Electrical Engineering
IIT Madras

TYPE OF COURSE : New | Elective | UG/PG
INTENDED AUDIENCE : Third or Final year BE/BTech, First year ME/MTech/MS/PhD
COURSE DURATION : 12 weeks (28 Jan'19-19 Apr'19)
EXAM DATE : 27 April 2019
PRE-REQUISITES : Basic knowledge in Electromagnetics is preferred

INDUSTRIES APPLICABLE TO : Sterlite Technologies, NeST Photonics, Tejas Networks, Vinvish Technologies, BEL, CGCRI, RRCAT, DRDO – LASTEC/IRDE/CHESS

COURSE OUTLINE :

Introductory course in photonics leading to more advanced courses such as Lasers, Optical Communications, Optical Sensors and Photonics Integrated Circuits. The learning objectives are: (1) Learn the fundamental principles of photonics and light-matter interactions, (2) Develop the ability to formulate problems related to photonic structures/processes and analyze them, and (3) Understand processes that help to manipulate the fundamental properties of light.

ABOUT INSTRUCTOR :

Dr. Balaji Srinivasan obtained his Ph.D. in 2000 from the University of New Mexico, USA. He subsequently worked as a Senior Development Scientist at Corning Incorporated, USA, where he led technology development efforts related to 3D Optical Cross-connects and Channel Selectable Tunable Filters. Since 2004 he has been with the Indian Institute of Technology Madras as a faculty in the Department of Electrical Engineering, presently as Professor. Prof. Balaji's research interests span the development of active and passive optical components / subsystems for fiber lasers and distributed fiber optic sensors. He has co-authored more than 130 journal and international conference publications. He also has seven patents to his credit.

COURSE PLAN :

Week 01 : Wave/particle duality; What are photons?
Week 02 : Statistical properties of light, Coherence
Week 03 : Photon properties - energy, flux, statistics
Week 04 : Interaction of photons with atoms
Week 05 : Light amplification
Week 06 : Laser Fundamentals
Week 07 : Semiconductor Junction devices
Week 08 : Semiconductor light sources
Week 09 : Semiconductor light detectors
Week 10 : Interaction of light with RF and acoustic waves
Week 11 : Nonlinear behavior of materials
Week 12 : Photonic systems - Examples

ELECTRICAL ENGINEERING

BIOMEDICAL SIGNAL PROCESSING

PROF. SUDIPTA MUKHOPADHYAY
Department of Electrical Engineering
IIT Kharagpur

TYPE OF COURSE : Rerun | Elective | PG
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
PRE-REQUISITES : Signals and Systems
EXAM DATE : 27 Apr 2019
INDUSTRY SUPPORT : Philips Research, GE Global Research, Siemens Research, TCS, Wipro, Xerox Research Centre
INTENDED AUIDENCE : BE/ME - EE, EC, EI

COURSE OUTLINE :

This course is prepared for the engineering students in their final year of undergraduate studies or in their graduate studies. Electrical Engineering students with a good background in Signals and Systems are prepared to take this course. Students in other engineering disciplines, or in computer science, mathematics, geo physics or physics should also be able to follow this course. While a course in Digital Signal Processing would be useful, it is not necessary for a capable student. The course has followed problem solving approach as engineers are known as problem solvers. The entire course is presented in the form of series of problems and solutions.

ABOUT INSTRUCTOR :

Prof. Sudipta Mukhopadhyay, Department of Electronics and Electrical Communication Engineering, Indian Institute of Technology, Kharagpur is a graduate from JU (1988), MTech (1991) and PhD (1996) from IIT Kanpur. He worked in Philips Medical Systems & Ge Global Research for more than a decade before joining IIT Kharagpur about a decade back. He has written more than 100 articles in refereed journals and international conferences. Guided more than 60 MTech and 7 PhD scholars.

COURSE PLAN

Week 01 : Preliminaries; Biomedical signal origin & dynamics (ECG)

Week 02 : Biomedical signal origin & dynamics (EEG, EMG etc.)

Week 03 - 06 : Filtering for Removal of artifacts

Week 07 - 08 : Event Detection

Week 09 - 10 : Waveform Analysis

Week 11 - 12 : Frequency-domain Analysis

ELECTRICAL ENGINEERING

CONTROL ENGINEERING

PROF. RAMKRISHNA PASUMARTHY
Department of Electrical Engineering
IIT Madras

PROF. VISWANATH TALASILA
Dept. of Telecommunication Engineering
MSRIT Bangalore

TYPE OF COURSE : Rerun | Core | UG
INTENDED AUDIENCE : BE/EE/EC
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 27 Apr 2019
PRE-REQUISITES : Network and Circuits, Basic Engineering Mathematics. For those who would like to refer to some material prior to this course, we suggest the NPTEL course on Networks and Systems by Dr. V.G.K. Murti. Content in Lectures 1-6 and 20-29 will be most relevant for this course.
INDUSTRY SUPPORT : Any industry into Industrial Automation

COURSE OUTLINE :

This course shall introduce the fundamentals of modeling and control of linear time invariant systems; primarily from the classical viewpoint of Laplace transforms and a brief emphasis on the state space formulation as well. The course will be useful for students from major streams of engineering to build foundations of time/frequency analysis of systems as well as the feedback control of such systems. The 11th module of the course will cover a detailed application of filter design in the field of navigation and human movement (gait). Students will be able to design their very own basic navigational system using inertial sensors and microcontrollers.

ABOUT INSTRUCTOR :

Ramkrishna Pasumarthy is currently an Associate Professor at Department of Electrical Engineering, IIT Madras. He obtained PhD in systems and control from University of Twente, The Netherlands and held post doc positions at University of Melbourne and UCLA. His interests lie in the area of modeling and control of complex physical systems.

Viswanath Talasila currently an Associate Professor at the Telecommunication Engineering Department at Ramaiah Institute of Technology (Bengaluru). He has an engineering degree from Bangalore University in 1997. He worked at the Institute of Robotics and Intelligent Systems (DRDO lab, CAIR) from 1997 – 2000 in flight control.

COURSE PLAN :

Week 01 : Mathematical Modelling of Systems.
Week 02 : Laplace Transforms, transfer functions, block diagram representation.
Week 03 : Block diagram reduction, Time response characteristics.
Week 04 : Introduction to stability, Routh Hurwitz stability criterion.
Week 05 : Root locus plots, stability margins.
Week 06 : Frequency response analysis: Nyquist stability criterion, Bode plots and stability margins in frequency domain.
Week 07 : Basics of control design, the proportional, derivative and integral actions.
Week 08 : Design using Root Locus.
Week 09 : Design using Bode plots.
Week 10 : Effects of zeros, minimum and non-minimum phase systems.
Week 11 : Application of basic filter design to Navigation and Movement.
Week 12 : Introduction to state space methods, Linearization of nonlinear systems.

MULTIRATE DSP

PROF. R. DAVID KOILPILLAI
Department of Electrical Engineering
IIT Madras

TYPE OF COURSE : New | Elective | UG/PG
INTENDED AUDIENCE : B.E. / B.Tech/ M.E./ M.Tech/ Ph.D
PRE-REQUISITES : Basic course in Digital Signal Processing
COURSE DURATION : 12 weeks (28 Jan'19 -19 Apr'19)
EXAM DATE : 27 Apr 2019

COURSE OUTLINE :

The key features of this course include the following topics:
An in-depth understanding of sampling, reconstruction, sampling rate conversion using multirate building blocks , Applications of multirate DSP – Filter design, Filterbanks, Transmultiplexer, Delta-Sigma A/D , Mathematical framework for Perfect Reconstruction Filter banks, Achieving capacity in wireless channels, motivation for Multicarrier modulation, Redundancy via zero padding and cyclic prefix, Mathematical framework for OFDM and its extensions, Introduction to Wavelets and Multichannel filter banks, Matlab-based computer exercises to gain understanding of multirate DSP concepts and applications.

ABOUT INSTRUCTOR :

R. David Koilpillai received the B.Tech degree in Electrical Engineering from the Indian Institute of Technology Madras and the M.S. and Ph.D. degrees in Electrical Engineering from the California Institute of Technology, Pasadena, CA.In June 2002, David joined the EE faculty of IIT Madras. He is currently the Qualcomm Institute Chair Professor in EE and Dean (Planning). During the period April 2008 – December 2009, he served as the Co-Chair of the IITM special Task Force for setting up the new IIT at Hyderabad.

COURSE PLAN :

Week 01 : Introduction,Overview of Sampling and Reconstruction,Review Discrete-Time Systems, digital filters

Week 02 : Oversampling techniques, DT processing of continuous time signals

Week 03 : Fundamentals of Multi-rate Systems,Basic building blocks – Up sampling, down sampling, aliasing,Mathematical framework for sampling rate change

Week 04 : Sampling rate change and filtering, fractional sampling rate change

Week 05 : Interconnection of multirate DSP blocks, Multiplexer and Demultiplexer functionality, Polyphase decomposition, Noble Identities, efficient implementation of sampling rate conversion

Week 06 : Applications of Multirate DSP - DFT-based Filterbanks, Interpolated FIR filter design, Cascaded-Integrator-Comb (CIC) filters, Transmultiplexer, Filterbank interpretation of Spectral analysis using DFT

Week 07 : Two channel maximally decimated filter bank, Signal impairments - Aliasing, Magnitude distortion, Phase distortion, Aliasing cancellation

Week 08 : Allpass filters, properties, application in two channel filterbanks, Half-band filters, Power complementary filter pairs, Mth band filters, two channel perfection reconstruction filterbanks.

Week 09 : Capacity of wireless channels, Waterfilling method, motivation for Multicarrier modulation

Week 10 : Block transceivers with redundancy, Zero-padding, cyclic prefix, OFDM, extensions of OFDM incuding Filterbank Multicarrier (FBMC)

Week 11 : Application of Multirate DSP – Delta Sigma A/D conversion

Week 12 : Introduction to wavelets and M-channel perfect reconstruction filterbanks.

ELECTRICAL ENGINEERING

MATHEMATICAL METHODS AND TECHNIQUES IN SIGNAL PROCESSING

PROF. SHAYAN SRINIVASA GARANI
Department of Electrical Engineering
IISc Bangalore

TYPE OF COURSE : Rerun | Elective | PG
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
PRE-REQUISITES : UG in Digital Signal Processing, familiarity with probability and linear algebra
EXAM DATE : 28 Apr 2019
INTENDED AUDIENCE : Post graduates and senior UGs with a strong background in basic DSP.

INDUSTRIES APPLICABLE TO : Any company using DSP techniques in their work, such as, TI, Analog Devices, Broadcom and many more.

COURSE OUTLINE :

Review of basic signals, systems and signal space: Review of 1-D signals and systems, review of random signals, multi-dimensional signals, review of vector spaces, inner product spaces, orthogonal projections and related concepts. Sampling theorems (a peek into Shannon and compressive sampling), Basics of multi-rate signal processing: sampling, decimation and interpolation, sampling rate conversion (integer and rational sampling rates), oversampled processing (A/D and D/A conversion), and introduction to filter banks. Signal representation: Transform theory and methods (FT and variations, KLT), other transform methods including convergence issues.
Wavelets: Characterization of wavelets, wavelet transform, multi-resolution analysis.

ABOUT INSTRUCTOR :

Dr. Shayan Garani Srinivasa received his Ph.D. in Electrical and Computer Engineering from Georgia Institute of Technology – Atlanta, M.S. from the University of Florida – Gainesville and B.E. from Mysore University. Dr. Srinivasa has held senior engineering positions within Broadcom Corporation, ST Microelectronics and Western Digital. Prior to joining IISc, Dr. Srinivasa was leading various research activities, managing and directing research and external university research programs within Western Digital. He was the chairman for signal processing for the IDEMA-ASTC and a co-chair for the overall technological committee. He is the author of a book, several journal and conference publications, holds U.S patents in the area of data storage. Dr. Srinivasa is a senior member of the IEEE, OSA and the chairman for the Photonic Detection group within the Optical Society of America.

COURSE PLAN :

Week 01 : Review of vector spaces, inner product spaces, orthogonal projections, state variable representation
Week 02 : Review of probability and random processes
Week 03 : Signal geometry and applications
Week 04 : Sampling theorems, multirate signal processing decimation and expansion (time and frequency domain effects)
Week 05 : Sampling rate conversion and efficient architectures, design of high decimation and interpolation filters, Multistage designs.
Week 06 : Introduction to 2 channel QMF filter bank, M-channel filter banks, overcoming aliasing, amplitude and phase distortions.
Week 07 : Subband coding and Filter Designs: Applications to Signal Compression
Week 08 : Introduction to multiresolution analysis and wavelets, wavelet properties
Week 09 : Wavelet decomposition and reconstruction, applications to denoising
Week 10 : Derivation of the KL Transform, properties and applications.
Week 11 : Topics on matrix calculus and constrained optimization relevant to KL Transform derivations.
Week 12 : Fourier expansion, properties, various notions of convergence and applications.

ELECTRICAL ENGINEERING

ELECTRONIC SYSTEMS FOR CANCER DIAGNOSIS

PROF. HARDIK J PANDYA
Department of Electronic Sysyem Engineering
IISc Bangalore

TYPE OF COURSE : New | Elective | UG/PG
COURSE DURATION : 12 weeks (28 Jan'19 -19 Apr'19)
INTENDED AUDIENCE : Engineering Students, Faculty from Engineering Colleges
EXAM DATE : 28 April 2019
PRE-REQUISITES : Basic Electronics/Microfabrication

COURSE OUTLINE :

This course is designed with an aim of educating students on the process flow for designing electronic systems for tissue-based cancer diagnosis. An exposure towards developing strategies to discriminate pathological cells from normal ones based on the electrophysiological properties of cells. Design and integrate biochip with electronic module for understanding the electro-thermo-mechanical properties of tissues. microtechnology and its use to fabricate sensors and systems. Students will have an exposure towards how to fabricate the sensors and its application in real world. Several examples of engineering devices used in clinical research will be also covered.

ABOUT INSTRUCTOR :

Dr. Hardik J. Pandya is an Asssitant Professor in the Department of Electronic Systems Engineering, Division of Electrical Sciences, IISc Bangalore where he is developing Advanced Microsystems and Biomedical Devices Facility for Clinical Research and Biomedical and Electronic (10-6-10-9) Engineering Systems Laboratory to carry out cutting-edge research on novel devices to solve unmet problems in biology and medicine. He is recipient of prestigious Early Career Research Award from Science and Engineering Research Board, Government of India as well as a start-up grant of 228 Lacs from IISc. He has taught Design for Analog Circuits, Analog Integrated Circuits, VLSI technology, and Semiconductor Devices to undergraduate and graduate students from Electronic Engineering, Instrumentation Engineering, and Applied Physics.

COURSE PLAN :

Week 01 : Introduction to tissue related cancers (Focusing on Breast Cancer and Oral Cancer) Current Gold Standards
Week 02 : Understanding the change in cells or tissue morphology.Developing strategies for diagnosis based on Morphology changes.
Week 03 : Basics of tissue culture methods: Types of cell growth, Work area and equipment (Laminar flow hoods, CO2 incubators, Microscopes, Preservation, Vessels, Storage)
Week 04 : Maintaining cells (harvesting, media and growth requirements), Safety considerations, Cell counting
Week 05 : Understanding 3D Printing and its use as packaging and press-fit contacts in electronic systems for cancer diagnosis
Week 06 : Hands-on experience in designing a 3D printed casing for electronic system packaging
Week 07 : Process for designing electronic system for early diagnosis of cancer based on tissue images
Week 08 : Process for designing electronic systems for cytology studies (cell extraction, scanning and image capturing).
Week 09 : Electronic Systems integrated with Biochip for understanding change in electro-thermo-mechanical properties of tissue
Week 10 : Working in a Clean Room (non-conventional Class 10000) and inspection of Cancer Diagnosis Tool with a basic training of operating the tools
Week 11 : Hands-on experience on lithography
Week 12 : Hands-on experience on wet-bench

HUMANITIES & SOCIAL SCIENCES

HUMANITIES & SOCIAL SCIENCES

04 weeks

01. Patent Drafting for Beginners
02. Sociology of Science
03. Psychiatry - An overview
04. Perspectives on Neurolinguistic
05. Postcolonial Literature

08 weeks

01. Language And Mind
02. Introduction to Modern Indian Drama
03. Postmodernism in Literature
04. Elements of Visual Representation
05. Emotional Intelligence
06. Introduction to Basic Cognitive Processes
07. Introduction to the Pyschology of Language
08. Human Behaviour
09. Employment Communication A Lab based course
10. Speaking Effectively
11. Enhancing Soft Skills and Personality
12. Appreciating Carnatic Music
13. English Literature of the Romantic Period, 1798-1832

12 weeks

01. Patent Law For Engineers And Scientists
02. American Literature & Culture
03. The Nineteenth-Centry English Novel
04. Literature, Culture and Media
05. Introduction to Political Theory
06. Introduction to Cognitive Psychology
07. English language for Competitive exams
08. Better Spoken English
09. Feminist Writings
10. Introduction to World Literature
11. An Introduction to Microeconomics

PATENT DRAFTING FOR BEGINNERS

HUMANITIES & SOCIAL SCIENCES

PROF. FEROZ ALI
Chair Professor on Intellectual Property Rights
IIT Madras

TYPE OF COURSE : Rerun | Elective | UG/PG
INDUSTRY SUPPORT : Law Firms, LPOs, knowledge-based industries etc
INTENDED AUDIENCE : Anyone interested in patent drafting
COURSE DURATION : 4 weeks (28 Jan'19 - 22 Feb'19)
EXAM DATE : 31 Mar 2019

COURSE OUTLINE :

Patent specifications — the documents which encompass the patent right in a technological invention - are techno-legal documents created at the interface of science and law. Unlike technical writing, patent law requires drafting patent specifications to satisfy certain requirements. This course is designed to enable beginners without any prior knowledge on patent drafting to draft patent specifications on their own. The course will cover the fundamental principles of patent drafting and discuss in detail the concepts in patent law in the context of patent drafting.

ABOUT INSTRUCTOR :

Prof. Feroz Ali, is the Chair Professor on Intellectual Property Rights (IPR) at the Indian Institute of Technology (IIT) Madras. He teaches intellectual property laws and business laws. He is the author of three books on patent law. He is a practicing advocate at the Madras High Court. He litigates and counsels in intellectual property law, corporate law and competition law but his primary focus has remained in patent law. He has appeared before the Supreme Court, the High Courts, Intellectual Property Appellate Board and the Patent Offices.

COURSE PLAN :

Week 1 : Invention as a solution to an unsolved Problem

Week 2 : Drafting a Claim

Week 3 : Types and Arrangement of Claims

Week 4 : Structure of the Patent Specification

HUMANITIES & SOCIAL SCIENCES

SOCIOLOGY OF SCIENCE

PROF. ANINDYA JAYANTA MISHRA
Department of Humanities & Social Sciences
IIT Roorkee

TYPE OF COURSE : Rerun | Core/Elective | UG/PG
COURSE DURATION : 4 weeks (28 Jan'19 - 22 Feb'19)
INTENDED AUDIENCE : UG/PG across disciplines
EXAM DATE : 31 Mar 2019

INDUSTRIES APPLICABLE TO : It will be recognized by several industries & academic institutes

COURSE OUTLINE :

This course aims to stimulate inspire and provoke awareness of science and technology impact society on and vice versa. The course will also discuss the various theoretical underpinnings of science and technology in society The course will focus also on the impact of science and technology on international relations social institutions social groups and on everyday life One of the learning outcomes upon completion of the course would be that students will have a better understanding of the complex relationship between science and technology and between science technology and society.

ABOUT INSTRUCTOR :

Prof. Anindya Jayanta Mishra, Department of Humanities and Social Sciences, Indian Institute of Technology, Roorkee is a Gold Medal awardee in MA Sociology from Hyderabad Central University. He has obtained a Ph.D. in Sociology from IIT Kanpur in 2005. His research interests include Social Gerontology, Sociology of Health, Sociology of Work, and Science, Technology and Society. He has a teaching experience of 11 years at Indian Institute of Technology Roorkee where he has been teaching the Under graduate and Post Graduate students since 2006. An Associate Professor of Sociology in the Department of Humanities & Social Sciences, Dr Mishra has to his credit about 20 papers in reputed national and international journals besides having contributed significantly to various anthologies/conferences.

COURSE PLAN :

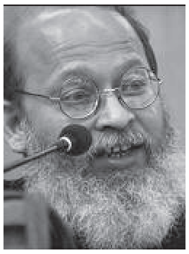
Week 1 : Introduction to Sociology, History of Science, Role of Social Sciences in Technology Institutes

Week 2 : Sociology of Science: Social Shaping of Science, Ethos of Science, Matthew Effect in Science

Week 3 : Structure & Methodology of Science: Structure of Scientific Revolution, Science as Falsification, Scientist as Indexical Reasoner

Week 4 : Science and Technology in India: Science & Technology in Colonial India, Development of Indian Science, Peer Review in Indian Science

PSYCHIATRY - AN OVERVIEW



PROF. ALOK BAJPAI
Psychiatrist
IIT Kanpur

TYPE OF COURSE : Rerun | Elective | UG/PG
COURSE DURATION : 4 weeks (28 Jan'19 - 22 Feb'19)
INTENDED AUDIENCE : MBBS doctors,undergraduate in Psychology, neurosciences and Post Graduate students in any medical discipline.
EXAM DATE : 31 Mar 2019
PRE-REQUISITES : Basic Knowledge about Brain should suffice.
INDUSTRIES APPLICABLE TO : Health, Pharmaceutical

COURSE OUTLINE :

This course is intended for medical students both UG and PG (from any speciality) as an introduction to Psychiatry and other mental health issues. It will be useful for Psychology and Neurosciences students too as it provides an overview of Psychiatric illnesses and their treatment as well as the biological /psychological basis of behavior.

ABOUT INSTRUCTOR :

Prof. Alok Bajpai has been trained in Psychiatry at National Institute of Mental health and NeuroSciences (NIMHANS) Bangalore. He did his DPM, MD and is currently practicing at Kanpur and is also the Psychiatrist with Counselling cell, IIT Kanpur. His research interests are in Physics of Brain, Sleep and EEG.

COURSE PLAN :

Week 01 : Brain and Behaviour – approaches : Neuroanatomy | Neurophysiology | Imaging | Electrophysiology | Psychology.

Week 02 : Diagnostic process in Psychiatry : Mental Status Examination 1 | Mental status examination 2 | Classificatory systems | Investigation | Psychological testing.

Week 03 : Psychiatric Disorders and their treatment-1 : Organic syndromes | Schizophrenia | Mood Disorders | Anxiety disorders | Obsessive Compulsive disorders.

Week 04 : Psychiatric Disorders and their treatment -2 : Childhood Disorders-introduction | Autism | Learning disability | ADHD | Other disorders.

HUMANITIES & SOCIAL SCIENCES

PERSPECTIVES ON NEUROLINGUISTIC

PROF. SMITA JHA
Department of Humanities & Social Sciences
IIT Roorkee

TYPE OF COURSE : Rerun | Core/Elective | UG/PG

COURSE DURATION : 4 weeks (28 Jan'19 - 22 Feb'19)

INTENDED AUDIENCE : UG/PG (Engg/Science)

EXAM DATE : 31 Mar 2019

INDUSTRIES APPLICABLE TO : Almost all corporate sector employee will value this course including sales professionals, business leaders and educators.

COURSE OUTLINE :

The proposed course is a program to use language of mind consistently to achieve a specific and desired outcome. This course aims to train a person to make an introspection of his or her own self. The course will also study the structure of subjective experience. Neuro Linguistic Programming focuses and polishes the human excellence and communication. This program works with modelling studying an expert in the field and then breaking down the process of what makes students successful into thoughts beliefs values and actions.

ABOUT INSTRUCTOR :

Prof. Smita Jha is currently working as faculty of English language and literature in the Department of Humanities & Social Sciences, Indian Institute of Technology Roorkee. She has done MA in English, Gold Medalist from Bihar University Bihar and Post graduate diploma in teaching English from CIEFL Hyderabad. Prof. Smita Jha has more than 23 years of teaching experience both at UG and PG level, She has developed course on Neurolinguistic for the first year B.Tech students and is running Linguistics as elective for the 3rd and the 4th year B.Tech students.

COURSE PLAN :

Week 1 : Introduction to Neurolinguitic Programming with history and uses of NLP

Week 2 : Introduction to four pillars of Neurolinguistic with sensory Acuity

Week 3 : Presupposition of NLP, Goals and outcomes

Week 4 : Negotiation and Persuasion with Emotionality and Stage/Anchoring

POSTCOLONIAL LITERATURE

HUMANITIES & SOCIAL SCIENCES

PROF. SAYAN CHATTOPADHYAY
Department of Humanities & Social Sciences
IIT Kanpur

TYPE OF COURSE : Rerun | Elective | PG

INTENDED AUDIENCE : PG/MA students of English Literature

COURSE DURATION : 4 weeks (28 Jan'19 - 22 Feb'19)

EXAM DATE : 31 Mar 2019

INDUSTRIES APPLICABLE TO : Universities and academic institutions teaching courses on postcolonialism and South Asian studies.

COURSE OUTLINE :

This course on Postcolonial literature will explore colonialism and anti-colonial resistance through the cultural legacies and literary imprints that they leave. It will also be an introduction to the specialised field of postcolonial studies which started emerging during the 1980s and ever since then has come to occupy a significant position within the various humanities departments across the world. It is hoped that this course will enable students to competently navigate the complex maze of theoretical terms and concepts that characterise postcolonial studies and savour the wonderful variety and richness of the literature that is today classified under the rubric of postcolonialism.

ABOUT INSTRUCTOR :

Dr. Sayan Chattopadhyay is an assistant professor of English literature at the Department of Humanities and Social Sciences at IIT Kanpur. He has a doctorate degree from the University of Cambridge. His primary areas of research include Postcolonial Studies and Indian English Writings, and his research articles have appeared in various scholarly journals including Journal of Postcolonial Writing (Routledge), Ariel: A Review of International English (University of Calgary), The Journal of Commonwealth Literature (Sage) and Prose Studies: History, Theory, Criticism (Routledge).

COURSE PLAN :

Week 01 : Introduction: What is postcolonialism | Commonwealth Literature | Colonial Discourse Analysis: Michel Foucault | Colonial Discourse Analysis: Edward Said | Joseph Conrad's Heart of Darkness.

Week 02 : Colonialism: The African Perspective | Chinua Achebe's Things Fall Apart | Decolonisation and the Discourse of Nationalism: The Context of India | Sonnets of Henry Derozio.

Week 03 : Raja Rao's Kanthapura | Critics of Nationalism: Rabindranath Tagore and Frantz Fanon | Homi Bhabha and the concept of cultural hybridity | Caribbean Poetry: Derek Walcott.

Week 04 : Diasporic literature: Selections from Jhumpa Lahiri's Interpreter of Maladies | Gayatri Spivak: Answering the question "Can the Subaltern Speak?" | Mahasweta Devi Pterodactyl | Conclusion: Postcolonial Futures.

HUMANITIES & SOCIAL SCIENCES

MANAGING INTELLECTUAL PROPERTY AT UNIVERSITIES

PROF. FEROZ ALI
Chair Professor on Intellectual Property Rights
IIT Madras

TYPE OF COURSE : New | Elective | UG/PG
INTENDED AUDIENCE : University administrators, Professors and Students
COURSE DURATION : 4 weeks (25 Feb'19 - 19 Apr'19)
EXAM DATE : 27 Apr 2019

COURSE OUTLINE :

Intellectual property (IP) help universities to improve their ranking, establish an innovation ecosystem, incubate knowledge-based start-ups, earn additional revenue and measure research activity. Managing intellectual property at Universities can be critical as regulatory authorities push for establishing innovation ecosystems and IP centres. The University Grants Commission (UGC) has asked all universities to set up IP centres. The National Institute Ranking Framework (NIRF) ranks institutions based on the number of patents applied for, granted and commercialised. The National Assessment and Accreditation Council (NAAC) awards points to institutes with an innovation ecosystem and a facility for identifying and promoting IP. Both the UGC and All India Council for Technical Education (AICTE) recommend changes to the curriculum with a focus on IPR education in technical institutes.

Those who take this course should be able to:
a) Identify the different types of intellectual property generated by universities;
b) Understand the need for an innovation ecosystem and the benefits it brings to universities;
c) Know the requirements for setting up an IP centre and get practical training on how IP centres function; and
d) Learn how startups can be incubated in universities.
This course will include practical training (optional) on the setting up and running an IP centre using a free account at www.techgrapher.com

ABOUT INSTRUCTOR :

Feroz Ali is the Department of Industry Policy and Promotion (DIPP), Ministry of Commerce and Industry Chair on Intellectual Property Rights (IPR) at the Indian Institute of Technology (IIT) Madras. He teaches intellectual property laws and business laws. He is the author of three books on patent law. He is a practicing advocate at the Madras High Court. He litigates and counsels in intellectual property law, corporate law and competition law but his primary focus has remained in patent law. He has appeared before the Supreme Court, the High Courts, Intellectual Property Appellate Board and the Patent Offices.

COURSE PLAN :

Week 1 : The Entrepreneurial University

Week 2 : Innovation Ecosystem

Week 3 : Intellectual Property Centre

Week 4 : Incubating Startups

LANGUAGE AND MIND

HUMANITIES & SOCIAL SCIENCES

PROF. RAJESH KUMAR
Department of Humanities and Social Sciences
IIT Madras

TYPE OF COURSE : Rerun | Elective | UG
INTENDED AUDIENCE : Anyone interested in the topic.
COURSE DURATION : 8 weeks (28 Jan'19 - 22 Mar'19)
EXAM DATE : 31 Mar 2019

COURSE OUTLINE :

Language learning can be put under three broad perspectives. Some believe language is pairing of lexicon and syntax i.e. of words and the set of rules that defines how we can combine those words. Most fundamental of these rules are innate i.e. they are already there in the human mind before it is exposed to society. This means there is perhaps an innate Language Faculty. Still others believe that General Cognitive Abilities that account for other kinds of learning can also account for language. There are many others who strongly believe that language is essentially socially embedded and that all learning takes place through social interactions. This course will briefly account for the most convincing position and will argue for it from generative perspective and biological foundations of language. Throughout the course we will try to be familiar with relationship between language and human mind; to understand language as a special purpose cognitive ability; and to understand underlying mental computation for natural language processing.

ABOUT INSTRUCTOR :

Rajesh Kumar teaches linguistics in the Department of Humanities and Social Sciences at IIT Madras in Chennai.

COURSE PLAN :

Week 01 : On Language : What is Language? | What is scientific about language? | How is language constitutive of being human? | Distinction between human and non-human language | Origin of language | What is the relationship between language and mind? | How do children acquire language? | Nature of learning language | Generative foundation of language acquisition| Biological foundation of Language| Language acquisition device| Universal grammar.

Week 02 : Language in Mind: Acquisition and/or learning | I-language and Innateness | Patterns – Universal Grammar | Human Brain | Language deficit/ loss.

Week 03 : Patterns in sounds and words : Sounds | Vowels/Consonants | Places and manners of articulation | Features of sounds.

Week 04 : Words and sentences : Words | Constraints of patterns in words | Cluster as constraints | Syllables.

Week 05 : Grammar : Parts of sentences | Subjects/ Predicates | Lexical categories | Functional categories | Nature of verbs.

Week 06 : Advanced Grammar : Complement/ adjunct | Restrictions | Semantic relations | Case | Movement.

Week 07 : Levels of representation and principles of grammar : Movement/displacement | Motivation for the movement | Complementizer phrase | Case assignment | Passive morphology and NP movement | D structure| Binding theory | Indices and antecedents | Co-indexing | Constraints.

Week 08 : On language and mind : Compound verb | Negation | Language and Cognition | Goal of cognitive sciences | Computational linguistics- goals, breakthroughs and challenges | Language and mind.

INTRODUCTION TO MODERN INDIAN DRAMA

PROF. KIRAN KESHAVAMURTHY
Department of Humanities & Social Sciences
IIT Guwahati

TYPE OF COURSE : New | Elective | UG/PG
INTENDED AUDIENCE : UG and PG students of Humanities and Social Sciences, Sciences and Engineering
COURSE DURATION : 8 weeks (25 Feb'19 - 19 Apr'19)
EXAM DATE : 28 April 2019

COURSE OUTLINE :

This course introduces students to the historical and social debates on modern Indian theatre from the latter decades of the 19th century to the mid-20th century. The purpose of the course is to familiarize students with modern Indian performance traditions and the social and political issues in the works of major modern Indian playwrights.

ABOUT INSTRUCTOR :

Dr. Kiran Keshavamurthy is Assistant Professor of English at the Department of Humanities and Social Sciences, IIT Guwahati. He completed his PhD in South and Southeast Asian Studies from University of California, Berkeley. His research interests include gender and sexuality studies, caste studies and modern Indian literatures. His first book which got published in 2016 by Oxford University Press, India, is titled Beyond Desire: Sexuality in Modern Tamil Literature.

COURSE PLAN :

Week 01 : Introduction to Course and Colonial History of Modern Indian Theatre

Week 02 : Early modern Indian Playwrights and their Works

Week 03 : Introduction to post-Independence Theatre

Week 04 : Major Modern Indian Playwrights: discussion of specific plays

Week 05 : Major Modern Indian Playwrights: Vijay Tendulkar's Plays

Week 06 : Major Modern Indian Playwrights:Mahesh Elkunchwar

Week 07 : Major Modern Indian Playwrights:Girish Karnad

Week 08 : Major Modern Indian Playwrights:Mahesh Dattani

POSTMODERNISM IN LITERATURE

HUMANITIES & SOCIAL SCIENCES

PROF. MERIN SIMI RAJ
Department of Humanities and Social Sciences
IIT Madras

TYPE OF COURSE : Rerun | Core | PG
INDUSTRY SUPPORT : Only academics
INTENDED AUDIENCE : Students of English Literature
COURSE DURATION : 8 weeks (25 Feb'19 - 19 Apr'19)
EXAM DATE : 28 Apr 2019

COURSE OUTLINE :

This is an eight-week course pitched at the Postgraduate level to provide an overview of a theoretical understanding of the fundamentals of Postmodernism in Literature. Through a discussion of seminal texts, key ideas and critical events in the 20th century, the course maps the dominant socio-cultural and literary practices usually labelled as Postmodernism. Ranging from popular culture to particular theories, from literary events to ideological debates, this course attempts to cover a wide variety of topics and frameworks, to enable a critical understanding of Postmodernism in Literature. The course includes the discussion of selected literary texts and engages with various literary critical approaches from different paradigms including Feminism and Postcolonialism.

ABOUT INSTRUCTOR :

Prof. Merin Simi Raj teaches in the Dept.of Humanities and Social Sciences at IIT Madras.Her teaching and research interests include literary historiography, Literary Criticism, Indian writing in English, Postcolonial literature and Narratives of marginality.

COURSE PLAN

Week 1 : Introducing Postmodernism -Definitions, Concepts, General Online background

Week 2 : Reading the seminal texts and events which define Postmodernism-Online Lyotard,Barthes

Week 3 : Locating the Postmodern in the contemporary

Week 4 : Postmodernism in literature and historical survey

Week 5 : Postmodernism as a literary critical approach

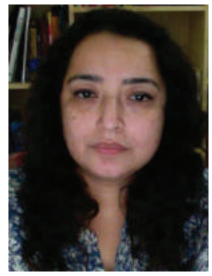
Week 6 : Detailed study of selected texts - Prose

Week 7 : Detailed study of selected texts, Poetry and drama

Week 8 : Detailed study of selected texts - miscellaneous

ELEMENTS OF VISUAL REPRESENTATION

HUMANITIES & SOCIAL SCIENCES



PROF. SHATARUPA THAKURTA ROY
Department of Humanities and Social Sciences
IIT Kanpur

TYPE OF COURSE : Rerun | Elective | UG
INTENDED AUDIENCE : Anyone can take the course.
COURSE DURATION : 8 weeks (25 Feb'19 - 19 Apr'19)
EXAM DATE : 28 Apr 2019

COURSE OUTLINE :

Visual Art is compulsorily a successful visual arrangement. Visual Representation is a mode of non-linguistic and nonverbal communication. It involves a wide range of symbolic icons that cannot be comprehended solely through intuition. The course introduces numerous theoretical constructs that enable its audiences to primarily understand the nature of visual medium and eventually develop a visual vocabulary to decode visual messages with a semiotic approach. The knowledge is instrumental in visual analysis, critical art appreciation, theoretical and practical art and design endeavors.

ABOUT INSTRUCTOR :

Dr. Shatarupa Thakurta Roy is an Assistant Professor at the Indian Institute of Technology Kanpur, in the discipline of Fine Arts, under the Department of Humanities and Social Sciences. She has done her BFA and MFA in Fine Arts from Kala Bhavana, Visva Bharati University, Santiniketan and PhD from the Department of Design, Indian Institute of Technology Guwahati. Her area of specialization is Graphic Art and Design Culture. She is involved in teaching art history, criticism and appreciation, design theory, drawing and painting.

COURSE PLAN :

Week 01 : Introduction to Art and visual language
Week 02 : Composition and Space
Week 03 : Perception of motion
Week 04 : Scale and Proportion
Week 05 : Line as a visual element
Week 06 : Visual harmony and balance as a rule
Week 07 : Color combination, value and texture
Week 08 : Visual analysis and conclusion

HUMANITIES & SOCIAL SCIENCES

EMOTIONAL INTELLIGENCE

PROF. RABINDRA KUMAR PRADHAN
Department of Humanities and Social Sciences
IIT Kharagpur

TYPE OF COURSE : Rerun | Elective |PG

COURSE DURATION : 8 weeks (28 Jan'19 - 22 Mar'19)

INDUSTRY SUPPORT : Human resource management division, training & developmentdivision of both manufacturing and service industries, MBA and HRM students

EXAM DATE : 31 Mar 2019

COURSE OUTLINE :

"Intelligence quotient (IQ) gets you hired but emotional quotient (EQ) gets you promoted". This popular quote by Times magazine during late nineties has made the concept of emotional intelligence more popular among people by highlighting its multiple implications and applications. The uses and utility of emotional intelligence at home, school and workplace have benefited thousands in many disciplines. This course is designed to sensitize the participants about the concept, theory and applications of emotional intelligence. over the hardware (EQ).

ABOUT INSTRUCTOR :

Prof. Rabindra Kumar Pradhan is currently working as Associate Professor in the Department of Humanities and Social Sciences, Indian Institute of Technology Kharagpur, in diverse areas of behavioral sciences and human resource management. He is actively involved in teaching, training & research in the fields of positive psychology, industrial and organizational psychology, human resource development and management, and organizational behavior. He has 18years of experience in teaching, research and training. He has published 2 books on emotional intelligence, 1 book on human resource management and 1 book on human development through training. He has also published more than 50 journal articles and 10 book chapters.

COURSE PLAN :

Week 1 : Introduction to emotion, intelligence & wisdom

Week 2 : Concept, theory, measurement and applications of intelligence

Week 3 : Emotional intelligence: concept, theory and measurements

Week 4 : Correlates of emotional intelligence

Week 5 : Emotional intelligence, culture, schooling and happiness

Week 6 : For enhancing emotional intelligence EQ mapping

Week 7 : Managing stress, suicide prevention, through emotional intelligence, spirituality and meditation

Week 8 : Application of emotional intelligence at family, school and workplace

HUMANITIES & SOCIAL SCIENCES

INTRODUCTION TO BASIC COGNITIVE PROCESSES

PROF. ARK VERMA
Department of Psychology
IIT Kanpur

COURSE DURATION : 8 weeks (25 Feb'19 - 19 Apr'19)

EXAM DATE : 27 Apr 2019

TYPE OF COURSE : Rerun | Elective | PG

INTENDED AUDIENCE : The course will be beneficial to both UG and PG students interested in Psychology. Also, Masters & PhD students studying Cognitive Psychology and/or with any of the basic mental processes as mentioned above. Professionals working with human factors, user – interface designs etc. will also find the insights from the course as useful.

INDUSTRIES APPLICABLE TO : All industries engaging with human resources, user – interface design & consumer oriented goods may benefit from this course.

COURSE OUTLINE :

Introduction to Basic Cognitive Processes is an introductory course in Cognitive Psychology. As opposed to the behaviorist tradition in psychology that concerns itself with only the observable behaviours of the individual, Cognitive Psychology focuses on the internal mental processes. The approach adopted in this course will look at human behaviour at large as made up of many component mental processes such as sensation, perception, attention, memory, language, imagery, decision making, problem solving, emotion and others.

ABOUT INSTRUCTOR :

Dr. Ark Verma received his B.A. (Psychology, English Literature) from the University of Allahabad in 2007. Later, he completed a Master's Degree in Cognitive Science at the Centre of Behavioral & Cognitive Sciences, University of Allahabad in 2009. He joined the PhD program in the Department of Experimental Psychology at Ghent University, Belgium in January 2010 & was awarded PhD in 2014. He joined IIT Kanpur as an Assistant Professor of Psychology in May 2015. His research lies in the field of Cognitive Psychology (Lateralisation, Symmetry Detection, Attention) & Psycholinguistics (Visual Word Recognition & Bilingualism).

COURSE PLAN :

Week 01 : Introduction to Cognitive Psychology, History and Foundations of Cognitive Psychology.

Week 02 : Approaches towards studying Cognitive Psychology and Cognitive Neuroscience.

Week 03 : Research Methods in Cognitive Psychology. Sensation. Psychophysics and Signal Detection Theory.

Week 04 : Physiology of Visual Perception, Representation in Perception and Approaches to Perception.

Week 05 : Theories of Object Recognition, Perception and Action, Attention.

Week 06 : Attention, Concept of Memory, Sensory Memory, Short Term Memory.

Week 07 : Long Term Memory, Errors in Memory, Improving Memory.

Week 08 : Memory and other topics.

INTRODUCTION TO THE PSYCHOLOGY OF LANGUAGE

HUMANITIES & SOCIAL SCIENCES

PROF. ARK VERMA
Department of Humanities and Social Sciences
IIT Kanpur

TYPE OF COURSE : New | Elective | PG
INTENDED AUDIENCE : MS/PhD
COURSE DURATION : 8 weeks (25 Feb'19 - 19 Apr'19)
EXAM DATE : 28 Apr 2019

INDUSTRIES APPLICABLE TO : Any companies dealing with verbal communication

COURSE OUTLINE :

The objective of this course is to understand the psychological processes involved in language production, acquisition & comprehension. Students will be expected to learn how words & sentences are formed, spoken & understood. Also, how language as a cognitive function plays its role in overall cognition (i.e. thought & understanding of the world)

ABOUT INSTRUCTOR :

Prof. ARK Verma has done his Bachelor's Degree in Psychology & English Literature from the University of Allahabad in 2007. After that he did Master's Degree in Cognitive Science at the Centre of Behavioral & Cognitive Sciences, University of Allahabad in 2009. He joined the PhD program in the Department of Experimental Psychology at Ghent University, Belgium in January 2010 & was awarded his PhD in 2014. He joined IIT Kanpur as an Assistant Professor of Psychology in May 2015. His research lies in the field of Cognitive Psychology (Lateralisation, Symmetry Detection, Attention) & Psycholinguistics (Visual Word Recognition & Bilingualism).

COURSE PLAN :

Week 1 : Introduction to Language.
Week 2 : Language Development
Week 3 : Words
Week 4 : Speech
Week 5 : Sentence Processing
Week 6 : Reading
Week 7 : Language Disorders
Week 8 : Special Topics

HUMAN BEHAVIOUR

PROF. NAVEEN KASHYAP
Department of Humanities and Social Sciences
IIT Guwahati

TYPE OF COURSE : New | Elective | PG
INTENDED AUDIENCE : UG/PG/PhD
COURSE DURATION : 8 weeks (28 Jan'19 - 22 Mar'19)
EXAM DATE : 31 March 2019

COURSE OUTLINE :

We as intelligent beings have always wondered why we do what we do. The most interesting knowledge that humans beings would kill to possess would be the knowledge to control other people. The basic premise of being human is individual difference (we are all different). One science that helps people in understanding other people and scientifically predicting their actions is the science of psychology. In the present course, I will make an attempt to simplify the science of human behavior.

ABOUT INSTRUCTOR :

Naveen Kashyap, Ph.D is Associate Professor of Psychology at the Indian Institute of Technology Guwahati. His research interests are sleep and human cognitive processes. Dr Kashyap has been teaching courses like cognitive psychology, introduction to psychology, consumer psychology, advance cognitive process and research methodology to UG and PG students of IIT Guwahati for the past 10 years.

COURSE PLAN :

Week 01 : Introduction to the science of human behavior

Week 02 : Basic psychological processes, Sensation & Perception, Consciousness

Week 03 : Advanced psychological processes, Learning and Conditioning, Memory

Week 04 : Language and thought

Week 05 : Motivation and Emotion

Week 06 : Intelligence

Week 07 : Personality

Week 08 : Social influence and cognition

EMPLOYMENT COMMUNICATION
A LAB BASED COURSE

HUMANITIES & SOCIAL SCIENCES

PROF. SEEMA SINGH
Department of Humanities & Social Sciences
IIT Kharagpur

TYPE OF COURSE : New | Elective | UG/PG
INTENDED AUDIENCE : Anyone can take this
COURSE DURATION : 8 weeks (25 Feb'19 -19 Apr'19)
EXAM DATE : 28 April 2019

COURSE OUTLINE :

Employment Communication: A Lab based course is intended as Finishing School for Undergraduate students of Colleges / Professional Institutes who are soon to join the workforce. It is possible that some of these students might have completed Courses or trained on Professional Communication / Soft / Communication Skills, the fact is that there is still a genuine need for intensive practice so as to put up a stellar performance during the three stage process of Employment Communication .In the first stage (CV writing) students will be trained to write impressive CVs aimed to grasp the attention of organizations / employers they would like to work with. In the 2nd phase, students will be taught the basics strategies of cracking Group Discussions (GDs) to demonstrate their Team working abilities; and also that they can emerge as leaders while still maintaining the Group /Project goals of the organizations. In the third and final stage, post a short & lucid theoretical lecture on how to tackle Interview Questions, students will undergo practical Personal Interview Sessions so as to get a feel of the real scenario and reduce the fear factor.In conclusion, the objective of the proposed course (on Employment Communication: A Lab based course) is to prepare students to effectively train & confidently prepare to enter the workplace.

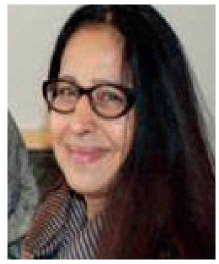
ABOUT INSTRUCTOR :

Dr. Singh joined IIT Kharagpur as an Assistant Professor (English) in 2003 December. Prior to that she worked for seven years in the Royal University of Bhutan as Senior Lecturer in English. Set against this background, she diversified further and guided Research Scholars in Managerial Communication, Indian Writing in English, and Subaltern Literature. In 2007 December, she floated the PG Core Course on English for Thesis Writing which is now the compulsory for all PhD Research Scholars & MS students as well. She is connected with the recruitment process at the Staff Selection Commission, Eastern Region Kolkata, as well as the Rajya Sabha, Parliament of India. Currently, she is Associate Professor of English at the Department of Humanities & Social Sciences where she teaches, trains, and researches in Soft Skills.

COURSE PLAN :

Week 01 : Course Introduction & Verbal Communication
Week 02 : Non Verbal Communication & Cross Cultural Communication
Week 03 : Body Language & Listening Skills
Week 04 : The Employment Process & CV Writing
Week 05 : The Cover Letter, CV Writing Lab & Group Discussions (GDs)
Week 06 : Group Discussion (GD) Lab & Introduction to Interviewing
Week 07 : Personal Interviews (PIs) & PI Practice Lab
Week 08 : PIs, Student Speak, & Course Wrap-up

SPEAKING EFFECTIVELY



PROF. ANJALI GERA ROY
Department of Humanities and Social Sciences
IIT Kharagpur

TYPE OF COURSE : Rerun | Elective | UG
PRE - REQUISITIES : An intermediate course in English language
COURSE DURATION : 8 weeks (28 Jan'19 - 22 Mar'19)
EXAM DATE : 31 Mar 2019

COURSE OUTLINE :

This course aims to introduce learners to the dynamics of effective spoken communication by establishing speaking as an autonomous medium with a distinctive vocabulary, syntax, structure, style and register. It will enable learners to participate in one to one interactions, in small groups and before a group. Learners are expected to master the fundamentals of speaking such as vocabulary, body language, pronunciation and basic conversation skills before they move on to more advanced activities such as appearing in interviews, making formal presentations and participating in meetings.

ABOUT INSTRUCTOR :

Prof. Anjali Gera Roy is a Professor in the Department of Humanities and Social Sciences IIT Kharagpur, where she has designed and taught courses in language, literature and communication for more than 25 years. She has conducted and taught in a number of executive development programs in IIM Bangalore and IIT Kharagpur and run several tailor-made programs for the industry. She has been a Visiting Faculty in IIM Bangalore and Guest Faculty in Communication in IIM Rohtak and IIM Kashipur.

COURSE PLAN :

Week 1: Introduction; The Art of Speaking; Encoding Meaning Using Verbal and Nonverbal Symbols; Cross Cultural Communication; Verbal Communication; Encoding Meaning Using Verbal Symbols; How Words Work and How to Use Words

Week 2: Nonverbal Communication; Encoding Meaning Using Nonverbal Symbols; How to Improve Body Language; Eye Communication, Facial Expression, Dress and Appearance; Posture and Movement, Gesture, Paralanguage; Role Plays and Activities

Week 3: Phonetics; Standard Language and Queen's English; Phonemes of English: Vowels; Phonemes of English: Diphthongs and Consonants; Stress and Rhythm; Intonation

Week 4: Voice and Delivery; Voice and Personality; How to Improve Voice; How to Improve Delivery; Pace,Pause,Pitch Volume, Modulation, Resonance

Week 5: Basic Conversational Skills; Greetings and making introductions; Asking for information and giving instructions Making requests; Agreeing and disagreeing; Making recommendations

Week 6: Appearing in Interviews and taking Interviews; Interviewing Skills; Appearing in an Interview; Conducting an Interview; Analysis of a bad interview; Analysis of a good interview

Week 7: Making and Assessing Presentations; How to Make Successful Presentations; How to Make Successful Presentations Analysis of a Bad Presentation; Analysis of a Good Presentation

Week 8: Group Discussions and Meetings; Participating in a Meeting; Chairing a Meeting; Analysis of an ill conducted meeting; Analysis of a well conducted meeting

HUMANITIES & SOCIAL SCIENCES

ENHANCING SOFT SKILLS & PERSONALITY

PROF. T. RAVICHANDRAN
Department of Humanities and Social Sciences
IIT Kanpur

TYPE OF COURSE : Rerun | Elective | UG/PG

PRE - REQUISITES : Developing Soft Skills and Personality

COURSE DURATION : 8 weeks (25 Feb'19 - 19 Apr'19)

EXAM DATE : 27 Apr 2019

INDUSTRY SUPPORT : All industry/companies/organisations will recognize and value this course and recommend this for their employees and trainee programs.

INTENDED AUDIENCE : Students, Teachers, Professionals, Trainers, Leaders, Employers

COURSE OUTLINE :

The course aims to cause an enhanced awareness about the significance of soft skills in professional and inter-personal communications and facilitate an all-round development of personality. Hard or technical skills help securing a basic position in one's life and career. But only soft skills can ensure a person retain it, climb further, reach a pinnacle, achieve excellence, and derive fulfilment and supreme joy. Soft skills comprise pleasant and appealing personality traits as self-confidence, positive attitude, emotional intelligence, social grace, flexibility, friendliness and effective communication skills. (The focus of this course is on interpersonal and management skills.)

ABOUT INSTRUCTOR :

Prof. T. Ravichandran is presently a Professor of English in the Department of Humanities and Social Sciences at the Indian Institute of Technology Kanpur, Uttar Pradesh, India. He has written about fifty research articles/book chapters, supervised six doctoral theses, edited a special issue on Cyberpunk Literature for the Creative Forum Journal, and published a book on Postmodern Identity. He is a recipient of the Fulbright-Nehru Academic and Professional Excellence Fellowship (2014-15) for his research/teaching at Duke University, North Carolina, USA. He is honored with Champa Devi Gangwal Chair Professorship at IIT Kanpur. (In his distinguished twenty-five years of teaching career, he has taught various courses in English Language and Literature. His NPTEL Video and Web courses on Communication Skills are well-acclaimed nationally and internationally. His NPTEL MOOC on Developing Soft Skills and Personality became hugely popular and well-received by about fifteen thousand participants from India and abroad.)

COURSE PLAN :

Week 1 : Highlights of Developing Soft Skills and Personality Course-1-24; Highlights of Developing Soft Skills and Personality Course-25-48; Definitions and Types of Mindset; Learning Mindsets; Secrets of Developing Growth Mindsets

Week 2 : Importance of Time and Understanding Perceptions of Time; Using Time Efficiently; Understanding Procrastination; Overcoming Procrastination; Don't Say "Yes" to Make Others Happy!

Week 3 : Types of People; How to Say "No"; Controlling Anger; Gaining Power from Positive Thinking-1; Gaining Power from Positive Thinking-2

Week 4 : What Makes Others Dislike You?; What Makes Others Like You?-1; What Makes Others Like You?-2 ; Being Attractive-1, 2

Week 5 : Common Errors-1,2,3,4,5

Week 6 : Humour in Communication; Humour in the Workplace; Function of Humour in the Workplace; Money and Personality; Managing Money

Week 7 : Health and Personality; Managing Health-1: Importance of Exercise; Managing Health-2: Diet and Sleep Love and Personality; Managing Love

Week 8 : Ethics and Etiquette; Business Etiquette; Managing Mind and Memory; Improving Memory; Care for Environment; Highlights of the Course

HUMANITIES & SOCIAL SCIENCES

APPRECIATING CARNATIC MUSIC

PROF. LAKSHMI SREERAM
Visiting Professor
IIT Madras

TYPE OF COURSE : Rerun | Elective | UG/PG
COURSE DURATION : 8 weeks (25 Feb'19 - 19 Apr'19)
INTENDED AUDIENCE : Anyone can take this course
EXAM DATE : 27 Apr 2019

COURSE OUTLINE :

Carnatic music is a vibrant musical tradition that has evolved, and is largely practiced, in Southern India and wherever else there is a significant diaspora of South Indians. A highly nuanced and tonally rich melodic music, its rhythmic aspect too is considerably complex. As much as it is rooted in tradition there is immense demand on the improvisational skills of the musicians. The coming together of these two aspects in a concert can give the listener a musical high.

ABOUT INSTRUCTOR :

Prof. Lakshmi Sreeram, Visiting Professor, IIT Madras Trained in Carnatic music since her childhood, Lakshmi has been a performer for over 25 years. She also performs Khayal, a north Indian tradition of classical music. She has a Ph.D in Philosophy from the University of Bombay focusing on the idea of dhvani in Anandavardhana's Dhvanyaloka, a 9th century Sanskrit text in the tradition of Alankarasastra (literary theory). She has been teaching introductory courses on Carnatic and Hindustani music at the prestigious Indian Institute of Technology, Madras. She is also a freelance journalist. For more details and music clips, please visit www.lakshmisreeram.com.Kharagpur with financial supports from industries.

COURSE PLAN :

Music in India
Variety of Music in India - Traditions of art or classical music in India
Carnatic Music – the southern music.

Musical material
The 12 pitches or swara sthana-s
The scale - natural or just tempered scale as opposed to the equal or even tempered scale.

Raga - the basic melodic facet of Indian music
What makes for a raga – swara (note/tone), gamaka (embellishment), pidi (phrase), graha, nyasa, jeeva swaras.
Variety of raga-s and their classification. The 72 melakarta schema

Tala - the rhythmic facet
Concepts of the avartana, samam, and eduppu
Suladi sapta tala schema

Composition
Composers - the Carnatic trinity and their contribution; before them and after them
Kinds of composition
Some great compositions
Carnatic music and notation

Improvisation: What is the nature of improvisation in Carnatic music; various kinds of improvisation - alapana, neraval, swara prastara and tanam

Presentation of a Carnatic concert - the meshing of the compositional and improvisational aspects.

Accompaniment - its unique nature in Carnatic music.

Percussive and melodic instruments

Listening to a Carnatic concert - aesthetic and technical aspects.

HUMANITIES & SOCIAL SCIENCES

ENGLISH LITERATURE OF THE ROMANTIC PERIOD, 1798-1832

PROF. PRAMOD K NAYAR
Dept of English
University of Hyderabad

TYPE OF COURSE : New | Core | UG/PG
INTENDED AUDIENCE : BA, MA - English
COURSE DURATION : 8 weeks (25 Feb'19 -19 Apr'19)
EXAM DATE : 27 April 2019

COURSE OUTLINE :

This is intended as a survey of one of the most significant periods in English literature, the Romantic Age. It provides the socio-cultural backgrounds, key features of the poetry and fiction and an introduction to some of the key poets and poems from the period. In addition it also offers a brief account of the principal aesthetic theories that informed the poetry, and an introduction to the visual arts of the period. It concludes with a short introduction to the orientalism that marked the age's literature.

ABOUT INSTRUCTOR :

Pramod K Nayar teaches at the Dept of English, the University of Hyderabad. Among his most recent books are Bhopal's Ecological Gothic (Lexington, 2017), Human Rights and Literature (Palgrave-Macmillan, 2017), The Extreme in Contemporary Culture (Rowman and Littlefield, 2017). He is the editor of English Romantic Poetry: An Anthology (Orient BlackSwan, 2013). Forthcoming is Brand Postcolonial: The 'Third World' Text and the Global (de Gruyter)

COURSE PLAN :

Week 01 : Literacy and Reading, Empire, Science
Week 02 : European Romanticism, Dissent and Revolutions, The Debate on Rights, Nature & the Environment, Ideas of the Self and Imagination
Week 03 : Fiction - General Features, Austen, Criticism: Coleridge and Wordsworth, The Historical Novel, The Gothic
Week 04 : Introduction: Sensibility and Passion, Selections from Wordsworth, Selections from Coleridge, Selections from Blake
Week 05 : Introduction: Nature and the Environment, Selections from Wordsworth, Selections from Coleridge, Selections from Shelley, Selections from Keats ('To Autumn') & Byron ('Darkness')
Week 06 : Introduction: Sublime and Picturesque Aesthetics Selections from Wordsworth, Selections from Blake/Coleridge, Selections from Shelley ('Mont Blanc'), Visual arts and the Romantics
Week 07 : Introduction to the Romantic Politics: Gender, Class, Race, Tyranny, Selections from Abolitionist Poetry (More, Opie, Byrne, Southey), Selections from Wordsworth & Shelley, Working Class Poetry (John Clare)
Week 08 : Introduction: Romanticism, the Empire and the Other, Selections from Prose (de Quincey), Selections from Byron, Selections from Shelley & Hemans

PATENT LAW FOR ENGINEERS AND SCIENTISTS

HUMANITIES & SOCIAL SCIENCES

PROF. FEROZ ALI
Chair Professor on intellectual property rights
IIT Madras

TYPE OF COURSE : Rerun | Elective | UG/PG
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 27 Apr 2019
PRE-REQUISITES : Background degree in Science or Technology is preferable. Students who enroll for this course may also benefit from the course "Patent Drafting for Beginners"

COURSE OUTLINE :

The course shall give an in-depth understanding of patent law to engineers and scientists. This course will help person with a science background to understand the fundamentals of patent law, know the requirements of patentability, learn how to read and interpret patent specifications, analyze patent office procedures and court cases and develop the basic understanding for drafting a patent specification. This course will cover the syllabus of Paper 1 of the Patent Agent Examination conducted by the Intellectual Property Office, Government of India.

ABOUT INSTRUCTOR :

Prof. Feroz Ali is the Chair Professor on Intellectual Property Rights (IPR) at the Indian Institute of Technology (IIT) Madras. He teaches intellectual property laws and business laws. He is the author of three books on patent law. He is a practicing advocate at the Madras High Court. He litigates and counsels in intellectual property law, corporate law and competition law but his primary focus has remained in patent law.

COURSE PLAN :

Week 1: Introduction to the Indian Patent System; Patent Laws as Concepts; Understanding the Patents Act, 1970; Understanding the Patents Rules, 2003; Preliminary Sections; Preliminary Rules; What's New in the Patents (Amendment) Rules, 2016; Easy way to read the Patents Act and Rules
Week 2: Patentability of Inventions; Statutory Exceptions to Patentability; Novelty and Anticipation; Inventive Step; Capable of Industrial Application; Person Skilled in the Art
Week 3: Patent Specification; Provisional and Complete Specifications; Structure of a Patent Specification—Title, Abstract, Description, Claims, etc.; Reading a Patent Specification—Fair basis, Enabling Disclosure, Definiteness, Priority; Introduction to Patent Drafting.
Week 4: Patent Prosecution: Patent Applications ; Patent Application—Who Can Apply, True and First Inventor, How to Make a Patent Application, What to include in a Patent Application, Types of Patent Applications, Patents of Addition, Dating of Application;
Week 5: Patent Prosecution: Publication and Examination - I; Publication of Application; Request for Examination; Examination of Application—First Examination Report
Week 6: Patent Prosecution: Publication and Examination – II
Expedited Examination of Application; Search for Anticipation—Procedure, Withdrawal of Application; Consideration of Report of Examiner
Week 7: Patent Prosecution: Powers of Controller; Powers of Controller—Examination Stage, Consideration of report by examiner, Refuse or Amend Applications, Division of Applications, Dating of Application, Anticipation, Potential Infringement; Putting Applications in Order; Amendments during Prosecution
Week 8: Patent Prosecution: Opposition; Pre-grant opposition; Post-grant opposition; Wrongful obtaining of invention; Mention of Inventor; Opposition in General.
Week 9: Patent Prosecution: Practice at the Patent Office- I; Secrecy Provisions; Grant of Patents; Rights Conferred by Grant; Rights of Co-Owners; Term of Patent; Restoration of Lapsed Patents;
Week 10: Patent Office and Patent Prosecution; Surrender; Revocation—Grounds for Revocation; Register of Patents, Patent Office and its Establishment; Patent Agents; Use and Acquisition by Government; Penalties.
Week 11: Compulsory Licensing; Compulsory Licensing—Working of Patents, Grounds for Grant of Compulsory License, Revocation; Patent Licensing;
Week 12: Patent Enforcement, International Arrangements and Other Miscellaneous Provisions; Intellectual Property Appellate Board; Declaratory Suits, Infringement Suits; International Application—Convention Application, PCT Application, Application Designating India, Multiple Priorities; PCT Timeline; Fees—Application, In Relation to Grant of Patents; Timelines—Application, Examination, Publication etc.

AMERICAN LITERATURE AND CULTURE

HUMANITIES & SOCIAL SCIENCES

PROF. AYSHA IQBAL
Department of Humanities & Social Sciences
IIT Madras

TYPE OF COURSE : Rerun | Core | PG
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
INTENDED AUDIENCE : BA/MA English
EXAM DATE : 27 Apr 2019
PRE-REQUISITES : Familiarity with English/American literature
INDUSTRIES APPLICABLE TO : Colleges/universities.

COURSE OUTLINE :

The course aims to inculcate an appreciation of specific American authors and texts, along with the literary history of the United States. Participants will also get familiar with the relation between American literature and important related historical and socio-cultural developments. The course also aims to foster an understanding of the development of various genres, forms, and themes in select American literature.

ABOUT INSTRUCTOR :

Prof. Aysha Iqbal is Professor in the Dept. of HSS, IIT Madras. Her books on communication include: English for Technical Communication,English for Nurses and English for the Hotel Industry.

COURSE PLAN :

Week 01-02	: Introduction to the course. Henry James. The Portrait of a Lady. Introduction to Henry James and his works Plot/character/literary techniques/style
Week 03	: Theodore Dreiser. An American Tragedy. Plot/character/literary techniques/style
Week 04	: Eugene O'Neill. Desire under the Elms. Introduction to Eugene O'Neill and his worksPlot/ character/ literary techniques/style
Week 05	: American RomanticismEdgar Allan Poe. "Annabel Lee."Flannery O'Connor. "Good Country People."
Week 06	: Ernest Hemingway. The Sun Also Rises. Plot/character/literary techniques/style
Week 07	: Edith Wharton. The Age of Innocence. Plot/character/literary techniques/style
Week 08	: Lillian Hellman. The Children's Hour. Plot/character/literary techniques/style
Week 09	: Arthur Miller. A View from the Bridge. Plot/character/literary techniques/style
Week 10	: Hart Crane. "To Brooklyn Bridge." Pulp fictionScience fiction Counter Culture
Week 11	: Christopher Hitchens "Jewish Power, Jewish Peril." Conclusion.
Week 12	: Summary

HUMANITIES & SOCIAL SCIENCES

THE NINETEENTH-CENTURY ENGLISH NOVEL

PROF. A. DIVYA
Department of Humanities & Social Sciences
IIT Madras

TYPE OF COURSE : New | Elective | UG/PG/PhD
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
INTENDED AUDIENCE : Faculty, Students of English Literature
EXAM DATE : 27 April 2019
INDUSTRIES APPLICABLE TO : The British Library, US Consulate

COURSE OUTLINE :

The Nineteeth-Century Novel course introduces student to the genre of the novel at its height in Nineteeth-Century Britain. Through a close study of the novels of the period the students will come to understand the nature of the plots and its compexities in relation to the social and culture impulses of the period.

ABOUT INSTRUCTOR :

Divya A is an Assistant Professor in English Studies in the Department of Humanities and Social Sciences in the Indian Institute of Technology Madras. She has published on Charles Dickens, Elizabeth Gaskell, Wilkie collins and the Pre-Raphaelites.

COURSE PLAN :

Week 01 : Introduction/ Jane Austen's Persuasion (1818), Volume I, Chapters 1-6
Week 02 : Jane Austen's Persuasion, Volume I, Chapters 7-12
Week 03 : Jane Austen's Persuasion, Volume II, Chapters 13-18
Week 04 : Jane Austen's Persuasion, Volume II, Chapters 19-24
Week 05 : Charles Dickens' A Tale of Two Cities (1859), Book I, Chapters 1-6, and Book II, Chapters 1-3
Week 06 : Charles Dickens' A Tale of Two Cities, Book II, Chapters 4-12
Week 07 : Charles Dickens' A Tale of Two Cities, Book II, Chapters 13-21
Week 08 : Charles Dickens' A Tale of Two Cities, Book II, Chapters 22-24 and Book III Chapters 1-6
Week 09 : Charles Dickens' A Tale of Two Cities, Book III, Chapters 7-15
Week 10 : R.L.Stevenson A Strange Case of Dr Jekyll and Mr Hyde (1886), Chapters 1-4
Week 11 : R.L.Stevenson A Strange Case of Dr Jekyll and Mr Hyde, Chapters 5-7
Week 12 : R.L.Stevenson A Strange Case of Dr Jekyll and Mr Hyde, Chapters 8-10

HUMANITIES & SOCIAL SCIENCES

LITERATURE, CULTURE AND MEDIA

PROF. RASHMI GAUR
Department of Humanities & Social Sciences
IIT Roorkee

TYPE OF COURSE : New | Elective | UG/PG
INTENDED AUDIENCE : BE/ME/MA/MSc/PhD
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 28 April 2019

COURSE OUTLINE :

This course aims to introduce students to an interdisciplinary framework that will allow them to explore and theorize on the intersections of literature, culture, and media. The students will get the opportunity to analyse the complex ways in which literary and cultural products/texts inter-animate each other to produce and reproduce the ways in which society and culture give rise to new forms of perspectives and ideologies; in turn, determining the ways in which identities are constructed.

ABOUT INSTRUCTOR :

Professor Rashmi Gaur teaches courses of Communication, Culture, Gender Studies and Media (Film and Literature) at IIT Roorkee. In her career, spanning three decades, she has guided about 12 Ph.D. theses, published four books, more than ninety research papers in national and international journals, besides participating in many conferences in India and abroad. Widely travelled, she also runs consultancy projects in related areas.

COURSE PLAN :

Week 01 : Introduction, Aims and Objectives; Defining Literature; Defining Culture; Relationship between Literature and Culture; Literature, Culture and Media

Week 02 : Introduction to Cultural Studies; Cultural Studies I: Raymond Williams; Cultural Studies II: Stuart Hall; High Culture and Popular Culture; Subculture and Counterculture

Week 03 : Modernism and Postmodernism I and II; Lyotard's The Postmodern Condition: A Report on Knowledge; Foucault's Notion of Knowledge and Power; Poststructuralism and Deconstruction

Week 04 : Introduction to Feminism I and II; Theories of Gender; Men's and Masculinity Studies; Queer Studies and Representations of Gender in Media

Week 05 : Intersectionality; Introduction to Postcolonial Theory; Key Concepts in Postcolonial theory; Said, Spivak and Bhabha; Postcolonial Reading of Achebe and Amitav Ghosh

Week 06 : Theories of Ideology; Adorno and Horkheimer on Culture; Culture Industry and Mass Deception,Walter Benjamin; Interconnections between Literature, Culture and Identity: Woolf and Deshpande I and II

Week 07 : The Evolution of Media: Print forms; Media and Culture; Media, Culture and Technology I and II; Harold Innis

Week 08 : Introduction to Marshall McLuhan; Media and the Electric Age; Hot and Cool Media; Postmodern Media I; Postmodern Media II and Formation of Public Opinion

Week 09 : Word and the Image: Drama, Photography, Birth of the Cinema; Film and Literature I and II; Language of Films: Mise-en-scene, Type of Shots, Camera angles/movements, Montage; Reading of 12 Years a Slave: Film and Text

Week 10 : Development of Media: Radio; Development of Media: Television; Film, Television and Literature; Impact of Technology on Literary Genres: Novel; Media in the 21st Century

Week 11 : Approaches to Digital Forms of Media; Literature, Internet and Culture; Digital Culture, Media, and Literature; Representation of Partition in different Media: A historical and Cultural Analysis I and II

Week 12 : Game Studies I and II; Body Culture Studies and Representation of Women in the Media; Media and Gender; Media and Language, Glass Ceiling in Media

INTRODUCTION TO POLITICAL THEORY

HUMANITIES & SOCIAL SCIENCES

PROF. MITHILESH KUMAR JHA
Department of Humanities & Social Sciences
IIT Guwahati

TYPE OF COURSE : New | Elective | UG/PG
INTENDED AUDIENCE : UG and PG students of Humanities and Social Sciences, Sciences and Engineering
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 27 April 2019

COURSE OUTLINE :

The major objective of this course is to introduce the students to some of the key concepts and ideas of politics which shape our political discourse. These concepts are essentially contested concepts and yet inevitable for understanding and explaining the politics of any country or society. A clear understanding of these debates or contestations over some of the key concepts and ideas of politics, it is hoped, will help the students develop their own independent views and judgments about politics and democracy in their own societies as well as in the world at large.

ABOUT INSTRUCTOR :

Dr. Mithilesh Kumar Jha teaches Political Science in the Department of Humanities and Social Sciences, Indian Institute of Technology Guwahati. His research interests are - political thought in comparative perspective particularly Indian and Western political thought, political theory, Indian politics especially language and related issues of state formations in modern India. His important publications are Language Politics and Public Sphere in North India: Making of the Maithili Movement, Oxford University Press, New Delhi (2018); Glimpses of Mithila and Maithili: The Correspondence of George Abraham Grierson, Kalyani Foundation: Darbhanga (2013).

COURSE PLAN :

Week 01 : Political Theory: Introduction & Liberty

Week 02 : Liberty & Equality

Week 03 : Equality & Rights

Week 04 : Rights & Justice

Week 05 : Justice

Week 06 : Power

Week 07 : State and sovereignty - I

Week 08 : State and sovereignty - II

Week 09 : Democracy

Week 10 : Citizenship

Week 11 : Politics & Environmental ethics - I

Week 12 : Politics & Environmental ethics - II & Concluding lecture

HUMANITIES & SOCIAL SCIENCES

INTRODUCTION TO COGNITIVE PSYCHOLOGY

PROF. NAVEEN KASHYAP
Department of Humanities and Social Sciences
IIT Guwahati

TYPE OF COURSE : Rerun | Elective | UG/PG
INTENDED AUDIENCE : UG/PG/PhD
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 28 Apr 2019

COURSE OUTLINE :

One of the most puzzling facts for humans over the centuries has been the understanding of human behavior. Understanding and predicting human behavior will help humans in exerting more control over situations. The bases of human behavior are the cognitive processes underlying them. The present course is an attempt to discuss and understand the basic cognitive processes that guide human behavior. The knowledge from the course will be useful in tackling everyday problems and attaining optimal solutions.

ABOUT INSTRUCTOR :

Prof. Naveen Kashyap is an Associate Professor of Psychology at the Department of Humanities and Social Sciences Indian Institute of Technology Guwahati. His research interests are sleep and human cognitive processes. Dr. Kashyap has been teaching courses like cognitive psychology, introduction to psychology, human memory, advance cognitive process and research methodology to UG and PG students of IITG Guwahati for the past 10 years.

COURSE PLAN :

Topic: Introduction to Cognitive Psychology

Week 1: History and study of human cognition
Week 2: Theories and Research in human cognition

Topic: Basic Cognitive Processes

Week 3: Object Perception and Recognition
Week 4: Attentional Processes and cognition
Week 5: Encoding and retrieving memory traces

Topic: Organizational Knowledge

Week 6: Memory of general knowledge
Week 7: Concept Formation
Week 8: Visual and Spatial Memory

Topic: The Use of Knowledge

Week 9: Human language skills
Week 10: Thought process and Problem Solving
Week 11: Reasoning
Week 12: Decision Making

ENGLISH LANGUAGE FOR COMPETITIVE EXAMS

PROF. AYSHA IQBAL
Department of Humanities & Social Sciences
IIT Madras

TYPE OF COURSE : Rerun | Elective | UG/PG
INTENDED AUDIENCE : Anyone can take this course
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 27 Apr 2019

COURSE OUTLINE :

The course aims to help participants develop their English language skills , particularly those planning to appear for competitive exams that test their English language abilities. During a span of 30 hours, students will be exposed to material that facilitates aspects of grammar, writing and vocabulary.

ABOUT INSTRUCTOR :

Prof. Aysha Iqbal is Professor in the Dept. of HSS, IIT Madras. Her books on communication include: English for Technical Communication,English for Nurses and English for the Hotel Industry.

COURSE PLAN :

- Introduction/Practice Tests
- Advanced Grammar
- Advanced Grammar for Competitive Exams
- Advanced Vocabulary for Competitive Exams
- Advanced Reading for Competitive Exams
- Advanced Writing for Competitive Exams
- Conclusion

HUMANITIES &
SOCIAL SCIENCES

BETTER SPOKEN ENGLISH

PROF. RAJESH KUMAR
Department of Humanities and Social Sciences
IIT Madras

TYPE OF COURSE : Rerun | Elective | UG/PG
INTENDED AUDIENCE : Anyone can take this Course
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 28 Apr 2019

COURSE OUTLINE :

This course aims at introducing students in spoken English, the elements involved in it, presentation skills, etc.

ABOUT INSTRUCTOR :

Prof. Rajesh Kumar, Associate Professor, Department of Humanities and Social Sciences, Indian Institute of Technology, Madras has a Ph.D (Linguistics), University of Illinois at Urbana-Champaign, M.Phil & MA (Linguistics) from University of Delhi. His Research interests are Language in Education, Sociolinguistics, Linguistic Theory, Language and Cognition. Honours and Awards: Fellow of the Marlene and Morton Meyerson Centennial Chair (2002-03) in the Department of Asian Studies and the College of Liberal Arts at the University of Texas at Austin, U.S.A. Henry Kahane award for Outstanding Teaching Assistant 2001, Department of Linguistics, University of Illinois at Urbana-Champaign, IL, U.S.A.

The original course contents have been developed by Prof. Shreesh Chaudhary, who was a faculty member at IIT Madras. This course is one of the most popular NPTEL courses on English Language.

COURSE PLAN :

- Speaking slowly with pauses
- Production of Speech Sounds
- Some "difficult" English sounds
- English stress system
- Presentation: what & how much to say
- Stage Manners – turn out & body language
- Presentation Aid: slides, handouts, etc.
- Presenting numbers, charts, diagrams, etc.
- Presentation

FEMINIST WRITINGS

PROF. AVISHEK PARUI
Department of Humanities & Social Sciences
IIT Madras

TYPE OF COURSE : New | Elective | UG/PG
INTENDED AUDIENCE : B.A and M.A
PRE-REQUISITES : B.A in English or Cultural Studies
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 27 April 2019

COURSE OUTLINE :

This course seeks to study some of the key texts in feminist writings that engage with issues such as patriarchy, violence, embodiment, agency and identity. Through a careful study of selected fiction and non-fiction, the course aims to offer a complex understanding of gender and representation, drawing on literary as well as cultural studies.

ABOUT INSTRUCTOR :

Dr Avishek Parui is Assistant Professor in English at IIT Madras and Associate Fellow of the UK Higher Education Academy. He researches and supervises PhDs on medical humanities, masculinity studies, narrative studies, memory studies and postmodernism. His recent book Postmodern Literatures, has been published by Orient Blackswan.

COURSE PLAN :

Week 01 : Introduction; Understanding Patriarchy
Week 02 : Understanding Patriarchy; Cyborg Manifesto
Week 03 : Cyborg Manifesto; The Fly
Week 04 : The Fly; Tickets, Please!
Week 05 : Tickets, Please! ; The Goblin Market
Week 06 : The Goblin Market; The Second Sex
Week 07 : The Second Sex; Tulips
Week 08 : Tulips; The Yellow Wallpaper
Week 09 : The Yellow Wallpaper; The Iraqi Nights
Week 10 : The Iraqi Nights; Gender Trouble
Week 11 : Gender Trouble; Remains of the Feast
Week 12 : Remains of the Feast; A Temporary Matter

HUMANITIES & SOCIAL SCIENCES

INTRODUCTION TO WORLD LITERATURE

PROF. MERIN SIMI RAJ
Department of Humanities & Social Sciences
IIT Madras

TYPE OF COURSE : New | Elective | PG
INTENDED AUDIENCE : BA, MA - English
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 27 April 2019

COURSE OUTLINE :

This course is an introduction to a wide range of writings produced in different nations, languages and cultural contexts. While this course cannot claim to cover all literary traditions from all time periods, it does try to introduce the learners to representative texts that are available in English language. The objective of the course is to focus on learning how great writings can intervene and engage with global cultures while remaining rooted and situated in their specific, local contexts. These discussions need to be seen as 'entry points' that would enable to learners to explore world literatures.

ABOUT INSTRUCTOR :

Dr. Merin Simi Raj teaches in the Dept of Humanities and Social Sciences, IIT Madras. She has offered NPTEL courses namely, History of English Language and Literature; Postmodernism in Literature and Indian Fiction in English. Her other research and teaching interests are: Literary Criticism and theory; Anglo-Indian Studies and Literary historiography Studies.

COURSE PLAN :

Week 01 : Introduction
Week 02 : Classics:Beowulf, Don Quixote, Arabian Nights
Week 03 : Indian literature:Kalidasa, Tagore, Rushdie, Kamala Das
Week 04 : Literature in translation:Akutagawa's In a GroveBorges' Garden of Forking PathsManto's Toba Tek Singh
Week 05 : Short stories and excerpts from novels:Marquez, Borges, Calvino, Flaubert, Tolstoy
Week 06 : PoetryDover Beach, Wasteland, Song of Lawino
Week 07 : DramaIbsen's Doll's HouseShakespeare's Othello
Week 08 : African-American literatureToni MorrisonAchebe's Things Fall ApartEveryday Use by Alice Walker
Week 09 : English and American literature:Arnold's Dover BeachEliot's WastelandFaulkner's A Rose for Emily
Week 10 : Women writers:Gilman's Yellow WallpaperAphra Behn's Oroonoko
Week 11 : Prose (non-fiction) and critical theory:Aristotle's PoeticsBarthes' Death of the authorWoolf's A Room of One's Own Kolodny's Dancing through the minefield
Week 12 : Contemporary writers and new genres

HUMANITIES & SOCIAL SCIENCES

AN INTRODUCTION TO MICROECONOMICS

PROF. VIMAL KUMAR
Department of Economics
IIT Kanpur

TYPE OF COURSE : Rerun | Core | PG
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
PRE-REQUISITES : Class 12 level maths
EXAM DATE : 27 Apr 2019
INTENDED AUDIENCE : Undergraduate Economics Students, Professionals from other stream interested in learning Economics
INDUSTRIES APPLICABLE TO : All Banking Enterprises

COURSE OUTLINE :

Microeconomics is the study of the allocation of scarce resources among individuals. Economic theories are based on the assumption that individuals as well as firms have well defined objectives; utility maximization for individuals and profit maximization for firms and they act systematically according to the incentives and constraints of their economic environment. It is this framework that allows the economist to gain a fundamental understanding of the human puzzle in an economic setting. This course in the fundamentals of economics covers consumer theory, producer theory as well as the market structures through which individuals and firms interact.

ABOUT INSTRUCTOR :

After receiving a Ph.D. in Economics from University of California Irvine in 2008, Vimal Kumar worked in the research division of a multinational firm called Watson Wyatt Worldwide for a year. In June 2009, he joined Indian Institute of Technology Kanpur, and is currently an Associate Professor at IITK.

COURSE PLAN :

Week 01 : What is Economics, Demand, Supply, Equilibrium, Change in Supply and Demand, Elasticity
Week 02 : Comparative Statics, Consumer Theory, Preferences, Utility Maximization, Substitution and Income Effect, Fiffin Goods
Week 03 : Compensated Demand, Producer Theory, Type of Firms, Production functions and Isoquants, Factor Substitutions, Return to Scale and Economies of Scale
Week 04 : Cost Curves, Cost Functions, Cost Minimization, Profit Maximization, Market Structures, perfect and Imperfect Markets
Week 05 : Perfectly competitive firm, Monopoly, Market Power, Price discrimination, Taxation, Introduction to Game Theory
Week 06 : Cost Curves
Week 07 : Market Environment 1,Perfectly Competitive Market,Short Run vs. Long Run
Week 08 : Equilibrium Analysis,Social Surplus,Dead weight Loss
Week 09 : Market Environment 2- Monopoly,Profit Maximization
Week 10 : Price Discrimination,First Degree,Second Degree,Third Degree
Week 11 : Introduction to Game Theory,Nash Equilibrium
Week 12 : Market Environment 3- Oligopoly,Cournot Game,Bertrand Game

MANAGEMENT

MANAGEMENT

04 weeks

01. Management of Field Sales
02. Services Marketing: A Practical Approach
03. MCDM Techniques Using R & MATLAB
04. Design Thinking - A Primer

08 weeks

01. Foundation Course in Managerial Economics
02. Managing change in organizations
03. Principles Of Human Resource Management
04. Sales and Distribution Management
05. Consumer Behaviour
06. Marketing Management - II
07. Global Marketing Management
08. Total Quality Management - II
09. Manufacturing Strategy
10. Supply Chain Analytics
11. Systems Engineering: Theory & Practice

12 weeks

01. Business analysis and data mining Modeling using R (Part -1)
02. Financial Statement Analysis and Reporting
03. Financial Institutions and Markets
04. Soft Skills For Business Negotiations And Marketing Strategies
05. Marketing Research and Analysis-II
06. Business Statistics
07. Business Analytics For Management Decision
08. Data Analysis & Decision Making - II
09. Six Sigma
10. Quality Design And Control
11. Operations and supply chain management
12. Advanced Green Manufacturing Systems

MANAGEMENT

MANAGEMENT OF FIELD SALES

PROF. JAYANTA CHATTERJEE
Department of Management
IIT Kanpur

TYPE OF COURSE : New | Core | UG/PG
COURSE DURATION : 4 weeks (28 Jan'19 - 22 Feb'19)
INTENDED AUDIENCE : B.E/B.Tech, M.E/M.Tech, M.S, PhD
EXAM DATE : 31 Mar 2019
PRE-REQUISITES : Familiarity with the Marketing Management I course will be useful

INDUSTRIES APPLICABLE TO : IT Companies/ R&D Companies/ Pharma Companies/ Manufacturing and Services sector

COURSE OUTLINE :

This is a post graduate level course on Sales Management. The objective of the course is to familiarize the participants with methods for identifying opportunities and how to convert the opportunities into relationship based sales. Participants will be provided with practical illustrations of theoretical concepts. After attending the course participants will be familiar with various techniques, processes and models for developing personal selling competency as well as the strategies for managing the field sales teams.

ABOUT INSTRUCTOR :

Prof. Jayanta Chatterjeeis is an Adjunct Senior Professor of Marketing, Sales and Strategy in the Department of Industrial and Management Engineering at IIT Kanpur. An Electrical Engineering graduate from Jadavpur University, M.Tech and PhD from IIT Delhi,(.) Prof. Chatterjee has eighteen years of Management teaching experience in India and abroad and 30 years of hands on management experience in different countries. He has risen through Sales, Marketing, Project Management, Technology and Business development functions in top multinationals like Siemens, Allen Bradley, and Rockwell International to CEO and Executive Director positions. He has founded two successful start-ups and mentored many. His earlier courses on Marketing Management I and II, Strategic marketing and Managing Services on NPTEL are well subscribed. The book on Services marketing co-authored by Prof Chatterjee and published by Pearson India is also well known.

COURSE PLAN :

Week 01 : Evolution of Field Sales,Relationship driven Selling-Fundamentals,Value based Selling strategies,Communication for Sales,Theoretical,FoundationProduct Life Cycle (PLC) and chasm

Week 02 : Products and Solutions,Approaches for Solution Selling,Buying Process Fundamentals-I,Buying Process Fundamentals- II,Opportunity classifications

Week 03 : Account based sales management,Adaptive Selling strategy,Consultative Interactions for the sales person,Pitching and Presentation,Sales Negotiation

Week 04 : Adaptive Sales Closing,Service management post-sales,Managing Sales Teams,Sales Automation,Personal Development for the Sales manager

SERVICES MARKETING – A PRACTICAL APPROACH

PROF. BIPLAB DATTA
Vinod Gupta School of Management
IIT Kharagpur

TYPE OF COURSE : Rerun | Elective | UG/ PG
INDUSTRY SUPPORT : Any company has to manage its services. Hence, any company will recognize/value this online course

COURSE DURATION : 4 weeks (28 Jan'19 - 22 Feb'19)
EXAM DATE : 31 Mar 2019

COURSE OUTLINE :

This course will help students to learn the fundamentals of services marketing from a practical point of view. The course focusses on the needs of the customers, who are to be kept satisfied and delighted for a business to prosper. The course will help students understand services marketing from various perspectives and will also be useful if participants wish to establish a new service business of manage an existing one.

ABOUT INSTRUCTOR :

Prof. Biplab Datta, is an Associate Professor (Marketing) at Vinod Gupta School of Management, Indian Institute of Technology Kharagpur, India. He holds a Ph.D. degree from Indian Institute of Technology Delhi, India. His research interests include Marketing Management, Service Quality Management and Customer Relationship Management. He was awarded a Silver Medal in Architecture by IIT Kharagpur in 1992 and earned ISO 9000 Lead Auditor Certificate from NBA, U.K. He has published a book entitled "Services Marketing: A Practical Approach". He has published several papers in national and international journals.

COURSE PLAN

Week 1 : Introduction, Why Study Services Marketing Management?, The Service System, Characteristics of Services, Understanding the Macro-Environment

Week 2 : Understanding the Micro-Environment, Services Marketing Process, Services Marketing Research, Exploring Marketing Opportunities, New Service Development, Segmenting the Market, Targeting and Positioning, Understanding Consumer Behaviour, The Service Product, Service Quality, Designing the Service Process

Week 3 : Developing Service Personnel, Educating Customers, Managing Service Delivery Channels, Managing Channel Conflict, Managing Demand and Capacity, Designing the Physical Evidence, Managing Integrated Marketing Communications, Pricing the Service, Managing Customers, Managing Service Recovery, Providing Service Guarantees, Consumer Protection.

Week 4 : Case Studies in Services Marketing-1, Case Studies in Services Marketing-2, Case Studies in Services Marketing-3, Case Studies in Services Marketing-4, Case Studies in Services Marketing-5

MANAGEMENT

MCDM TECHNIQUES USING R & MATLAB

PROF. GAURAV DIXIT
Department of Management
IIT Roorkee

TYPE OF COURSE : New | Elective | UG/PG
INTENDED AUDIENCE : UG, PG, MBA, PhD
COURSE DURATION : 4 weeks (25 Feb'19 - 22 Mar'19)
EXAM DATE : 27 April 2019
INDUSTRIES APPLICABLE TO : R&D organizations, Government Agencies, Consultancy firms

COURSE OUTLINE :

The objective of this subject is to introduce students with the concepts, tools and techniques of decision making under multiple criteria using software platforms like R & MATLAB.

ABOUT INSTRUCTOR :

Dr. Gaurav Dixit is an Assistant Professor in the Department of Management Studies at the Indian Institute of Technology Roorkee. He earned his doctoral degree from the Indian Institute of Management Indore and an engineering degree from Indian Institute of Technology (BHU) Varanasi. Previously, he worked in Hewlett-Packard (HP) as software engineer, and Sharda Group of Institutions as project manager on deputation.Gaurav's research focuses on information technology (IT) strategy, electronic commerce, electronic waste, data mining, and big data analytics and provides insights on business and social value of IT. His research has appeared in quality journals & conferences, including Resources, Conservation and Recycling, Journal of Global Information Technology Management, Sustainable Production and Consumption, Journal of Information Technology Management, DIGITS conference, India Finance Conference, Indian Academy of Management conference, and Academy of Management conference.

COURSE PLAN :

Week 01 : Basics and Principles of MCDM, MAVT & MAUT
Week 02 : AHP Method, Distance Based Methods
Week 03 : Outranking Methods, Group Decision Making, DEA Method
Week 04 : Structural Models, MODM Solving Methods

MANAGEMENT

DESIGN THINKING - A PRIMER

PROF. ASHWIN MAHALINGAM
Department of Civil Engineering
IIT Madras

PROF. BALA RAMADURAI
Consultant

TYPE OF COURSE : New | Elective | UG/PG
INTENDED AUDIENCE : BE/ME any discipline
COURSE DURATION : 4 weeks (25 Feb'19 - 22 Mar'19)
EXAM DATE : 27 April 2019

INDUSTRIES APPLICABLE TO : Many industries and institute recognize the need for design thinking - e.g., ICT, manufacturing, sales, marketing

COURSE OUTLINE :

Design thinking is a systematic method of solving problems. This method is unique that it starts and ends with humans. The design thinkers start by observing, interviewing or just plain experiencing a situation. Then, they proceed to improve the situation of the humans by solving problems for them.

ABOUT INSTRUCTOR :

Dr. Bala Ramadurai is an independent innovation consultant and professor. He has 3 patents to his credit and 10+ publications in international research journals. He co-founded TRIZ Innovation India (http://trizindia.org) and is an Adjunct Professor at Symbiosis Institute of Business Management, India. He has a PhD from Arizona State University, USA, and a B.Tech from IIT Madras, India.

Dr. Ashwin Mahalingam joined the faculty in the Building Technology and Construction Management division of the Civil engineering department at IIT-Madras in 2006. Ashwin received his B.Tech in Civil engineering from IIT-Madras and then proceeded to Stanford University for a Masters in Construction Engineering and Management. He then helped start up an internet based company in the USA called All Star Fleet, aimed at providing asset management services for construction companies.

COURSE PLAN :

Week 01 : Introduction to Design Thinking
Week 02 : Empathize Phase: Customer Journey Mapping
Week 03 : Analyze Phase: 5-Whys and How might we...
Week 04 : Solve Phase: Ideation: Free Brainstorming & Make/Test Phase: Prototype

FOUNDATION COURSE IN MANAGERIAL ECONOMICS

MANAGEMENT

PROF. BARNALI NAG
Vinod Gupta School of Management
IIT Kharagpur

TYPE OF COURSE : Rerun | Elective | UG/ PG
INDUSTRY SUPPORT : Public Policy organizations, Banks, Managerial levels in all Industries.
PRE-REQUISITES : Basic Algebra and Calculus

COURSE DURATION : 8 weeks (25 Feb'19 - 19 Apr'19)
EXAM DATE : 28 Apr 2019

COURSE OUTLINE :

This course is developed to teach modern microeconomic theory to understand the behavior of household, firms and their interaction under different market structure. The purpose of this course is to provide students with a basic understanding of economic theory that can be used in managerial decision making problems within various organizational settings such as a firm or a government agency. Objective is to develop a good understanding of economic concepts and tools that have direct managerial applications.

ABOUT INSTRUCTOR :

Prof. Barnali Nag teaches economics and business environment in Vinod Gupta School of Management, IIT Kharagpur. She is a PhD from IGIDR (Indira Gandhi Institute of Development Research), Mumbai and did her post-doctoral research from Wharton Business School, University of Pennsylvania. She has worked as Business Research Fellow at the Indian School of Business, Hyderabad and RIS, New Delhi, Ministry of External Affairs, GoI, an advanced Institute for actionable research. Before joining VGSoM, IIT Kharagpur, she was a faculty in Indian Institute of Management Kashipur. Dr. Nag has published in various refereed international journals of repute.

COURSE PLAN

Week 1 : Introduction, Demand and Supply

Week 2 : Elasticity of demand and supply.

Week 3 : Government intervention and efficiency

Week 4 : Producer theory and cost curves.

Week 5 : Market structures and perfect competition.

Week 6 : Monopoly and histology images.

Week 7 : Monopolistic competition

Week 8 : Oligopoly

MANAGEMENT

MANAGING CHANGE IN ORGANIZATIONS

PROF. KBL SRIVASTAVA
Department of Humanities and Social Sciences
IIT Kharagpur

TYPE OF COURSE : New | Elective | PG
INTENDED AUDIENCE : MBA/PGDM/MBA(HR)MHRM
COURSE DURATION : 8 weeks (28 Jan'19 - 22 Mar'19)
EXAM DATE : 31 March 2019

INDUSTRIES APPLICABLE TO : IT Sector/ R & D/ Pharma/ Manufacturing and Services Sector

COURSE OUTLINE :

The course aims to equip students to develop themselves into a critically reflective and capable scholar, practitioner, or a manager who can facilitate the change process in their organizations and can act as change leaders. The major objective of the course is to help students to understand why organizations need to change, how to scan the environment and find out the need for change, what are the various types of change taking place in organizations, and one can diagnose the kind of change organizations require. The course will offer students tools and framework for the diagnosis for organizational change which would enable them to understand the change process in order to better implement the change.

ABOUT INSTRUCTOR :

Dr Kailash B L Srivastava is Professor, Department of Humanities and Social Sciences and Joint Professor in Vinod Gupta School Management, and specializes in the area of Human Resource Management and Development and Organizational Behaviour at Indian Institute of Technology, Kharagpur. He holds a first class Master's degree in Psychology from Gorakhpur University and Ph.D. from Indian Institute of Technology, Kanpur, and has around 28 years of teaching, research, and training experience. He has taught earlier at BITS Pilani, and T A Pai Management Institute, Manipal, and also served as visiting faculty in XLRI, Jamshedpur (2002), and Asian Institute of Technology, Bangkok (2005), and UNU Tokyo (2013).

COURSE PLAN :

Week 01 : Nature of Organizational Change, Perspectives of Organizational Change, image of change managers Type of change: Incremental vs. transformation
Week 02 : Identifying the need for change: external and internal pressure for change; Scope of change: culture, strategy, technology, people management system, structure
Week 03 : Diagnosing organizational change: models and frameworks for change; managing resistance to change
Week 04 : Implementing change: Organizational development approaches to change; contingency and process based approaches
Week 05 : Linking vision and mission with change; leading change, politics of change, factors affecting change
Week 06 : Communicating change, strategies for change communication, sustaining change; Evaluating change, the role of change agents
Week 07 : Organizational change and innovation, Linking change management with organizational learning and learning organizations
Week 08 : Case examples and successful change management efforts in Indian organizations, Turnaround strategies, strategic convergence and learning from change , organizational effectiveness and change

MANAGEMENT

PRINCIPLES OF HUMAN RESOURCE MANAGEMENT

PROF. ARADHNA MALIK
Department of Management
IIT Kharagpur

TYPE OF COURSE	: Rerun | Elective | UG/PG	**COURSE DURATION**	: 8 weeks (28 Jan'19 - 22 Mar'19)
INTENDED AUDIENCE	: BE/ME, BBA/MBA	**EXAM DATE**	: 31 Mar 2019
PRE-REQUISITES	: Any student who has passed class XII		

COURSE OUTLINE :

Management of human resources is the most important function in any organization. It is essential to achieve a balance between caring for one's employees, helping them work to their maximum potential and achieving the goals of an organization through the work the employees put in. This course is specifically designed to sensitize students who are preparing to enter the workforce issues related to workforce management.

ABOUT INSTRUCTOR :

Prof. Aradhna Malik earned her Masters in Child Development from Punjab University, Chandigarh, India and PhD from University of Denver, USA. She has been serving Indian Institute of Technology Kharagpur as faculty in the School of Management since 2008. She teaches intercultural communication, business ethics and organizational behavior to Undergraduate, Masters and Doctoral level students. Her research and academic interests include, ageing, orality, human technology interaction, intercultural communication, communication disorders, management of public health and neuro linguistic programming (NLP).

COURSE PLAN :

Week 01 : Introduction to HRM, Staffing / Recruitment: Job Analysis and Design, Human resource Planning / Recruitment, Employee Testing and Selection, Interviewing Candidates | Performance Management and Appraisal Process : Performance Appraisal Process / Types of Performance Appraisal / Performance Evaluation / Performance Feedback

Week 02 : Training and development : Training Process / Need for Training / Training Methods / General and Specific Training/ Training evaluation

Week 03 : Managing Careers : Basics of Career Management / Career Planning / Succession Planning/ Career Development / Promotions and Transfers / Employee Commitment | Implications : Implications of the above in real life.

Week 04 : Compensation Management : Components of Wage Structure / Wage and Salary Administration / Compensation Structure / Compensation Benchmarking / Internal and External Parity / Competency based pay.

Week 05 : Pay for Performance and Incentives : Competency / Performance based pay / Variable pay / Team or Group base pay / Incentives / Managerial Incentives / Fringe Benefits.

Week 06 : Benefits and Services : Retirement / Insurance / Flexible benefits | Employee Relations : Ethics, Justice and Fair treatment in HR / Collective Bargaining /Employee Safety and Health / Managing Global Human Resources / International HRM

Week 07 : Strategic Human Resource Management and HR Scorecard :Linking people, strategy and performance HR – Strategic Partner, Creating an HR scorecard, Measuring HR alignment

Week 08 : Conclusion

SALES AND DISTRIBUTION MANAGEMENT

MANAGEMENT

PROF. SANGEETA SAHNEY
Vinod Gupta School of Management
IIT Kharagpur

TYPE OF COURSE : New | Elective | PG
INTENDED AUDIENCE : PG Course, MBA. PhD
COURSE DURATION : 8 weeks (25 Feb'19 - 19 Apr'19)
EXAM DATE : 28 April 2019

INDUSTRIES APPLICABLE TO : This is a marketing elective which deals with effective and efficient sales force management. Every company that deals with customers sales will recognize the relevance of this course.

COURSE OUTLINE :

The course investigates factors influencing the optimal design and management of distribution channels with particular emphasis on sales force management and channel designs for improving efficiency. The objective of the Course is to provide an understanding of Sales Management, with particular emphasis on sales force management.

ABOUT INSTRUCTOR :

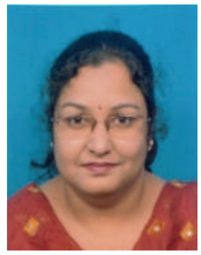
Sangeeta Sahney is Professor at the Vinod Gupta School of Management, IIT Kharagpur A gold medalist in MBA, and a PhD. From IIT Delhi in Management, she served as a faculty member at U.P Technical University and IIT Roorkee, before joining IIT Kharagpur in 2005. With a specialization in Marketing, she also teaches Organizational Behavior and HRM. Her research interests include studies in consumer behavior, organizational behavior and service quality primarily quality management in education. She has also taught at AIT, Bangkok as a part of the Indian Secondment in 2009 and 2016. She has published research papers in many leading national and international journals, and has also received several awards and accolades. She has also authored a book, titled Consumer Behavior, published by Oxford University Press.

COURSE PLAN :

Week 01 : Introduction to Sales Management
Week 02 : Determining Sales related Marketing Policies, Sales Organization; Sales Department Relations
Week 03 : Sales Organization; Sales Department Relations, Planning, Sales Forecasting and Budgeting
Week 04 : Buyer-Seller Dyads, Diversity of Personal-selling Situations, Theories of Selling
Week 05 : The Selling Process, Sales Force Management
Week 06 : Sales Force Management
Week 07 : Management of Sales Territory & Management of Sales Quota
Week 08 : The Sales Budget , Sales Control, Distribution Channel Management

CONSUMER BEHAVIOR

MANAGEMENT



PROF. SRABANTI MUKHERJEE
Vinod Gupta School of Management
IIT Kharagpur

TYPE OF COURSE : Rerun | Elective | UG/ PG
INDUSTRY SUPPORT : Marketing Department of the companies dealing in B2C and B2B markets
COURSE DURATION : 8 weeks (28 Jan'19 - 22 Mar'19)
EXAM DATE : 31 Mar 2019

COURSE OUTLINE :

Drawing heavily from the fields of psychology, anthropology and economics; the course Consumer Behaviour puts forth the decision-making processes of buyers, both individually and in groups. It studies the decision-making parameters at both individual as well as group levels as endeavors to understand the consumer preferences and choice heuristics. The course will also bring forth the parameters, process and conflicts while considering family as decision-making unit. The course will sensitize the participants about how the aforesaid concepts will help them in designing appropriate marketing mix and the overall marketing strategy.

ABOUT INSTRUCTOR :

Prof. Srabanti Mukherjee is an Assistant Professor in Marketing at Vinod Gupta School of Management, Indian Institute of Technology Kharagpur, India. She holds a PhD degree from Indian Institute of Engineering Science and Technology Shibpur, India. Prior to joining this Institute she has taught in several premiere institutes including Indian Institute of Management Indore, Indian Institute of Social Welfare and Business Management, IIEST Shibpur and Visva Bharti University.

COURSE PLAN

Week 1: Introduction to Consumer Behaviour, The Changing Patterns of Consumer Behaviour, Use of Market , Segmentation in Consumer Behaviour, Dimensions of Consumerism, Process of Motivation

Week 2: Theories of Motivation-1, Theories of Motivation-2, Consumer Involvement, Case study on Motivation and Involvement, Consumer perception and imagery

Week 3: Case Study on Consumer Perception formation, Theories of Personality, Self-Concept, Learning theories, Case Study on Consumer Learning Process

Week 4: Attitude Formation-1, Attitude Formation-2, Changing Attitude, Attitude Formation, Case Study on Consumer, Consumers' Value

Week 5: AIO classification of Lifestyle, VALS^TM Typology, Application of Lifestyle in Marketing, Culture and subculture, Group as a determinant of buyer behaviour

Week 6: Celebrities as Reference group, Concept of family and family life-cycle, Family Buying Decisions, Case Study on Family Buying Decisions, Diffusion of Innovation

Week 7: Opinion Leadership Types of Consumer Buying Behaviour, Black-Box Model, Modelling Buyer Behaviour-1, Modelling Buyer Behaviour-2

Week 8: Modelling Buyer Behaviour-3, Modelling Industrial buyer Behaviour-1,Modelling Industrial buyer Behaviour-2, Dimensions of Consumer Research, Course Wrap up

MARKETING MANAGEMENT - II

MANAGEMENT

PROF. JAYANTA CHATTERJEE
PROF. SHASHI SHEKHAR
IIT Kanpur

TYPE OF COURSE : Rerun | Elective | UG/ PG
INDUSTRY SUPPORT : FMCG, Automotive, Chemical, Pharmaceutical, Engineering and Service Industries
PRE-REQUISITES : Graduation, Marketing Management-I
INTENDED AUIDENCE : BE/ME/BBA/MBA
COURSE DURATION : 8 weeks (28 Jan'19 - 22 Mar'19)
EXAM DATE : 31 Mar 2019

COURSE OUTLINE :

This is part-II of a course on Marketing Management. The objective of the course is to introduce the participants to principles and practices, theoretical building blocks of marketing, its role as an organizational engine and the evolving marketing process of today. At the end of the course, a participant will be able to understand and manage the core marketing management function.

ABOUT INSTRUCTOR :

Dr. Shashi Shekhar Mishra was working as Assistant Professor in the Department of Industrial and Management Engineering at Indian Institute of Technology Kanpur since December 2011. Dr. Mishra received his PhD (Marketing) from Indian Institute of Management, Lucknow. He holds an Engineering degree in chemical technology from H.B.T.I. Kanpur, and has worked for three years in petrochemical and automobile industry before joining the doctoral program at IIM Lucknow.

Prof. Jayanta Chatterjee is Senior Professor of Marketing, Strategy and Innovation in the Department of Industrial and Management Engineering at IIT Kanpur. An Electrical Engineering graduate from Jadavpur University, M.Tech and PhD from IIT Delhi, Prof. Chatterjee has fifteen years of Management teaching experience in India and abroad and 30 years of hands on management experience in different countries.

COURSE PLAN

Week 1 : Design, Launch, & Management of Market Offerings

Week 2 : Design, Launch, & Management of Market Offerings - contd

Week 3 : Services Marketing

Week 4 : Brand Management

Week 5 : Brand Management - contd

Week 6 : Design and Implementation of Pricing Strategies

Week 7 : Marketing Channels and Distribution System

Week 8 : Integrated Marketing Communication

MANAGEMENT

GLOBAL MARKETING MANAGEMENT

PROF. Z. RAHMAN
Department of Management
IIT Roorkee

TYPE OF COURSE : New | Elective | PG
INTENDED AUDIENCE : MBA, MIB, MBA-IB, M.Com
COURSE DURATION : 8 weeks (25 Feb'19 - 19 Apr'19)
EXAM DATE : 28 April 2019

INDUSTRIES APPLICABLE TO : All companies working in exports and international business

COURSE OUTLINE :

Global business comprises of a large and growing portion of the world's total business. Today, global events and competition affect almost all companies- large and small-because most sell output to and secure supplies from foreign countries. Many companies also compete against products and services that come from abroad. Thus most managers, regardless of industry or company size, need to approach their operating strategies, from a global perspective. In view of the above, this course provides a fresh, up-to-date analysis of the global business environment and successfully blends a comprehensive review of global business with exhaustive discussion of what happens in the many parts of the global market. Moreover, the course not only describes the ideas of global marketing but also presents many contemporary examples, scenarios and cases. This course will therefore provide first-hand knowledge of Global Marketing operations and help practitioners and budding scholars of international business.

ABOUT INSTRUCTOR :

Dr. Zillur Rahman is Associate Professor and Head in the Department of Management Studies, Indian Institute of Technology, Roorkee. He received his B.Sc. (Hon.) Mathematics, MBA and Ph.D from Aligarh Muslim University, India. Dr. Rahman has more than 20 years of experience in academia. He has delivered research talk in many countries including USA, Switzerland, Germany, France, Italy and Turkey. He has published research papers in reputed international papers including the Journal of Cleaner Production, Journal of Service Marketing, Telematics and Informatics, International Journal of Contemporary Hospitality Management, among others. Prof. Rahman is recipient of Highly Commended Paper in Emerald Literati Network Awards for Excellence, 2016. Prof. Rahman is also the recipient of Commendable Faculty Award in the domain Business, Management and Accounting, 2018.

COURSE PLAN :

Week 01 : Globalization,Global Economic Environment:
Week 02 : Financial Environment,Cultural Issues and Buying Behavior,Political/Legal Environment
Week 03 : Political/Legal Environment,Global Marketing Research,Global Segmentation and Positioning:
Week 04 : Global Marketing Strategies,Global Market Entry Modes,Global Product Development
Week 05 : Global Product Development,Marketing Products and Services,Global Pricing:
Week 06 : Communicating with the World Consumer,Sales Management,Global Logistics and Distribution
Week 07 : Global Logistics and Distribution,Export/Import Management,Planning, Organization, and Control of Global Marketing Operations
Week 08 : Planning, Organization, and Control of Global Marketing Operations,Marketing in Emerging Markets,-Global Marketing and the Internet.

MANAGEMENT

TOTAL QUALITY MANAGEMENT - II

PROF. RAGHU NANDAN SENGUPTA
Department of Humanities and Social Sciences
IIT Kanpur

TYPE OF COURSE : Rerun | Elective | PG
COURSE DURATION : 8 weeks (28 Jan'19 - 22 Mar'19)
INDUSTRY SUPPORT : All service, manufacturing, industry, government department, any type of private industry
EXAM DATE : 31 Mar 2019

INTENDED AUDIENCE : Masters in Business Administration, Masters in Economics, Masters in Statistics/Mathematics, Masters in Industrial Engineering, Masters in Operations Research/Operations Management, Phd in related fields as mentioned above

PREREQUISITES : Probability & Statistics

COURSE OUTLINE :

This is the second part of the two part course (TQM-I, TQM-II) and will cover topics ranging from Quality Engineering, Quality Function Development, Introduction to Design of Experiments, Process Optimization and Robust Product Design, Steps to Six Sigma, Management of Quality, its ultimate philosophy, etc.

ABOUT INSTRUCTOR :

Prof. Raghu Nandan Sengupta completed his bachelors in engineering in Mechanical Engineering from Birla Institute of Technology Mesra, Ranchi INDIA and his FPM (PhD) from Indian Institute of Management Calcutta, INDIA with specialization in Operations Management. His research interests are in Sequential Analysis, Statistical & Mathematical Reliability, Optimization and its use in Financial Optimization. His research work has been published in journals like Metrika, European Journal of Operational Research, Sequential Analysis, Computational Statistics & Data Analysis, Communications in Statistics: Simulation & Computation, Quantitative Finance, etc. At Indian Institute of Technology Kanpur, he is a Professor in the Industrial & Management Engineering Department and teaches courses like Probability & Statistics, Stochastic Processes & their Applications, Management Decision Analysis, Financial Risk Management, etc.

COURSE PLAN

Week 1 : Quality Engineering, Quality Function Deployment

Week 2 : Quality Function Deployment, Introduction to Design of Experiments

Week 3 : Introduction to Design of Experiments

Week 4 : Introduction to Design of Experiments

Week 5 : Introduction to Design of Experiments, Process Optimization and Robust Product Design

Week 6 : Process Optimization and Robust Product Design

Week 7 : Process Optimization and Robust Product Design, Steps to Six Sigma

Week 8 : Steps to Six Sigma, Management of Quality, its ultimate philosophy

MANAGEMENT

MANUFACTURING STRATEGY

PROF. RAJAT AGRAWAL
Department of Industrial & Systems Engineering
IIT Roorkee

TYPE OF COURSE : New | Elective | UG/PG
COURSE DURATION : 8 weeks (25 Feb'19 - 19 Apr'19)
INTENDED AUDIENCE : B.E/B.Tech,M.S,B.Sc,M.Sc,PhD
EXAM DATE : 27 Apr 2019
INDUSTRIES APPLICABLE TO : Manufacturing companies like GM, Tata Motors, Tata Steel, Process industries such as ONGC, Mining industry like Coal India Limited , Construction companies like L&T, General Electric, R&D organizations

COURSE OUTLINE :

The aim of this course is to provide a treatment to manufacturing functions to gain competitive advantage. Normally, operation activities are considered reactive in nature. Therefore, organizations are not able to use operation function for competitiveness. W.Skinner wrote the seminal article in HBR in 1969 to highlight the role of manufacturing in corporate strategy. This course will discuss the process of formulation of manufacturing strategy and will also discuss various tools and techniques for making a world class organization. This course will have a right blend of theory and case discussions.

ABOUT INSTRUCTOR :

Prof . Rajat Agrawal is a member of faculty (Associate Professor) at Department of Management Studies, Indian Institute of Technology, Roorkee. He is also associate faculty member at Center of Excellence for Disaster Mitigation and Management and Center of Excellence for Transportation Management, IIT Roorkee. He administers various initiatives of IIT Roorkee in the field of IPR, incubation and entrepreneurship in different capacities. He initiated incubation centre at IIT Roorkee. He is co-cordinator of Design innovation centre at IIT Roorkee.

COURSE PLAN :

Week 01 : (1) Manufacturing output (2) Operations Systems (3) Operations Strategy (4) Functional strategy within context of a firm (5) Functional dominance within corporate strategy

Week 02 : (1) Concept of world class manufacturing organization (2) 6 Ps of Manufacturing (3) Skinners' view and Hayes and Wheelwright framework of Manufacturing Strategy (4) Alternative paradigm of manufacturing strategy (5) Some generic manufacturing strategies I

Week 03 : (1) Developing a manufacturing strategy (2) Understanding markets (3) The concept of order winners and qualifiers (4) Basic Characteristics and Specific Dimensions of Order Winners and Qualifiers (5) Some specific order winners and qualifiers I

Week 04 : (1) Some specific order winners and qualifiers II (2) Some specific order winners and qualifiers III (3) Some specific
order winners and qualifiers (Non operation related criteria) (4) Developing an Operations Strategy: Methodology (5) Developing an Operations Strategy

Week 05 : (1) Developing an Operations Strategy: Roth and Miller Classification, (2) Enlightened View of Manufacturing, (3) Manufacturing Strategy Taxonomy: Some evidences from China (4) Quality Management and Manufacturing Excellence, (5) Total Quality Management and Manufacturing Excellence

Week 06 : (1) Deming's approach to Quality (2) Business Excellence Awards (3) Process Choice (4) Process Choice: 3 Dimensional View (5) Product Profiling

Week 07 : (1) Critical success factors for World Class Manufacturing (2) Value Added Engineering (3) Total Employee Involvement (4) HR theories for Operations Strategy (5) Flexible Manufacturing system

Week 08 : (1) Concept of Focus wrt Manufacturing Strategy (2) Toyota production System I (3) Toyota production System II (4) World Class Manufacturing and India (5) Achieving World Class Status

SUPPLY CHAIN ANALYTICS

MANAGEMENT

PROF. RAJAT AGRAWAL
Department of Management Studies
IIT Roorkee

COURSE DURATION : 8 weeks (28 Jan'19 - 22 Mar'19)
EXAM DATE : 31 Mar 2019

TYPE OF COURSE : Rerun | Elective | UG/ PG
INTENDED AUDIENCE : It is an elective course for PG students and working professionals.
PRE-REQUISITES : Basic knowledge of Operations management will be desirable.

COURSE OUTLINE :

In present time of intense global competition, customers are demanding more and more variety, with better quality and service at lowest cost. This means that in order to be successful, firms need to develop supply chain strategies and logistical capabilities that serve the needs of their customers whilst maximizing overall profitability. All supply chains, in order to function properly, must focus on the huge opportunity that exists in their analytics.

ABOUT INSTRUCTOR :

Prof. Rajat Agrawal is an Associate Professor at Department of Management Studies, Indian Institute of Technology Roorkee, He is associate faculty member at Center of Excellence for Disaster mitigation and Management and Center of Excellence for Transportation Management, IIT Roorkee. He administers various initiatives of IIT Roorkee in the field of IPR, incubation and entrepreneurship in different capacities.

COURSE PLAN

Week 1: Context of today's supply chains (SC) analytics, Understanding and defining the supply chain analytics (SCA), Revisions of Basic Lessons of Supply Chain Management, Why is Analytics Important in a supply chain?, Relating Operations Management with Supply chain concepts with SC Analytics, The importance of supply chain analytics in the flows involving material, money, information and ownership

Week 2: Supply chain analytics, Key issues in supply chain analytics, What involves in supply chain analytics, Concept of Descriptive Analytics in a Supply Chain, Discussion on a Few Supply Chains Analytics applications in India (students participation is expected), Decision Domains in in supply chain analytics

Week 3: Foundation of Business Anlaytics (BA), E2: Introduction to Modeling, Approaches for Optimization and Simulation, Modeling software, Supply Chain (SC) Decisions that requires mathematical or interpretative modelingUnderstanding of Data and its role in Analytics, Analytics of a Transportation problem in a Supply Chain, Managerial implication of results of analytics

Week 4: A case study of supply chain analytics

Week 5: Foundation of Prescriptive Analytics In Network Planning In A Supply Chain, Network Planning in a Supply Chain, Importance of Network Planning, Design of Logistics Network using Heuristics/optimization (Exercise 3.4 Levi (2008) Concept of 3PL/4PL in a Supply Chain, Case Study: GATI

Week 6: Foundation of Modeling Coordination Decisions in Supply Chain Management

Week 7: Foundation of Performace Management In Supply Chain Management

Week 8: It Enablement Of Supply Chains, Role of ICT in Supply chains

MANAGEMENT

SYSTEMS ENGINEERING: THEORY & PRACTICE

PROF. DEEPU PHILIP
Department of Design Programme
IIT Kanpur

TYPE OF COURSE : Rerun | Elective | UG/ PG
COURSE DURATION : 8 weeks (25 Feb'19 - 19 Apr'19)
INDUSTRY SUPPORT : HAL, BHEL, BEL, L&T, Automotive companies, Aerospace and defense companies, DRDO, Boeing, Lockheed, Airbus, Brahmos, ISRO, VSSC, etc.
EXAM DATE : 28 Apr 2019
PREREQUISITES : The student should have either completed an engineering degree or is enrolled in the program and have completed at least six semesters of the curriculum
INTENDED AUDIENCE : Students of all engineering disciplines, specifically, Aerospace, Mechanical, Electrical, Civil, Chemical, and Computer Science

COURSE OUTLINE :

Systems engineering is a discipline that utilizes an inter-disciplinary problem-solving approach across the entire technical effort irrespective of whether the systems or the systems of systems are for military, industrial, commercial or civil applications. This course will provide an overview of both theory and practice of the systems engineering discipline along with systems engineering design approach.

ABOUT INSTRUCTOR :

Prof. Deepu Philip is a faculty of Industrial & Management Engg. Department and Design Programme of IIT Kanpur. He works in the area of Production and Operations, Systems Simulation, Product Life Cycle Management, Unmanned Aerial Systems, and Systems Engineering. He holds Bachelor degree in Industrial Engineering with his doctorate in Industrial & Management Engineering from MSU Bozeman. He has both academic and industrial experience with leading organizations of the world. He has experience in designing and implementing complex system of systems in different fields including defense, aviation, fertilizer, strategic chemical plants, transportation, banking, automation, health care, energy, and communication.

COURSE PLAN

Week 1 : Systems engineering – what is, origin, and examples; Systems engg as a profession Power of systems engg and examples; Systems engg viewpoint, perspectives, domains; Systems engg fields, approaches, activities, and products
Week 2 : Complex system structure-building blocks, hierarchy, interfaces; Complex system structure-environment, interactions, complexity; System development process–life cycle,evolutionary characteristics; Systems engg method; Systems testing throughout development
Week 3 : Managing systems development, risks, work breakdown structure (WBS), systems engg management plan (SEMP) Systems risk management, organizing for systems engg; Need analysis – originating, operations, functional, and feasibility Need validation, systems ops requirement; System requirements development, performance requirements
Week 4 : Implementing concept exploration, validating requirements; Concept definition – selection and validation, functional analysis and allocation ; Systems architecture, system modeling languages, Model-Based Systems Engg (MBSE) Decision making, modeling for decisions; Simulation, Trade-off analysis
Week 5 : Engg development stage – program risk reduction, prototype development for risk mitigation
Development testing, risk reduction; Revision of functional analysis and design; Overview of probability data analysis; Hypothesis testing
Week 6 : Engineering design – implementing system building blocks, component design; Design validation, change management; Concepts of reliability, redundancy; Concepts of maintainability, availability, producibility; User interface design and GUI
Week 7 : Integration, testing and evaluating total system; Test planning and preparation, system integration
Developmental and operational test and evaluation; Engineering for production, transition from development to production Production operations - 1
Week 8 : Production operations - 2; Installation, maintenance and upgrading; Installation testing; In-service support
Upgrades and modernization

MANAGEMENT

BUSINESS ANALYTICS AND DATA MINING MODELING USING R - (PART-1)

PROF. GAURAV DIXIT
Department of Management studies
IIT Roorkee

TYPE OF COURSE : Rerun | Elective | UG/ PG
INDUSTRY SUPPORT : Big Data companies, Analytics & Consultancy companies, Companies with Analytics Division
PRE REQUISITES : Basic Statistics Knowledge

COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 27 Apr 2019

COURSE OUTLINE :

Objective of this course is to impart knowledge on use of data mining techniques for deriving business intelligence to achieve organizational goals. Use of R statistical computing are included to build, assess, and compare models based on real datasets and cases with an easy-to-follow learning curve.

ABOUT INSTRUCTOR :

Prof. Gaurav Dixit is an Assistant Professor in the Department of Management Studies at the Indian Institute of Technology Roorkee. He earned his doctoral degree from the Indian Institute of Management Indore and an engineering degree from Indian Institute of Technology (BHU) Varanasi. Previously, he worked in Hewlett-Packard (HP) as software engineer, and Sharda Group of Institutions as project manager on deputation.

COURSE PLAN

Week 1 : General Overview of Data Mining and its Components Introduction and Data Mining Process Introduction to R Basic Statistical Techniques

Week 2 : Data Preparation and Exploration Visualization Techniques

Week 3 : Data Preparation and Exploration Visualization Techniques Dimension Reduction Techniques Principal Component Analysis

Week 4 : Performance Metrics and Assessment Performance Metrics for Prediction and Classification

Week 5 : Supervised Learning Methods Multiple Linear Regression

Week 6 : Supervised Learning Methods Multiple Linear Regression - contd

Week 7 : Supervised Learning Methods Nave Bayes

Week 8 : Supervised Learning Methods Classification & Regression Trees

Week 9 : Supervised Learning Methods Classification & Regression Trees - contd

Week 10 : Supervised Learning Methods Logistic Regression

Week 11 : Supervised Learning Methods Logistic Regression Artificial Neural Networks

Week 12 : Supervised Learning Methods and Wrap Up Artificial Neural Networks Discriminant Analysis Conclusion

MANAGEMENT

FINANCIAL STATEMENT ANALYSIS AND REPORTING

PROF. ANIL K. SHARMA
Department of Management Studies
IIT Roorkee

TYPE OF COURSE : Rerun | Elective | UG/ PG
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
INDUSTRY SUPPORT : All industries/companies
EXAM DATE : 27 Apr 2019
INTENDED AUDIENCE : It is an elective course for UG/PG. Anyone interested in Financial Analysis.

COURSE OUTLINE :

Financial Analysis and reporting is an integral part of overall financial analysis carried out by various business organizations in India and all around the world. It depicts the financial health of any company and helps the companies to augment their financial resources and management of generated funds efficiently.

ABOUT INSTRUCTOR :

Prof. Anil K. Sharma, Department of Management Studies Indian Institute of Technology, Roorkee, is a gold medalist in M.Com and has a Ph.D. in Financial Management from Punjab University, Chandigarh. He is working at IIT Roorkee for the past 15 years and has more than 20 years teaching experience in total. His area of interest is finance and accounting.

COURSE PLAN

Week 1 : Introduction, Indian Economy, Industry & Industrial scenario in India, Forms of business organizations, Sole Proprietorship, Partnership firms and private companies, Public and Govt. Companies.
Week 2 : Content of annual reports, Quality of financial reporting, Reporting regulation in India, Reporting regulations for Partnership firms, Reporting regulations of Companies.
Week 3 : Nature & objectives of Financial Statements, Uses & Limitations of Financial Statements, Stakeholders of financial statements, Income Statement, Income Statement.
Week 4 : Income Statement, Income Statement, Balance Sheet, Balance Sheet, Balance Sheet.
Week 5: Balance Sheet, Cash Flow Statement, Sources of financial information, Tools and techniques of financial statement analysis, Tools and techniques of financial statement analysis.
Week 6 : Tools and techniques of financial statement analysis, Ratio Analysis, Ratio Analysis, Ratio Analysis, Ratio Analysis.
Week 7 : Ratio Analysis, Ratio Analysis, Cash flow statement, Cash flow statement, Cash flow statement.
Week 8 : Cash flow statement, Comparative Statement, Common Size Statement, Du-Pont Analysis, Concepts on sickness, distress.
Week 9 : Report preparation of financial statement analysis, Types of business combinations, Consolidated financial statements, Consolidated financial statements, Consolidated financial statements.
Week 10 : Inter-company transactions and profit confirmations, Inter-company transactions and profit confirmations, Minority interest, consolidated net income and consolidated retained earnings, Minority interest, consolidated net income and consolidated retained earnings, Minority interest, consolidated net income and consolidated retained earnings.
Week 11 : Balance Sheet Under Income Tax Act, Balance Sheet Under Income Tax Act, Balance Sheet Under Companies Act, Balance Sheet Under Companies Act, Balance Sheet Under Companies Act.
Week 12 : Window dressing, Window dressing, Recent scandals in financial reporting, Recent scandals in financial reporting, Recent scandals in financial reporting.

FINANCIAL INSTITUTIONS AND MARKETS

MANAGEMENT

PROF. JITENDRA MAHAKUD
Department of Humanities and Social Sciences
IIT Kharagpur

TYPE OF COURSE : New | Core | UG/PG
INTENDED AUDIENCE : Economics, Commerce and MBA Finance
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 27 April 2019

INDUSTRIES APPLICABLE TO : Financial Consulting Companies, Regulatory Bodies like RBI, SEBI, IRDA, PFRDA

COURSE OUTLINE :

This course will provide an understanding of the functions, and operations of the financial markets and institutions operating in India. It explains the role of financial system on economic development. Various conceptual issues related to risk and return, the role of regulatory bodies, mechanism of commercial banking, operations of insurance companies and mutual funds are discussed elaborately. It also describes the importance of small savings, provident funds, pension funds and credit rating agencies.

ABOUT INSTRUCTOR :

Jitendra Mahakud is Professor of Economics and Finance at the Department of Humanities and Social Sciences, Indian Institute of Technology Kharagpur. He is also a joint faculty at the Vinod Gupta School of Management, IIT Kharagpur, in the area of finance. He obtained his PhD from the Indian Institute of Technology, Mumbai. His areas of teaching and research include financial markets and institutions, corporate finance, investment management, financial economics, behavioural finance and banking.

COURSE PLAN :

Week 01 : Introduction to Financial System and Economic Development Indicators of Financial Development
Week 02 : Concepts Related to Financial Markets and Institutions - Concept of Risk, Concept and types of return and yield,Asset Pricing Models, Valuation of Assets
Week 03 : Theories of Level and Structure of Interest Rates
Week 04 : Financial Regulations and Regulatory Institutions in India (RBI,SEBI,IRDA,PFRDA), Operating Procedures of Monetary Policy, Corporate Governance and SEBI
Week 05 : Commercial Banking - Role of Banks, Banks' Financial Statement, Banks' Computation, International Banking, NPA, Risk Management in Banking
Week 06 : Other Important Financial Institutions – I (Provident Fund, Pension Fund, Insurance Companies)
Week 07 : Other Important Financial Institutions – II (Mutual Fund, Credit Rating Agencies, Merchant Bank, Venture Capital Funds)
Week 08 : Money Markets in India (Call Money Market, Treasury Bill, Commercial Paper, Certificate of Deposit)
Week 09 : Bond Market - Bond Features, Bond Price Volatility, Government Security Market, Corporate Bond Market, Public Sector Undertaking Bonds
Week 10 : Classification of Stock Market and Securities - IPO, Stock Exchanges, Stock Market Indices, Market Micro-Structure in Stock Market
Week 11 : Derivatives Market - Types of Derivatives, Important Concepts used in Derivatives Market, Pricing of Futures, Options and Swaps
Week 12 : Foreign Exchange Market - Foreign Exchange Market Structure, Risk Management in Foreign Exchange Market, Exchange Rate Determination, Foreign Capital – FDI & FII, Central Bank Intervention in Foreign Exchange Market

MANAGEMENT

SOFT SKILLS FOR BUSINESS NEGOTIATIONS AND MARKETING STRATEGIES

PROF. UTTAM KUMAR BANERJEE
Department of Architecture & Regional Planning
IIT Kharagpur

TYPE OF COURSE : Rerun | Elective | UG/ PG
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 27 Apr 2019
INDUSTRY SUPPORT : This course would also be very useful for the aspirants for Government as well as Private employment..

INTENDED AUDIENCE : Students of: Business Management Marketing, Product Management, Architecture Engineering, Commerce, Infrastructure Design and Management, Candidates appearing for Job interviews, Potential Negotiators, Marketing professionals

COURSE OUTLINE :

The primary focus of this course is to highlight various categories and applications of soft skills through various cases extracted from the real field and other research case studies. The fundamental concepts and distinctions between Soft Skills and Hard Skills are discussed. The course is tailored very effectively to introduce various Soft skill application examples. This course would be very useful for the students, practicing professionals as well as common people who are voluntarily or involuntarily involved in negotiations and strategies in daily life. The lectures would be supported with illustrative sketches, analysis and demonstrative enactments, in addition to the digital illustrations time to time with various examples. This would facilitate easy comprehension for the students of different level of ability and exposure. Multiple illustrations with case studies would be the strength of this course disseminated with lucid lectures.

ABOUT INSTRUCTOR :

Prof. Uttam Kumar Banerjee, is currently a Senior Professor in the Department of Architecture & Regional Planning, as well as Joint-Faculty in the RCG School of Infrastructure Design and Management at the Indian Institute of Technology Kharagpur, where he has served as the Head in both the departments from 2004 to 2007 and 2011 to 2014 respectively. He has graduated with Bachelor of Architecture (B.Arch), post-graduated with Master of City Planning (MCP) and Ph.D. in Transportation system evaluation from Indian Institute of Technology Kharagpur.

COURSE PLAN

Week 1 : Soft Skills and Hard Skills

Week 2 : Non-verbal communications

Week 3 : Negotiations

Week 4 : Professional Negotiations

Week 5 : Business Negotiation

Week 6 : Product Marketing Negotiation

Week 7 : Negotiation for Services

Week 8 : Marketing Strategy

Week 9 : Power Marketing

Week 10 : Power Marketing Strategies

Week 11 : Power Marketing Presentations

Week 12 : Time Management in Marketing

MARKETING RESEARCH AND ANALYSIS - II

MANAGEMENT

PROF. J. K. NAYAK
Department of Management
IIT Roorkee

TYPE OF COURSE : New | Elective | UG/ PG
INTENDED AUDIENCE : U.G, P.G and PhD
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 28 April 2019

INDUSTRIES APPLICABLE TO : All Industries both in Public and Private Space, academic institutions and Research organizations

COURSE OUTLINE :

Marketing research and Analysis-II (Application oriented) is an extension of the course Marketing Research and Analysis. In this course the emphasis has been laid on the practical side of research and data analysis. It is intended to give a step by step approach for researchers who are involved in data analysis for their thesis and publication work. Industry practitioners can have a real time feel of the data analysis process. It describes the tools covered under multivariate data analysis techniques which students and practitioners find slightly confusing and thus, this course would answer their queries and help them progress in their respective fields of research. It uses research tools like univariate tests, deep analysis of various regression analysis techniques, factor and cluster analysis, discriminant analysis and SEM in details etc.alongwith non-parametric techniques also. SPSS and AMOS software has been used and explained for data analysis. Most importantly interpreting the data and finally writing for a research work has been explained for all the techniques.

ABOUT INSTRUCTOR :

Dr. J.K.Nayak is a faculty in the Department of Management Studies at IIT Roorkee. He is a Civil engineer, MBA and PhD from VGSOM, IIT Kharagpur. Currently he teaches marketing research at IIT Roorkee. Apart from these Dr. Nayak has published almost 30 international publications in journals such as Elsevier, Emerald, Sage, Springer etc. Recently he has published a book with Cengage publications on Retail management. He is a reviewer for various international journals such as Journal of retailing and consumer services and tourism management perspectives etc. He has been involved in the startup ecosystem as a mentor at IIT Roorkee and IIM -Ahmedabad.

COURSE PLAN :

Week 01 : Introduction to marketing research
Week 02 : Marketing research process and hypotheses development
Week 03 : Research design
Week 04 : Data purification and handling
Week 05 : Hypothesis testing
Week 06 : Non-parametric test
Week 07 : Introduction to ANOVA & ANCOVA
Week 08 : ANOVA, ANCOVA, MANOVA & MANCOVA in SPSS
Week 09 : Correlation and regression
Week 10 : Various types of regression and discriminant analysis
Week 11 : Exploratory and Confirmatory factor analysis
Week 12 : Structural equation modelling & cluster analysis

MANAGEMENT

BUSINESS STATISTICS

PROF. MUKESH KUMAR BARUA
Department of Management
IIT Roorkee

TYPE OF COURSE : New | Core| UG/PG
INTENDED AUDIENCE : B.Tech. M.Tech, PhD and working professionals

COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 27 Apr 2019

COURSE OUTLINE :

This course will introduce you to business statistics, or the application of statistics in the workplace. Statistics is a course in the methods for gathering, analyzing, and interpreting data. You'll also explore basic probability concepts, including measuring and modeling uncertainty, and you'll use various data distributions, along with the Linear Regression Model, to analyze and inform business decisions.

ABOUT INSTRUCTOR :

Dr. M.K. Barua is an Associate Professor at Department of Management Studies, Indian Institute of Technology Roorkee. He is also seconded faculty at Asian Institute of Technology (AIT) Bangkok and Defense Engineering College, FDRE's Metals and Engineering Corporation, Ethiopia. Also he is visiting faculty at IIM Sirmaur and IIM Rohtak. His research interest includes Operations management, project management and supply chain management. He has published more than 100 research papers in international journals of repute.

COURSE PLAN :

Week 01 : Introduction, data collection and presenting data in tables

Week 02 : Numerical descriptive measures and basic probability

Week 03 : Discrete and continuous probability distributions

Week 04 : Sampling and sampling distributions

Week 05 : Confidence interval estimation

Week 06 : One sample tests and hypothesis testing

Week 07 : Two sample tests means

Week 08 : Two sample tests proportions and variance

Week 09 : ANOVA

Week 10 : Chi-Square tests

Week 11 : Simple linear regression

Week 12 : Multiple regression basics

MANAGEMENT

BUSINESS ANALYTICS FOR MANAGEMENT DECISION

PROF. RUDRA P. PRADHAN
Vinod Gupta School of Management
IIT Kharagpur

TYPE OF COURSE	: Rerun | Elective | PG	**COURSE DURATION**	: 12 weeks (28 Jan'19 - 19 Apr'19)
INTENDED AUDIENCE	: Management	**EXAM DATE**	: 28 Apr 2019
PRE-REQUISITES	: Basic Statistics, Basic Mathematics, Basic Management		

COURSE OUTLINE :

Students can get exposure on data analysis, modeling and spreadsheet use with BUSINESS ANALYTICS for DECISION MAKING. This course will be exclusively quantitative and an application to business/ management related problems. It is connected with problem sets and real life cases to know the relevance of a particular problem and the decision making thereof.

ABOUT INSTRUCTOR :

Rudra P. Pradhan is Associate Professor at Vinod Gupta School of Management, IIT Kharagpur. His specialization is Econometric Modeling and Financial Econometrics. His teaching and research assignments are mostly on econometric modeling and mathematical modeling.

COURSE PLAN

Week 1 : Introduction to Business Analytics

Week 2 : Exploring Data and Analytics on Spreadsheets

Week 3 : Descriptive Analytics

Week 4 : Inferential Analytics 1

Week 5 : Inferential Analytics 2

Week 6 : Predictive Analytics 1

Week 7 : Predictive Analytics 2

Week 8 : Predictive Analytics 3

Week 9 : Prescriptive Analytics 1

Week 10 : Prescriptive Analytics 2

Week 11 : Prescriptive Analytics 3

Week 12 : Decision Analytics

DATA ANALYSIS AND DECISION MAKING - II

MANAGEMENT

PROF. RAGHU NANDAN SENGUPTA
Department of Industrial and Management Engineering
IIT Kanpur

TYPE OF COURSE : New | Elective | PG
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
INTENDED AUDIENCE : M.E/M.Tech, M.S, PhD
EXAM DATE : 28 Apr 2019
PRE-REQUISITES : Probability & Statistics, Operations Research
INDUSTRIES APPLICABLE TO : Manufacturing industry, chemical industry, steel industry, cement industry, etc.

COURSE OUTLINE :

This is the first part of the three part course (DADM-I, DADM-II, DADM-III) which covers Operations Research and its tools with applications. In general Decision Analysis and Decision Making (DADM) covers three main areas which are: Operations Research and its tools with applications, Other Decision Making Models like DEA, AHP, ANP, TOPSIS, etc., and Multivariate Statistical Analysis with its applications. This three part DADM course will be more practical and application oriented rather than theoretical in nature.

ABOUT INSTRUCTOR :

Raghu Nandan Sengupta completed his bachelors in engineering in Mechanical Engineering from Birla Institute of Technology Mesra, Ranchi INDIA and his FPM (PhD) from Indian Institute of Management Calcutta, INDIA with specialization in Operations Management. His research interests are in Sequential Analysis, Statistical & Mathematical Reliability, Optimization and its use in Financial Optimization. His research work has been published in journals like Metrika, European Journal of Operational Research, Sequential Analysis, Computational Statistics & Data Analysis, Communications in Statistics: Simulation & Computation, Quantitative Finance, etc. At Indian Institute of Technology Kanpur, INDIA he is a Professor in the Industrial & Management Engineering department and teaches courses like Probability & Statistics, Stochastic Processes & their Applications, Management Decision Analysis, Financial Risk Management, etc. He is also the recipient of IUSSTF Fellowship 2008 and visited Operations Research & Financial Engineering department at Princeton University, USA, ERASMUS MUNDUS Fellowship 2011 to Warsaw University, POLAND, EU-NAMASTE Fellowship 2015 to IST, University of Lisboa, PORTUGAL, DAAD Fellowship 2015 to TU Dresden, GERMANY.

COURSE PLAN :

Week 01 : MCDM, MAUT and related concepts
Week 02 : Utility theory, Pareto optimality and related concepts
Week 03 : Decision Trees
Week 04 : Data Envelopment Analysis (DEA)
Week 05 : Analytical Hierarchy Process (AHP) and Analytical Network Process (ANP)
Week 06 : TOPSIS
Week 07 : ELECTRE
Week 08 : PROMETHE
Week 09 : MACBETH
Week 10 : SWOT analysis and System analysis
Week 11 : Other Decision Making tools
Week 12 : Fuzzy Logic

MANAGEMENT

SIX SIGMA

PROF. JITESH J THAKKAR
Department of Industrial and Systems Engineering
IIT Kharagpur

TYPE OF COURSE : New | Elective | UG/PG
INTENDED AUDIENCE : Mechanical, MBA, Industrial
PRE-REQUISITES : Engineering and Math courses in undergraduate (B Tech) program.
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 28 April 2019

INDUSTRIES APPLICABLE TO : Manufacturing and Service Industry

COURSE OUTLINE :

The course on Six Sigma will focus on detailed strategic and operational issues of process improvement and variation reduction called Six Sigma, a measure of quality that strives for near perfection. It is a disciplined, data-driven approach for eliminating defects (driving towards six standard deviations between the mean and the nearest specification limit) in any process-from manufacturing to transactional and from product to service. A Six Sigma defect is anything outside of customer specifications. To be tagged Six Sigma, a process must not produce more than 3.4 defects per million opportunities.

ABOUT INSTRUCTOR :

Dr. Jitesh J. Thakkar is an Associate Professor at the Department of Industrial and Systems Engineering, Indian Institute of Technology Kharagpur, India. He received Ph.D in Supply Chain Management from IIT Delhi, Masters in Technology in Industrial Engineering from IIT Delhi and Bachelors in Mechanical Engineering with Gold Medal from the oldest Government Engineering College Birla Vishvakarma Mahavidyalaya, Sardar Patel University, Gujarat.

COURSE PLAN :

Week 01 : Brief overview of the course, Quality concepts and definition, Six Sigma overview and history of continuous improvement, Six Sigma principles and focus areas, Six Sigma Applications

Week 02 : Quality management: Basics and Key concepts, Fundamentals of Total Quality Management (TQM), Cost of quality and Six Sigma, Voice of customer, Quality Function Deployment (QFD) Six Sigma Management tools

Week 03 : Six Sigma : Project identification, selection and definition, Six Sigma : Project Charter and Monitoring, Process characteristics and analysis, Process Mapping, Data collection

Week 04 : Measurement systems: Fundamentals, Measurement system analysis : Gauge R & R Study, Seven QC Tools, Basic statistics, Probability theory

Week 05 : Hypothesis testing: Fundamentals, Hypothesis testing: Two population Test, Hypothesis testing: Two population: Examples and Illustrations, Correlation and Regression analysis: Key principles, Correlation and Regression analysis: Model validation

Week 06 : Statistical Process Control: Basics, Statistical Process Control: Control Charts for variables, Statistical Process Control: Control Charts for attributes, Statistical Process Control: Implementation issues, Statistical Process Control: Minitab application

Week 07 : Process capability analysis: Basics and concepts, Process capability analysis: Measures and indices, Process capability analysis: Minitab application, Non-normal process capability analysis, Non-normal process capability analysis: Minitab application

Week 08 : Failure Mode Effect Analysis (FMEA): Basics and Principles, Failure Mode Effect Analysis (FMEA): Application, Multi-vari analysis: Basics and concepts, Multi-vari analysis: Illustrative example, Multi-vari analysis: Application in Minitab

Week 09 : ANOVA: Basics, One-way ANOVA, Two-way ANOVA, Introduction to Design of Experiment, Design of Experiment: Replication, Repetition and Blocking

Week 10 : Randomized block design: Basics, Randomized block design: Illustrative application, Randomized block design: Application in Minitab,Factorial design: Basics, Factorial design: Illustrative application

Week 11 : Fractional factorial design: Basics and concepts, Fractional factorial design: Key principles, Fractional factorial design: Illustrative example, Taguchi Method: Basics and concepts, Taguchi Method: Practical application

Week 12 : Design for Six Sigma (DFSS): Key concepts, Design for Six Sigma (DFSS): DFM, DFA, DMADOV, Team Management, Six Sigma: Case study, Six Sigma: Summary of key concepts and strategies

QUALITY DESIGN AND CONTROL

MANAGEMENT

PROF. PRADIP KUMAR RAY
Department of Industrial and Systems Engineering
IIT Kharagpur

TYPE OF COURSE : Rerun | Elective | UG/ PG
INDUSTRY SUPPORT : Tata Steel, Tata Motors, L&T Linde and similar such manufacturing and service organizations including IT companies
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 28 Apr 2019
INTENDED AUDIENCE : Management, Industrial Engineering, Mechanical Engineering, Production Engineering and related disciplines.

COURSE OUTLINE :

The objective of the course is to introduce basic concepts and statistical methods employed for assurance of quality in products, processes and systems in an industrial environment (manufacturing and service organizations), such as Management and Control of Quality and Quality System, Statistical Process Control, Process Capability Analysis, Acceptance Sampling, Process Capability Analysis, Design for Reliability, Robust Design and Taguchi Method for Quality Improvement.

ABOUT INSTRUCTOR :

Prof. Pradip Kumar Ray, Department of Industrial and Systems Engineering Indian Institute of Technology, Kharagpur, He served as the Head of the Department during September, 2006 to August, 2009. A mechanical engineering graduate (IIEST, Shibpur) with MTech degree and PhD in industrial engineering (IIT Kharagpur), Professor Ray has about more than thirty-six years of diversified experience - eight years in industry and more than twenty-eight years of teaching and research experience at IIT Kharagpur. He has served as a visiting professor at several institutions abroad and is trained in Japan on Production Management/JIT-based Manufacturing.

COURSE PLAN

Week 1 : History and Evolution of Quality Control and Management

Week 2 : Management of Quality-I

Week 3 : Management of Quality-II

Week 4 : Statistical Process Control-I

Week 5 : Statistical Process Control-II

Week 6 : Process Capability Analysis

Week 7 : Acceptance Sampling-I

Week 8 : Acceptance Sampling-II

Week 9 : Design for Reliability-I

Week 10 : Design for Reliability-II

Week 11 : Quality by Experimental Design

Week 12 : Robust Design and Taguchi Method

OPERATIONS AND SUPPLY CHAIN MANAGEMENT

MANAGEMENT

PROF. G. SRINIVASAN
Department of Management
IIT Madras

TYPE OF COURSE : Rerun | Elective | UG/ PG
INTENDED AUDIENCE : B.E, M.E, M.S, B.Sc, M.Sc, Ph.D, M.A.
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 27 Apr 2019

COURSE OUTLINE :

This course introduces the viewer to the basics of Operations and Supply Chain Management. The concepts in Operations Management are restricted to the planning and operational decisions within an organization while the supply chain concepts are for a network of organizations. The main emphasis of the course is on the basic concepts and on quantitative modeling of the various decision problems.

ABOUT INSTRUCTOR :

G Srinivasan is a Professor in the Department of Management Studies at IIT Madras. He has more than 25 years of teaching and research experience. His areas of Interest include Operations Research, Supply Chain Management, O.R. Applications. His videos in Operations Research available under NPTEL are popular.

COURSE PLAN :

Week 01 : Forecasting : Need for forecasting | Quantitative methods.
Week 02 : Facility layout and location : Qualitative aspects | Quantitative models for layout decisions | Product, process fixed position, group layout | Location decisions-quantitative models.
Week 03 : Capacity and aggregate planning | Capacity measurement, Long-term and short term strategies | Aggregate planning.
Week 04 : Inventory management : Various costs in inventory management and need | Deterministic models and discounts | Probabilistic inventory management.
Week 05 : Scheduling models and applications | Scheduling in MRP system | Sequencing rules and applications | Batch production sequencing and scheduling.
Week 06 : Introduction to supply chain : Definition, complexity, key issues | Centralized vs. decentralized systems.
Week 07 : Value of information and supply chain integration : Bullwhip effect | Push-based, pull based systems.
Week 08 : Outsourcing : Make or buy decisions.
Week 09 : Transportation decision : Drivers of the decision | Network design decisions | Cross-docking, transshipment.
Week 10 : Distribution and logistics in supply chains : Direct shipment/intermediate storage policies | Vehicle routing models | Third-party logistics.
Week 11 : Information technology in supply chain | Enabling supply chain through IT | ERP vendor platforms | Service oriented architecture (SOA) | RFID.
Week 12 : Summary

MANAGEMENT

ADVANCED GREEN MANUFACTURING SYSTEMS

PROF. DEEPU PHILIP
Department of Management
IIT Kanpur

PROF. AMANDEEP SINGH
Department of Mechanical Engg
IIT Kanpur

TYPE OF COURSE : New | Elective | UG/PG
INTENDED AUDIENCE : Students of all Engineering & Science
PRE-REQUISITES : The student should have completed six semesters of UG Engineering or Science program.
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 28 Apr 2019

INDUSTRIES APPLICABLE TO : HAL, NAL, SAIL, ISRO, BHEL, L&T, BEL, BDL, TATA, DRDO, Automotive manufacturers, DELL, HP, Pharmaceuticals, Johnson & Johnson, Abbott, UPL, etc., Chemical industries: GAIL, ONGC, Reliance, HPCL, IOCL, FACT, HMT, etc. so on.

COURSE OUTLINE :

Sustainability aims to conserve energy and natural resources, and to ensure that they have minimal impact on the environment and society. It targets at fulfilling the needs of the presentwithout compromising the ability of future generations to meet their own needs. This course provides an overview of realizing Green Manufacturing Systems. Compared to conventional manufacturing process that is purely productivity driven; various strategies and applicationsare necessary to improve the ecology first focus of green manufacturing. Specific tools and relevant case studies are presented to provide an engineering approach to the course.

ABOUT INSTRUCTOR :

Deepu Philip is a faculty of Industrial & Management Engineering Department and Design Programme of IIT Kanpur. He works in the area of Production and Operations, Systems Simulation, Product Life Cycle Management, Unmanned Aerial Systems, and Systems Engineering. He holds bachelor degree in Industrial Engineering with his doctorate in Industrial & Management Engineering from MSU Bozeman. He has both academic and industrial experience with leading organizations of the world. He has experience in designing and implementing complex system of systems in different fields including defense, aviation, fertilizer, strategic chemical plants, transportation, banking, automation, health care, energy, and communication.

Amandeep Singh is working as a Project Scientist in the Mechanical Engineering Department, and Design Program at Indian Institute of Technology, Kanpur, India. He holds PhD degree from Indian Institute of Technology Kanpur, India, and a Bachelor degree in Production Engineering. Dr. Singh has ten years of industrial and academic experience. His research interests are Sustainable Manufacturing Processes and Systems, Simulation of Manufacturing Systems, Product Design and Manufacturing, and Applied Ergonomics.

COURSE PLAN :

Week 01 : Introduction to Advanced Green Manufacturing Systems
Week 02 : Statistics in sustainability (for quantification)
Week 03 : Optimization for sustainability
Week 04 : Optimization for sustainability continued
Week 05 : Design of Experiments for Green Manufacturing Systems
Week 06 : Value Engineering Green Plan
Week 07 : Design for Sustainability and Maintenance
Week 08 : Green transportation models
Week 09 : Green Manufacturing techniques
Week 10 : Life Cycle Assessment (software demonstration)
Week 11 : Sustainable Manufacturing facility development
Week 12 : Design of Higher Education for Sustainable development

MATHEMATICS

MATHEMATICS

04 weeks

01. Descriptive Statistics with R

08 weeks

01. Multivariable calculus
02. Calculus for Economics, Commerce & Management
03. Graph Theory
04. Basic Linear Algebra

12 weeks

01. Engineering Mathematics - I
02. Integral and Vector Calculus
03. Transform Calculus and its applications in Differential Equations
04. Probability and Statistics
05. Statistical Interference
06. Dynamical System and Control
07. Advanced Engineering Mathematics
08. Mathematical Methods and its Applications
09. Commutative Algebra
10. Galois Theory

MATHEMATICS

DESCRIPTIVE STATISTICS WITH R

PROF. SHALABH
Department of Mathematics
IIT Kanpur

TYPE OF COURSE : New | Elective | UG/PG
COURSE DURATION : 4 weeks (25 Feb'19 - 22 Mar'19)
INTENDED AUDIENCE : Anyone can learn this
EXAM DATE : 28 Apr 2019
PRE-REQUISITES : Mathematics background up to class 12 is needed.
INDUSTRIES APPLICABLE TO : All industries having R & D set up will use this course.

COURSE OUTLINE :

Any data analysis is incomplete without statistics. After getting the data, any statistical analysis starts with descriptive statistics which aims to extract the information hidden inside the data. The tools of descriptive statistics are based on mathematical and statistical functions which are to be evaluated using the software. The statistical software are paid as well as free. Most of the statistical software are paid software. A popular free statistical software is R. What are the basic tools of descriptive statistics and how to use the R software for descriptive statistical analysis is the objective of the course to be taught.

ABOUT INSTRUCTOR :

Dr. Shalabh is a Professor of Statistics at IIT Kanpur. His research areas of interest are linear models, regression analysis and econometrics. He has more than 23 years of experience in teaching and research. He has developed several web based and MOOC courses in NPTELincluding on regression analysis and has conducted several workshops on statistics for teachers, researchers and practitioners. He has received several national and international award and fellowships. He has authored more than 75 research papers in national and international journals. He has written four books and one of the book on linear models is co- authored with Prof. C.R. Rao.

COURSE PLAN :

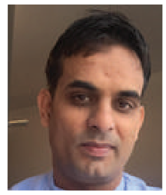
Week 01 : Basic operations of R, frequency distribution.
Week 02 : Measures of central tendency and dispersion.
Week 03 : Measures of symmetry, correlation and regression.
Week 04 : Association of two variables, simple random sampling

MATHEMATICS

MULTIVARIABLE CALCULUS

PROF. S.K. GUPTA
Department of Mathematics
IIT Roorkee

PROF. SANJEEV KUMAR
Department of Mathematics
IIT Roorkee



TYPE OF COURSE	:	Rerun | Core | UG
PRE-REQUISITES	:	None
COURSE DURATION	:	8 weeks (28 Jan'19 - 22 Mar'19)
EXAM DATE	:	31 Mar 2019
INTENDED AUDIENCE	:	BE/B.Sc

COURSE OUTLINE :

This course is a basic course offered to UG and PG students of Engineering/Science background. It contains various topics related to the calculus of the functions of two or more variables. In particular, this course includes topics like differentiation and integration of the functions of two or more variables together with their various applications. This course also includes the calculus of vector functions with different applications.

ABOUT INSTRUCTOR

Prof. S.K. Gupta is an Associate Professor in the Department of Mathematics, IIT Roorkee. His area of expertise includes nonlinear, non-convex and Fuzzy optimization. He has guided three PhD theses and has published more than 40 papers in various international journals of repute.

Prof. Sanjeev Kumar is working as an Associate Professor with Department of Mathematics, IIT Roorkee. Earlier, he worked as a postdoctoral fellow with Department of Mathematics and Computer Science, University of Udine, Italy and Assistant Professor with IIT Roorkee. He is actively involved in teaching and research in the area of computational algorithms, inverse problems and image processing. He has published more than 55 papers in various international journals conferences of repute. He has completed a couple of sponsored research projects and written several chapters in reputed books published with Springer and CRC press.

COURSE PLAN

Week 1 : Limits, continuity and partial derivatives of multivariable functions

Week 2 : Differentiability and chain rule

Week 3 : Change of variables, Euler's theorem, tangent planes, normal lines and extreme values

Week 4 : Taylor's theorem, error approximation, polar curves and multiple integrals

Week 5 : Change of order and change of variables in multiple integral

Week 6 : Beta and gamma functions

Week 7 : Normal vector and potential field

Week 8 : Vector identities and line integral

MATHEMATICS

CALCULUS FOR ECONOMICS, COMMERCE AND MANAGEMENT

PROF. INDER KUMAR RANA
Department of Mathematics
IIT Bombay

TYPE OF COURSE : Rerun | Core | UG
INTENDED AUDIENCE : Students, PhD scholars, teachers, industry
PRE-REQUISITES : Basic School Level Mathematics
COURSE DURATION : 8 weeks (25 Feb'19 - 19 Apr'19)
EXAM DATE : 27 Apr 2019

COURSE OUTLINE :

This course is based on the course" Mathematics for Economics, Commerce and Management", which was run at IIT Bombay for 8 years. Mathematical tools give a precise way of formulating and analyzing a problem and to make logical conclusions. Knowledge of mathematical concepts and tools have have become necessary for students aspiring for higher studies and career in any branch of Economics, Commerce and Management. Math for ECM aims to strengthen the mathematical foundations of students of Economics, Commerce, and Management. Professionals working in these field, wishing to upgrade their knowledge, will also benefit. The stress of the course will be on building the concepts and their applications. The main topic will be Calculus and its applications.

ABOUT INSTRUCTOR :

Prof. Inder Kumar Rana, Department of Mathematics, Indian Institute of Technology, Bombay is an Emeritus Fellow at Department of Mathematics, IIT Bombay. He has an experience of 36 years of teaching mathematics courses to Undergraduate (B. Tech) and Master's M.Sc. students at IIT Bombay. He has authored 4 books,namely, Introduction to measure and Integration American Mathematical Society, Graduate Studies in Mathematics Volume 45, 2000, From Numbers to Analysis: World Scientific Press, 1998, Calculus @IITB: Concepts and Examples, Math4all, India, 2007 From Geometry to Algebra: A course in Linear Algebra: Math4all, India, 2007.

COURSE PLAN :

Week 1 : Revision of basic concepts from Mathematical finance

Week 2 : Basic set theory and concept of functions

Week 3 : Limits and Continuity of a function of one variable and its applications

Week 4 : Derivative and tools to compute

Week 5 : Application of derivatives in increasing/decreasing

Week 6 : Application of derivatives in optimization

Week 7 : Functions of several variables

Week 8 : Applications

GRAPH THEORY

MATHEMATICS

PROF. SOUMEN MAITY
Department of Mathematics
IISER Pune

TYPE OF COURSE : Rerun | Elective | UG/PG
COURSE DURATION : 8 weeks (28 Jan'19 - 22 Mar'19)
INTENDED AUDIENCE : B.Sc, M.Sc, B.Tech, M.Tech
EXAM DATE : 31 Mar 2019
INDUSTRIES APPLICABLE TO : It will be recognized by several industries & academic institutes

COURSE OUTLINE :

Graph theory began in 1736 when the Swiss mathematician Euler solved Konigsberg seven-bridge problem. It has been two hundred and eighty years till now. Graph theory is the core content of Discrete Mathematics, and Discrete Mathematics is the theoretical basis of computer science and network information science. This course introduces in an elementary way some basic knowledge and the primary methods in Graph Theory.

ABOUT INSTRUCTOR :

Prof. Soumen Maity is an Associate Professor of Mathematics at Indian Institute of Science Education and Research (IISER) Pune. He received a PhD from the Theoretical Statistics & Mathematics Unit at Indian Statistical Institute (ISI) Kolkata, India in 2002. He has postdoctoral experience from Lund University, Sweden; Indian Institute of Management (IIM) Kolkata, India; and University of Ottawa, Canada. Prior to joining IISER Pune in 2009, he worked as Assistant Professor at IIT Guwahati and IIT Kharagpur.

COURSE PLAN :

Week 01 : Paths, Cycles, Trails, Eulerian Graphs, Hamiltonian Graphs
Week 02 : Bipartite graphs, Trees, Minimum Spanning Tree Algorithms
Week 03 : Matching and covers
Week 04 : Maximum matching in Bipartite Graphs
Week 05 : Cuts and Connectivity
Week 06 : 2-connected graphs
Week 07 : Network flow problems, Ford-Fulkerson algorithm
Week 08 : Planar graphs; Coloring of graphs

BASIC LINEAR ALGEBRA

PROF. I.K. RANA
Department of Mathematics
IIT Bombay

TYPE OF COURSE : New | Core | UG
INTENDED AUDIENCE : B.Tech, B.Sc., M.Sc (maths) , BA/MA Economics/Statistics
PRE-REQUISITES : Basic mathematics at school level
COURSE DURATION : 8 weeks (28 Jan'19 - 22 Mar'19)
EXAM DATE : 31 Mar 2019

COURSE OUTLINE :

Linear Algebra is a basic course for students who intend to go for Engineering studies and higher studies in Mathematics. We will cover the basic tools needed in these branches.

ABOUT INSTRUCTOR :

After working as a Professor at IITBombay from 1984-2015, he rejoined as Emeritus Fellow at IITB. He is president of AMTI (The Association of Mathematics Teachers of India) and has supervised three Ph.D. students and authored 4 books:
1) "Introduction to measure and Integration" AMS Graduate Studies in Mathematics Volume 45, 2000."
2) From Numbers to Analysis" World Scientific Press, 1998"
3) Calculus @IITB, Concepts and Examples", math4all, India, 2007
4) "From Geometry to Algebra: A course in Linear Algebra" Ane Books, India, 2007

COURSE PLAN :

Week 01 : Matrices and Matrix operations, REF
Week 02 : Linear systems, Gauss Elimination and Inverse of a matrix
Week 03 : Rn; subspaces, linear independence, rank of a matrix
Week 04 : Determinants, rank, inveribility
Week 05 : Linear transformations,rank-nullity
Week 06 : Inner product spaces, Gram-Schmidt process
Week 07 : Eigenvalues and Eigenvectors
Week 08 : Similarity, diagonalization and applications

ENGINEERING MATHEMATICS - I

MATHEMATICS

PROF. JITENDRA KUMAR
Department of Mathematics
IIT Kharagpur

TYPE OF COURSE : New | Core | UG
INTENDED AUDIENCE : All branches of science and engineering
COURSE DURATION : 12 weeks (28 Jan'19- 19 Apr'19)
EXAM DATE : 27 April 2019

COURSE OUTLINE :

This course is about the basic mathematics that is fundamental and essential component in all streams of undergraduate studies in sciences and engineering. The course consists of topics in differential calculus, integral calculus, linear algebra and differential equations with applications to various engineering problems.

1. Mean Value Theorems; Indeterminate Forms; Taylor's and Maclaurin's Theorems. Partial Derivatives; Differentiability; Taylor's Expansion of Functions of Several Variables. Maxima and Minima
2. Improper Integrals. Differentiation under Integral Sign (Leibnitz rule). Multiple Integrals and their Properties. Applications of Multiple Integrals
3. System of Linear Equations. Vector Spaces; Basis and Dimension of a Vector Space. Rank of a Matrix and its Properties. Linear Transformation. Eigenvalues and Eigenvectors. Diagonalization
4. First Order Differential Equations. Higher Order Differential Equations with Constant Coefficients. Cauchy-Euler Equations. System of Differential Equations

ABOUT INSTRUCTOR :

Jitendra Kumar is an Associate Professor at the Department of Mathematics, IIT Kharagpur. He completed his M.Sc. in Industrial Mathematics from IIT Roorkee and Technical University of Kaiserslautern, Germany in 2001 and 2003, respectively. He received his PhD degree in 2006 from Otto-von-Guericke University Magdeburg, Germany. He was Research Associate at the Institute for Analysis and Numerical Mathematics, Otto-von-Guericke University Magdeburg, Gerany from 2006 to 2009. His research interests include Numerical Solutions of Integro-Differential Equations and numerical analysis.

COURSE PLAN :

Week 01 : Differential Calculus - Functions of One Variable
Week 02 : Partial Derivatives
Week 03 : Total Differential and Differentiability
Week 04 : Taylor's Expansion of Functions. Maxima and Minima
Week 05 : Improper Integrals
Week 06 : Multiple Integrals & their Applications
Week 07 : System of Linear Equations - Gauss Elimination. Vector Spaces
Week 08 : Linear Transformations
Week 09 : Eigenvalues and Eigenvectors, Diagonalization
Week 10 : First Order Differential Equations
Week 11 : Higher Order Differential Equations with Constant Coefficients
Week 12 : System of Differential Equations

INTEGRAL AND VECTOR CALCULUS

MATHEMATICS

PROF. HARI SHANKAR MAHATO
Department of Mathematics
IIT Kharagpur

TYPE OF COURSE : New | Core | UG
INTENDED AUDIENCE : Mathematics
PRE-REQUISITES : Differential calculus of one and several variables.
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 27 April 2019

COURSE OUTLINE :

This course will offer a detailed introduction to integral and vector calculus. We'll start with the concepts of partition, Riemann sum and Riemann Integrable functions and their properties. We then move to anti-derivatives and will look in to few classical theorems of integral calculus such as fundamental theorem of integral calculus. We'll then study improper integral, their convergence and learn about few tests which confirm the convergence. Afterwards we'll look into multiple integrals, Beta and Gamma functions, Differentiation under the integral sign.

ABOUT INSTRUCTOR :

Prof. Hari Shankar Mahato is currently working as an Assistant Professor in the Department of Mathematics at the Indian Institute of Technology Kharagpur. Before joining here, he worked as a postdoc at the University of Georgia, USA. He did his PhD from the University of Bremen, Germany and then he worked as a Postdoc at the University of Erlangen-Nuremberg and afterwards at the Technical University of Dortmund, both located in Germany. His research expertise are Partial Differential Equations, Applied Analysis, Variational Methods, Homogenization Theory and very recently he has started working on Mathematical Biology. He can be able to teach (both online and offline) any undergraduate courses from pre to advanced calculus, mechanics, ordinary differential equations, up to advanced graduate courses like linear and nonlinear PDEs, functional analysis, topology, mathematical modeling, fluid mechanics and homogenization theory

COURSE PLAN :

Week 01 : Partition, concept of Riemann integral, properties of Riemann integrable functions, anti-derivatives, Fundamental theorem of Integral calculus, mean value theorems.

Week 02 : Reduction formula and derivation of different types of formula, improper integrals and their convergence, tests of convergence.

Week 03 : Beta and Gamma function, their properties, differentiation under the integral sign, Leibnitz rule.

Week 04 : Double integrals. change of order of integration, Jacobian transformations, triple integrals.

Week 05 : Area of plane regions, rectification, surface integrals.

Week 06 : Volume integrals, center of gravity and moment of Inertia.

Week 07 : Collection of vector algebra results, scalar and vector fields, level surfaces, limit, continuity, differentiability of vector functions

Week 08 : Curves, Arc-length, partial derivative of vector function, directional derivative gradient, divergence and curl.

Week 09 : Irrotational, conservative and Solenoidal fields, tangent, normal, binormal, Serret-Frenet formula.

Week 10 : Application of vector calculus in mechanics, lines, surface and volume integrals. line integrals independent of path.

Week 11 : The divergence theorem of Gauss, Stokes theorem, and Green's theorem.

Week 12 : Integral definition of gradient, divergence and curl. revision of problems from Integral and Vector calculus.

MATHEMATICS

TRANSFORM CALCULUS AND ITS APPLICATIONS IN DIFFERENTIAL EQUATIONS

PROF. ADRIJIT GOSWAMI
Department of Mathematics
IIT Kharagpur

TYPE OF COURSE : New | Core | UG/PG
INTENDED AUDIENCE : All UG/PG students
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 28 April 2019

COURSE OUTLINE :

For undergraduate students in the discipline of Mathematics, the course on Transform Calculus has become an integral part. This course is designed to train students with the basic Integral Transform techniques. Application of these transforms techniques in solving ordinary differential equations and partial differential equations will be discussed. We will also introduce some higher level concepts that will prepare them for future research and development projects.

ABOUT INSTRUCTOR :

Adrijit Goswami joined the Institute as a Faculty member in 1992. He received his M.Sc. and Ph.D. degree from Jadavpur University, India in 1985 and 1991 respectively. His research interest and publications have been on Operations Research and Theoretical Computer Science. His initial interest has been in developing mathematical models in Inventory Control under deterministic, probabilistic and fuzzy environment. For the past several years he has been involved in various aspects of database systems, data mining and cryptography and computer network as a researcher.

COURSE PLAN :

Week 01 : Introduction to Laplace transform: Definition and properties
Week 02 : Laplace Transform of derivatives and integrals
Week 03 : Laplace Transform of some special functions
Week 04 : Inverse Laplace Transform
Week 05 : Application of Laplace Transform to Ordinary Differential Equations and Integral Equations
Week 06 : Fourier Series
Week 07 : Introduction to Fourier Transforms: Definition and properties
Week 08 : Fourier Sine and Cosine transforms of different functions
Week 09 : Parseval's Identity for Fourier Sine and Cosine Transforms
Week 10 : Application of Fourier Transform to Ordinary Differential Equations and Integral Equations
Week 11 : Application of Fourier Transform to Partial Differential Equations
Week 12 : Finite Fourier transform and its application to Boundary Valued Problems

MATHEMATICS

PROBABILITY AND STATISTICS

PROF. SOMESH KUMAR
Department of Mathematics
IIT Kharagpur

TYPE OF COURSE : Rerun | Core | UG/PG

COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)

PRE-REQUISITES : Must have good knowledge of

EXAM DATE : 28 Apr 2019

: Differential and Integral Calculus, sequences and series, Basic Linear/Matrix Algebra (usually students who have completed Mathematics-I and II at first year undergraduate level.)

INTENDED AUDIENCE : Anyone can take the course.

INDUSTRIES APPLICABLE TO : Today all industries use statistical methods. So for students desirous to work in any type of industry, this course will be indispensable. In particular, companies dealing with Business Analytics, Banking and finance, Insurance, machine learning, data mining etc. this course will be invaluable.

COURSE OUTLINE :

The use of statistical reasoning and methodology is indispensable in modern world. It is true for any discipline, be it physical sciences, engineering and technology, economics or social sciences. Much of the advanced research in biology, genetics, and information science relies increasingly on use of statistical tools. It is essential for the students to get acquainted with the subject of probability and statistics at an early stage. The present course has been designed to introduce the subject to undergraduate/postgraduate students in science and engineering.

ABOUT INSTRUCTOR :

Prof. Somesh Kumar is a Professor in the Department of Mathematics, IIT Kharagpur. He has over 27 years of experience of teaching courses on Probability Statistics, Statistical Inference, Sampling Theory, Stochastic Processes, Multivariate Analysis, Regression analysis, Time Series, Experimental Designs, Decision Theory to undergraduate, postgraduate and doctorate students. His NPTEL courses (under MHRD) on Probability and Statistics, Statistical Inference and Statistical Methods for Scientists and Engineers (each of 40 hours) are available online.

COURSE PLAN :

Week 01 : Sets, Classes, Collections | Sequence of Sets | Ring, Field (Algebra) | Sigma-Ring, Sigma-Field, Monotone Class | Random Experiment, Events | Definitions of Probability.
Week 02 : Conditional Probability | Independence of Events | Problems in Probability | Random Variables | Probability Distribution of a Random Variable.
Week 03 : Moments | Characteristics of Distributions | Special Discrete Distributions.
Week 04 : Poisson Process | Special Continuous Distributions.
Week 05 : Normal Distribution | Problems on Normal Distribution | Function of a Random Variable.
Week 06 : Joint Distributions | Independence, Product Moments | Linearity Property of Correlation and Examples | Bivariate Normal Distribution.
Week 07 : Additive Properties of Distributions | Transformation of Random Variables | Distribution of Order Statistics | Basic Concepts | Chi-Square Distribution.
Week 08 : t-Distribution | F-Distribution | Descriptive Statistics.
Week 09 : Introduction to Estimation | Unbiased and Consistent Estimators | LSE, MME | Examples on MME, MLE.
Week 10 : UMVUE, Sufficiency, Completeness | Rao-Blackwell Theorem and its Applications | Confidence Intervals.
Week 11 : Basic Definitions | Two Types of Errors | Neyman-Pearson Fundamental Lemma | Applications of N-P Lemma.
Week 12 : Testing for Normal Mean | Testing for Normal Variance | Large Sample Test for Variance and Two Sample Problem | Paired t-Test | Testing Equality of Proportions | Chi-Square Test for Goodness Fit | Testing for Independence in Contingency Table.

MATHEMATICS

STATISTICAL INFERENCE

PROF. SOMESH KUMAR
Department of Mathematics
IIT Kharagpur

TYPE OF COURSE : New | Elective | UG/PG
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 27 Apr 2019
INTENDED AUDIENCE : Students studying Major in Statistics, Mathematics, all engineering disciplines aspiring for a career in data science and data analytics.
PRE-REQUISITES : Students must have done a basic course in Probability, Distributions and Statistics
INDUSTRIES APPLICABLE TO : All companies which deal with data/business analytics will recognize this course.

COURSE OUTLINE :

Sir R.A. Fisher published two seminal papers on the foundations of statistical inference in 1922 and 1925. These and subsequent publication of his book "Statistical Methods for Research Workers" led to a revolutionary use of statistical ideas in all branches of science, engineering, medical, biology and social sciences. Shortly afterwards the testing of hypothesis was given a firm theoretical foundation by J. Neyman and E.S. person in a series of papers. the theory behind these.

ABOUT INSTRUCTOR :

Prof. Somesh Kumar is a Professor in the Department of Mathematics, IIT Kharagpur. He has over 30 years of experience of teaching courses on Probability Statistics, Statistical Inference, Sampling Theory, Stochastic Processes, Multivariate Analysis, Regression analysis, Time Series, Experimental Designs, Decision Theory toundergraduate, postgraduate and doctorate students.

COURSE PLAN :

Week 01 : Introduction and Motivation | Basic Concepts of Point Estimations.
Week 02 : Finding Estimators.
Week 03 : Properties of MLEs.
Week 04 : Lower Bounds of Variance
Week 05 : Sufficiency and Information | Minimal Sufficiency, Completeness | UMVU Estimation, Ancillarity.
Week 06 : Testing of Hypotheses: Basic Concepts | Neyman Pearson Fundamental Lemma | Application of NP Lemma.
Week 07 : UMP Tests | UMP Unbiased Tests.
Week 08 : UMP Unbiased Tests | Applications of UMP Unbiased Tests | Unbiased Tests for Normal Populations.
Week 09 : Unbiased Tests for Normal Populations | Likelihood Ratio Tests.
Week 10 : Likelihood Ratio Tests | Test for Goodness of Fit.
Week 11 : Interval estimation
Week 12 : Invariant Estimation | Invariant Tests.

DYNAMICAL SYSTEM AND CONTROL

MATHEMATICS

PROF. N. SUKAVANAM
Department of Mathematics
IIT Roorkee

PROF. D.N. PANDEY
Department of Mathematics
IIT Roorkee

TYPE OF COURSE : New| Elective | UG/PG
INTENDED AUDIENCE : All UG/PG students
EXAM DATE : 28 April 2019
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
PRE-REQUISITES : Basic concepts from Linear Algebra and Ordinary Differential Equations

COURSE OUTLINE :

This course 'Dynamical systems and control' is a basic course offered to PG students and final year UG students of Engineering/Science background. The objective of this course is to enhance the understanding of the theory, properties and applications of various dynamical and control systems. After completing the course one may be able to understand some of the important aspects of dynamical systems such as mathematical modeling, well posedness (existence, uniqueness and stability) of the considered problem.

ABOUT INSTRUCTOR :

Dr. N. Sukavanam is a Professor in the Department of Mathematics, IIT Roorkee. His area of research includes Control Theory and Robotics. He has supervised nineteen Ph.D. theses and has published more than 80 research papers in reputed international journals. He coordinated five QIP short term courses and a Continuing Eduacation course on Dynamical Systems, Control Theory and Robotics and has delivered many invited lectures on these subjects in many institutions of national importance.

Dr. D. N. Pandey is an Associate Professor in the Department of Mathematics, IIT Roorkee. Before joining IIT Roorkee he worked as a faculty member in BITS-Pilani Goa campus and LNMIIT Jaipur. His area of expertise includes semigroup theory, functional differential equations of fractional and integral orders. He has already prepared e-notes for course titled "Ordinary Differential Equations and Special Functions" under e- Pathshala funded by UGC.

COURSE PLAN :

Week 01 : Formulation of Physical System | Existence and uniqueness of solution of a dynamical systems
Week 02 : Existence and uniqueness of solution of a dynamical systems | Linear Systems | Solution of linear systems
Week 03 : Solution of linear systems | Fundamental Matrix | Fundamental matrices for non autonomous systems | Solution of non-homogeneous systems.
Week 04 : Linear systems with periodic coefficients | Stability of systems, Stability of linear autonomous systems.
Week 05 : Stability of weakly non linear systems | Stability of non linear systems using linearization | Properties of orbits.
Week 06 : Phase Portrait | Limit cycle and periodic solutions | Stability of autonomous systems.
Week 07 : Stability of autonomous systems | Stability of non linear non autonomous systems | Poincare Bendixon Theorem.
Week 08 : Definition of controllability and Observability | Kalmann theorem for autonomous systems | Kalman Theorem for non-autonomous system.
Week 09 : Duality Theorem | Optimal control | Companion form, Feedback control.
Week 10 : Stabilization of linear control systems | Stabilizability using Lyapunov theory.
Week 11 : Optimal control of linear system
Week 12 : Discrete control systems

ADVANCED ENGINEERING MATHEMATICS

MATHEMATICS

PROF. P.N. AGRAWAL
Department of Mathematics
IIT Roorkee

TYPE OF COURSE : New | Core | UG/PG
INTENDED AUDIENCE : All UG and PG students
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 28 April 2019

COURSE OUTLINE :

This course is a basic course offered to UG/PG students of Engineering/Science background. It contains Analytic Functions, applications to the problems of potential flow, Harmonic functions, Harmonic conjugates, Milne's method, Complex integration, sequences and series, uniform convergence, power series, Hadamard's formula for the radius of convergence, Taylor and Laurent series, zeros and poles of a function, meromorphic function, the residue at a singularity, Residue theorem, the argument principle and Rouche's theorem, contour integration and its applications to evaluation of a real integral

ABOUT INSTRUCTOR :

Dr. P.N. Agrawal is a Professor in the Department of Mathematics, IIT Roorkee. His area of research includes approximation Theory and Complex Analysis. He delivered 13 video lectures on Engineering Mathematics in NPTEL Phase I and recently completed Pedagogy project on Engineering Mathematics jointly with Dr. Uaday Singh in the same Department. Further he has completed online certification course "Mathematical methods and its applications" jointly with Dr. S.K. Gupta and two more courses namely "Integral equations and calculus of variations and its applications" and "Numerical Linear Algebra" with Dr. D. N. Pandey of the same department.

COURSE PLAN :

Week 01 : Analytic Functions, Cauchy-Riemann Equations, Harmonic Functions, Harmonic Conjugates and Milne's Method, Applications to the problems of potential flow-I, II

Week 02 : Complex integration, Cauchy's theorem-I, II, Cauchy's Integral Formula for the Derivatives of an Analytic Function, Morera's theorem, Liouville's theorem and Fundamental Theorem of Algebra

Week 03 : Winding Number and Maximum Modulus Principle, Sequences and Series, Uniform Convergence of Series, Power Series, Taylor series

Week 04 : Laurent Series, Zeros and Singularities of an Analytic Function, residue at a singularity, Residue theorem, Meromorphic functions

Week 05 : Evaluation of real integrals using residues-I, II, III, IV, V

Week 06 : Bilinear Trans formations, Cross ratio, Conformal Mapping-I, II, Conformal mappings from half plane to disk and half plane to half plane-I

Week 07 : Conformal mappings from disk to disk and angular region to disk, Application of Conformal mapping to potential theory, Review of Z-transforms-I, II, III

Week 08 : Review of bilateral Z-transforms, Finite Fourier transforms, Fourier integrals and Fourier transforms, Fourier Series, Discrete Fourier transforms-I

Week 09 : Discrete Fourier transforms-II, Basic concepts of probability, Conditional probability, Bayes theorem and Probability networks, Discrete probability distribution

Week 10 : Binomial distribution, Negative binomial distribution and Poisson distribution, Continuous probability distribution. Poisson Process, Exponential distribution

Week 11 : Normal distribution, Joint distribution-I, II, III, Correlation and regression-I

Week 12 : Correlation and regression-II, Testing of hypotheses-I, II, III, Application to Queueing Theory and Reliablility Theory

MATHEMATICAL METHODS AND ITS APPLICATIONS

PROF. P.N. AGRAWAL
Department of Mathematics
IIT Roorkee

PROF. S.K. GUPTA
Department of Mathematics
IIT Roorkee

TYPE OF COURSE : Rerun | Core | UG
INTENDED AUDIENCE : UG students of technical universities/colleges.
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 27 Apr 2019

COURSE OUTLINE :

This course is a basic course offered to UG students of Engineering/Science background. It contains ODE,PDE, Laplace transforms, Z-transforms, Fourier series and Fourier transforms. It plays an important role for solving various engineering sciences problems. Therefore, it has tremendous applications in diverse fields in engineering sciences.

ABOUT INSTRUCTOR :

Dr. P.N. Agrawal is a Professor in the Department of Mathematics, IIT Roorkee. His area of research includes approximation Theory and Complex Analysis. He has supervised nine Ph.D. theses and has published 143 research papers in reputed international journals of the world.

Dr. S.K. Gupta is an Associate Professor in the Department of Mathematics, IIT Roorkee. His area of expertise includes nonlinear, non-convex and Fuzzy optimization. He has guided three PhD thesis and has published more than 45 papers in various international journals of repute.

COURSE PLAN :

Week 01 : Introduction to linear differential equations, Linear dependence, independence and Wronskian of functions, Solution of second-order homogeneous linear differential equations with constant coefficients, Method of undetermined coefficients.

Week 02 : Methods for finding Particular Integral for second-order linear differential equations with constant coefficients, Euler-Cauchy equations, Method of reduction for second- order, linear differential equations.

Week 03 : Method of variation of parameters, Solution of second order differential equations by changing dependent variable, Solution of second order differential equations by changing independent variable, Solution of higher-order homogenous linear differential equations with constant coefficients, Methods for finding Particular Integral for higher-order linear differential equations.

Week 04 : Formulation of Partial differential equations, Solution of Lagrange's equation-I, Solution of first order nonlinear equations.

Week 05 : Solution of first order nonlinear equations, Introduction to Laplace transforms, Laplace transforms of some standard functions, Existence theorem for Laplace transforms.

Week 06 : Properties of Laplace transforms, Convolution theorem for Laplace transforms.

Week 07 : Convolution theorem for Laplace transforms, Initial and final value theorems for Laplace transforms, Laplace transforms of periodic functions, Laplace transforms of Heaviside unit step function, Laplace transforms of Dirac delta function.

Week 08 : Applications of Laplace transforms, Z – transform and inverse Z-transform of elementary functions, Properties of Z-transforms.

Week 09 : Properties of Z-transforms, Initial and final value theorem for Z-transforms, Convolution theorem for Z- transforms, Applications of Z- transforms.

Week 10 : Applications of Z- transforms, Fourier series and its convergence, Fourier series of even and odd functions, Fourier half-range series.

Week 11 : Parsevel's Identity, Complex form of Fourier series, Fourier integrals, Fourier sine and cosine integrals, Fourier transforms.

Week 12 : Fourier sine and cosine transforms, Convolution theorem for Fourier transforms,Applications of Fourier transforms to BVP.

COMMUTATIVE ALGEBRA

MATHEMATICS

PROF. DILIP PATIL
Department of Mathematics
IIT Bombay

TYPE OF COURSE : New | Elective | PG
INTENDED AUDIENCE : ME / MSc / PhD
PRE-REQUISITES : Linear Algebra , Algebra – First Course , Commutative Algebra – Basic Course ; Homological Algebra – Elementary Level
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 28 April 2019

COURSE OUTLINE :

The main purpose of this course is to provide important workhorses of commutative algebra assuming only basic course on commutative algebra. Special efforts are made to present the concepts at the center of the field in a coherent, tightly knit way, streamlined proofs and a focus on the coreresults. Virtually all concepts and results of commutative algebra have natural interpretations. It is the geometric view point that brings out the true meaning of the theory.

ABOUT INSTRUCTOR :

Dilip P. Patil received B. Sc. and M. Sc. in Mathematics from the University of Pune in 1976 and 1978, respectively. From 1979 till 1992 he studied Mathematics at School of Mathematics, Tata Institute of Fundamental Research, Bombay and received Ph. D. through University of Bombay in1989. Currently he is a Professor of Mathematics at the Departments of Mathematics, Indian Institute of Science, Bangalore and at present he is a Visiting Professor at the Department of Mathematics, IITBombay. He has been a Visiting Professor at Ruhr-Universität Bochum, Universität Leipzig,Germany and several universities in Europe and Canada. His research interests are mainly in Commutative Algebra and Algebraic Geometry.

COURSE PLAN :

Week 01 : Noether's Normalisation Lemma — Classical Version (Part -1)
Week 02 : Noether's Normalisation Lemma — Classical Version (Part -2)
Week 03 : Dimension of Graded Rings and Modules
Week 04 : Digression on Basic Concepts
Week 05 : Dimension Theorem
Week 06 : Krull's Principal Ideal Theorem and its Generalisation
Week 07 : Digression on the Language of Algebraic Geometry
Week 08 : Regular Local Rings
Week 09 : Homological Dimension of Modules and Global Dimension of Rings
Week 10 : Homological Characterisation of Regular Local Rings
Week 11 : Discrete Valuation Rings
Week 12 : Dedekind Domains

MATHEMATICS

GALOIS THEORY

PROF. DILIP PATIL
Department of Mathematics
IIT Bombay

TYPE OF COURSE : New | Core | UG/PG
INTENDED AUDIENCE : BSc / BE /ME/ MSc / PhD
PRE-REQUISITES : Linear Algebra; Algebra – First Course
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 28 April 2019

INDUSTRIES APPLICABLE TO : R&D Departments of IBM / Microsoft Research Labs SAP /TCS /Wipro / Infosys

COURSE OUTLINE :

Galois Theory is showpiece of a mathematical unification which brings together several differentbranches of the subject and creating a powerful machine for the study problems of considerablehistorical and mathematical importance. This course is an attempt to present the theory in such alight , and in a manner suitable for undergraduate and graduate students as well as researchers.This course will begin at the beginning. These expressions are more complicated than their quadratic counterpart, but the fact that they exist comes as no surprise. It is therefore altogether unexpected that no such formulas are available for solving polynomials of degree ≥ 5. A complete answer to this intriguing problem is provided by Galois theory. In fact Galois theory was created precisely to address this and related questions about polynomials. This feature might not be apparent from a survey of current textbooks on university level algebra .This course develops Galois theory from historical perspective and I have taken opportunity to weave historical comments into lectures where appropriate.

ABOUT INSTRUCTOR :

Dilip P. Patil received B. Sc. and M. Sc. in Mathematics from the University of Pune in 1976 and1978, respectively. From 1979 till 1992 he studied Mathematics at School of Mathematics, Tata Institute of Fundamental Research, Bombay and received Ph. D. through University of Bombay in 1989. Currently he is a Professor of Mathematics at the Departments of Mathematics, Indian Institute of Science, Bangalore. At present he is a Visiting Professor at the Department of Mathematics, IIT Bombay. He has been a Visiting Professor at Ruhr-Universität Bochum, Universität Leipzig,Germany and several universities in Europe and Canada. His research interests are mainly in Commutative Algebra and Algebraic Geometry.

COURSE PLAN :

Week 01 : Prime Factorisation in Polynomial Rings, Gauss's Theorem
Week 02 : Algebraic Extensions
Week 03 : Group Actions
Week 04 : Galois Extensions
Week 05 : Finite Fields, Cyclic Groups, Roots of Unity, Cyclotomic Fields
Week 06 : Splitting Fields, Algebraic Closure
Week 07 : Normal and Separable Extensions
Week 08 : Norms and Trace
Week 09 : Fundamental Theorem on Symmetric Polynomials
Week 10 : Proof of the Fundamental Theorem of Algebra
Week 11 : Orbits of the action of Galois group
Week 12 : Inverse Galois Problem

MECHANICAL ENGINEERING

MECHANICAL ENGINEERING

04 weeks

01. Convective Heat Transfer
02. Product Design and Development
03. Inspection and Quality Control in Manufacturing
04. Polymer Assisted Abrasive Finishing Processes

08 weeks

01. Modelling and Simulation of Dynamic Systems
02. Engineering Mechanics - Statics and Dynamics
03. Basics of Finite Element Analysis-I
04. Automatic Control
05. Radiative Heat Transfer
06. Steam and Gas Power Systems
07. Fundamental of Welding Science and Technology
08. Joining Technologies for metals
09. Principles of Casting Technology
10. Weldability of Metals: Mechanisms-weld defects & prevention
11. Manufacturing Guidelines for Product Design
12. Electronic Packaging and Manufacturing
13. Kinematics of Mechanisms and Machines
14. Surface Engineering of Nanomaterials
15. Introduction to Machining and Machining Fluids
16. BioMEMS and Microsystems

12 weeks

01. Principles of Mechanical Measurement
02. Industrial Automation and Control
03. Conduction and Convection Heat Transfer
04. IC Engines and Gas Turbines
05. Thermodynamics
06. Concepts of Thermodynamics
07. Introduction to Fluid Mechanics
08. Manufacturing Process Technology I & II
09. Product Design and Manufacturing
10. Rapid Manufacturing
11. Introduction To Mechanical Micro Machining
12. Machinery Fault Diagnosis And Signal Processing
13. Spray Theory
14. Financial Mathematics
15. Introduction To Composites

MECHANICAL ENGINEERING

CONVECTIVE HEAT TRANSFER

PROF. ARUP KUMAR DAS
Department of Mechanical and Industrial Engineering
IIT Roorkee

TYPE OF COURSE	: Rerun | Elective | UG	**COURSE DURATION**	: 4 weeks (25 Feb'19 - 22 Mar'19)
PRE-REQUISITES	: Fluid Mechanics and Thermodynamics	**EXAM DATE**	: 28 Apr 2019

INTENDED AUDIENCE It is an elective course for Bachelor students in Mechanical/Chemical/Aerospace Engineering, Middle level managers from related industry

INDUSTRIES APPLICABLE TO : Intel, General Electric, General Motors, ABB, Nuclear Industries, etc.

COURSE OUTLINE :

Convection is a major mode of heat transfer when fluid is attached with the source. Processes of convection are fundamental and linked up with fluid mechanics laws and derivations of thermodynamics. Convective heat transfer has its wide horizon spreading from flow over a flat plate under constant heat flux or constant temperature boundary conditions to thermally developing or developed flow inside a duct. Moreover convection theories will widely vary depending on medium flow field which differentiates forced flow and natural gravity driven heat transfer modes. Convective heat transfer takes a major role in phase change heat transfer as well as mass transfer analogies in chemical processes. Present course targets fundamental understanding of all these facets with derivations and mathematical examples.

ABOUT INSTRUCTOR :

Dr. Arup Kumar Das is Assistant Professor in Department of Mechanical and Industrial Engineering at IIT Roorkee and actively involved in teaching and research in the direction of heat transfer for the last ten years. His research interests are in the fundamental understanding of interfacial transport in macro and micro-scale confinements with applications in energy, environment, and bio-systems. He has authored and co-authored more than 35 peer-reviewed journal papers, which includes publications in Springer, Royal Society of Chemistry, American Chemical Society and Elsevier journals.

COURSE PLAN :

Week 01 : Different Convective Modes, Balance of Total Energy, Derivation of Thermal Energy Equation, Thermal Boundary Layer, Forced Convection: Low Prandtl Number over a Flat Plate.

Week 02 : Forced Convection: High Prandtl Number over a Flat Plate, Forced Convection over a Flat Plate: Uniform Heat Flux, Natural Convection: Uniform Wall Temperature, Natural Convection: Uniform Heat Flux, Tutorials on Convection over flat plate.

Week 03 : Forced Convection in Ducts, Thermally Developed Slug Flow in a Duct, Thermally and Hydrodynamically Developed Flow: Uniform Heat Flux, Thermally and Hydrodynamically Developed Flow: Uniform Wall Temperature, Thermal Entrance Region.

Week 04 : Tutorials on Convection inside duct, Rayleigh Benard Convection, Heat Transfer with Phase Change, Mass Transfer, Tutorials on Phase change and mass transfer

PRODUCT DESIGN AND DEVELOPMENT

MECHANICAL ENGINEERING

PROF. INDERDEEP SINGH
Department of Mechanical Engineering
IIT Roorkee

TYPE OF COURSE : Rerun | Elective| UG/PG

COURSE DURATION : 4 weeks (28 Jan'19 - 22 Feb'19)

PRE - REQUISITES : Nil

EXAM DATE : 31 Mar 2019

INDUSTRY SUPPORT : All industries where products are being conceptualized, designed and developed in order to satisfy the human needs and requirements.

COURSE OUTLINE :

It has been established worldwide that the most successful economies are based on innovation and creativity led entrepreneurship. The government is focusing on putting concerted efforts to produce job creators. The current MOOC on Product Design and Development is conceptualized and planned in such a way that it helps both job creators as well as job seekers.

ABOUT INSTRUCTOR :

Prof. Inderdeep Singh is currently working as Associate Professor in Department of Mechanical and Industrial Engineering at Indian Institute of Technology Roorkee. He has taught among others, the industrial engineering courses such as Production Planning and Control, Product Design and Development, Work System Design, Industrial Management and Quality Management. He has been actively involved in the National Mission Project on Education Through ICT (NME-ICT) of Government of India. He has completed three video and one web course under the National Programme on Technology Enhanced Learning (NPTEL). He has developed suitable pedagogical methods for two under-graduate courses of Mechanical Engineering.

COURSE PLAN :

Week 1 : Introduction to course, Product life-cycle, Product policy of an organization. Selection of a profitable product, Product design process, Product analysis.

Week 2 : Value engineering in product design; Advantages, Applications in product design, Problem identification and selection, Analysis of functions, Anatomy of function.Primary versus secondary versus tertiary/unnecessary functions, Functional analysis: Functional Analysis System Technique (FAST), Case studies.

Week 3 : Introduction to product design tools, QFD, Computer Aided Design, Robust design, DFX, DFM, DFA, Ergonomics in product design,.

Week 4 : DFMA guidelines, Product design for manual assembly, Design guidelines for metallic and non-metallic products to be manufactured by different processes such as casting, machining, injection molding etc., Rapid prototyping, needs, advantages, working principle of SLA, LOM and SLS

MECHANICAL ENGINEERING

INSPECTION AND QUALITY CONTROL IN MANUFACTURING

PROF. KAUSHIK PAL
Department of Mechanical & Industrial Engineering
IIT Roorkee

TYPE OF COURSE : New | Elective | UG/PG
INTENDED AUDIENCE : B.E./M.E./ M.Sc./Ph.D
COURSE DURATION : 4 weeks (25 Feb'19 - 22 Mar'19)
EXAM DATE : 27 April 2019

INDUSTRIES APPLICABLE TO : TATA Motors, ISRO, DRDO, Railways, BHEL,IOCL, Bharat Forge, Larsen and Toubro, Mahindra & Mahindra; etc.

COURSE OUTLINE :

In manufacturing, quality control is a process that ensures customers receive products free from defects and meet their requirements. Inspection and measurement is needed during production for quality control because of the inherent variability introduced by the machines, tools, raw materials, and human operators which causes variations in the different quality characteristics (length, diameter, thickness, tensile strength, surface finish etc.) of the product. Inspection and testing are very important in maintaining a certain quality level in the product during production.

ABOUT INSTRUCTOR :

Dr. Kaushik Pal is an Associate Professor in Department of Mechanical and Industrial Engineering, IIT Roorkee since 2012. He obtained his Ph.D Degree (2009) from IIT, Kharagpur and then joined Gyeongsang National University, South Korea for pursuing Post-Doc research. His fields of interests are surface modification of nano-materials and use of such materials in different electronic, mechanical and bio-medical applications.

COURSE PLAN :

Week 01 : Introduction, Fundamental Concept of Quality, Role of Inspection and Measurement for Quality Control in Manufacturing, Need of Inspection, Inspection types and Principles, Design for Inspection, Destructive Inspection, Testing of Composite Materials

Week 02 : Non-destructive Inspection-I: Visual Inspection, Dye Penetrant Inspection, Magnetic Particle Inspection, Eddy Current Inspection, Ultrasonic Testing

Week 03 : Non-destructive Inspection-II: Acoustic Emission Inspection, Radiography, Leak Testing, Thermographic Non-destructive Testing, Advanced Non-destructive Techniques, NDT Standards, Safety in NDT

Week 04 : Engineering Metrology: Linear Measurement, Angular Measurement, Measurement of Surface Finish, Screw Thread Metrology, Gear Measurement, Miscellaneous Measurements

MECHANICAL ENGINEERING

POLYMER ASSISTED ABRASIVE FINISHING PROCESSES

PROF. M. RAVI SANKAR
Department of Mechanical Engineering
IIT Guwahati

TYPE OF COURSE : New | Elective | UG/PG
COURSE DURATION : 4 weeks (28 Jan'19 - 22 Feb'19)
INTENDED AUDIENCE : BE / ME, PHD (Mechanical Engineering, Production Engineering)
EXAM DATE : 31 March 2019

INDUSTRIES APPLICABLE TO : Oil India Ltd., ONGC, TATA motors, ISRO, BARC, DRDL, NTPC, CMTI, CMERI, CGCRI, Grind Master, NRL

COURSE OUTLINE :

Micro and Nano finishing is one of the basic courses for the mechanical undergraduate students. This process comes under the subtractive manufacturing processes where in material is removed in micro to nano range. This course gives the basic understanding of the various polymer assisted abrasive micro to nano finishing processes and its physics. The mentioned syllabus is systematic order to understand gradually, what is the importance of surface finish, how the polymers supports the abrasive particles to finish the workpiece surface to nano level. This course mostly deals with abrasive flow finishing process where polymer rheological abrasive medium/fluids are used achieve nano surface roughness. This course also gives emphasis on polymer rheology and its effect on nano finishing.

ABOUT INSTRUCTOR :

Dr. Mamilla Ravi Sankar is currently an Assistant Professor in the Department of Mechanical Engineering, IIT Guwahati. He did his B.Tech from Sri Venkateswara University, Tirupati, and M.Tech as well as PhD from IIT Kanpur. His research group is focus on Sustainable Manufacturing, Eco-friendly Cutting fluids, Coatings, Advanced Manufacturing, Tribology and Rheology. MRS Lab also involves in development of lab scale Innovations to Commercial Manufacturing Products. He has published over 30 research articles in internationally reputed journals, 2 Patents, 2 Edited Books and 6 Book chapters. He is recipient of prestigious awards such as Institution of Engineers India (IEI) Young Engineers Award-2015 in Production Engineering, Indian Society for Advancement in Materials and Process Engineering (ISAMPE)-2011 and finalist of Indian National Academy of Engineering (INAE) Young Engineer Award-2014.

COURSE PLAN :

Week 01 : Introduction to Polymer Assisted Abrasive Finishing Processes,Importance of Mirco to Nano Finishing and Surface roughness representation,Finishing with polymer grinding wheels and polymer medium for vibratory bowl finishing

Week 02 : Polymer abrasive medium for vibratory bowl finishing and Pitch Polishing,Polymer Pad and Chemo-mechanical Polishing,Elastic Emission and Elasto Abrasive Finishing

Week 03 : Abrasive Flow Machining and Finishing,Polymer Rheological Abrasive Medium/ Fluids for Finishing: Rheology and Tribology,Active abrasive particles and finishing forces during finishing using Polymer assisted Abrasives

Week 04 : Advances in Abrasive Flow Finishing: DBGAFF, Spiral Polishing, CFAAFM, R-AFF, Micro AFF, Vibrations assisted AFF, Electro AFF process,Modeling of Polymer rheological abrasive medium for finishing,Finishing of Bio Implants: Knee implant, Hip implants

MODELLING AND SIMULATION OF DYNAMIC SYSTEMS

PROF. PUSHPARAJ MANI PATHAK
Dept. of Mechanical Engineering
IIT Roorkee

TYPE OF COURSE : Rerun | Elective | UG/PG
INTENDED AUDIENCE : B. Tech/M.Tech students or Professionals.
INDUSTRIES APPLICABLE TO : Railways, DRDO

COURSE DURATION : 8 weeks (28 Jan'19 - 22 Mar'19)
EXAM DATE : 31 Mar 2019

COURSE OUTLINE :

The term modeling refers to the development of a mathematical representation of a physical system while the term simulation refers to the procedure of solving the equations that resulted from model development. The quality or usefulness in a model is measured by its ability to capture the governing physical features of the problem. Here, the expertise of the modeler is useful. The model is amenable to manipulation which would be impossible, too expensive, or too impractical to perform on the system which it portrays. This feature makes it a very useful tool to study system behavior.

ABOUT INSTRUCTOR :

Dr. Pushparaj Mani Pathak is currently Associate Professor at IIT Roorkee. He graduated from N.I.T., Calicut in 1988 in Mechanical Engineering. He completed his M. Tech in Solid Mechanics and Design from IIT Kanpur in 1998. Later he was awarded the PhD degree from IIT Kharagpur in 2005. His areas of research are Robotics, Dynamics, Control, and Bond Graph Modelling. He has served in different industries from 1989 to 1994. He is in teaching profession since 1994. He is serving in Mechanical and Industrial Engineering Department, IIT Roorkee since 2006. He has co-authored one book on Intelligent Mechatronic Systems: Modeling, Control and Diagnosis published by Springer, London and has published more than 40 papers in International Journals in the field of Robotics and Control. He has supervised 34 M. Tech theses and 7 PhD theses in different areas.

COURSE PLAN :

Week 01 : Introduction to Modelling and Simulation
Week 02 : Bond Graph Modelling of Dynamic Systems
Week 03 : Basic System Models
Week 04 : System Models of Combined Systems
Week 05 : Dynamic Response and System Transfer Function
Week 06 : Block diagram/Signal flow diagram/State Space formulation and Frequency response.
Week 07 : Simulation and Simulation application
Week 08 : Parameter Estimation, System Identification and Optimization

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ENGINEERING MECHANICS – STATICS AND DYNAMICS

MECHANICAL ENGINEERING

PROF. MAHESH V PANCHAGNULA
Dept. of Applied Mechanics
IIT Madras

TYPE OF COURSE : Rerun | Core | UG
INTENDED AUDIENCE : BE - Mechanical
Applied Mechanics

COURSE DURATION : 8 weeks (28 Jan'19 - 22 Mar'19)
EXAM DATE : 31 Mar 2019

COURSE OUTLINE :

Static and dynamical mechanical systems are the heart of all engineering today. The static systems range from bridges, load bearing members of roofs to fasteners and bolts. Dynamical systems are also ubiquitous in the form of machines which convert electrical energy to mechanical energy. Understanding the equations governing these static and dynamical systems is at the heart of this course.

ABOUT INSTRUCTOR :

Prof. Mahesh V Panchagnula, Professor in Department of Applied Mechanics, Indian Institute of Technology, Madras B.S. - Mechanical Engineering, Indian Institute of Technology, 1992, M.S. - Mechanical Engineering, Purdue University, 1994, Ph.D.- Mechanical Engineering,Purdue University, 1998. He is currently Dean of International Relations and Alumni affairs at IITM.

COURSE PLAN :

Week 01 : Basics of rigid bodies
Week 02 : Introduction to trusses and joints
Week 03 : Discussion on beams
Week 04 : Overview of friction and work & energy
Week 05 : Plane kinematics
Week 06 : Plane kinetics
Week 07 : Work-Energy and Impulse-Momentum methods
Week 08 : Overview of Vibrations

MECHANICAL ENGINEERING

BASICS OF FINITE ELEMENT ANALYSIS - I

PROF. NACHIKETA TIWARI
Department of Mechanical Engineering
IIT Kanpur

TYPE OF COURSE : Rerun | Elective | UG/PG
COURSE DURATION : 8 weeks (25 Feb'19 - 19 Apr'19)
INTENDED AUDIENCE : UGs, PGs, professionals in industry who want to learn about basics of sound and acoustics
EXAM DATE : 27 Apr 2019
PRE-REQUISITES : Must be enrolled into a B. Tech. program or equivalent and should have completed second year of his 4-year program

INDUSTRIES APPLICABLE TO : Automotive, NVH, Acoustics, Railways, Power Generation and all industry that has to address issus related to noise.

COURSE OUTLINE :

This course is intended for all those who want to learn FEA from an application standpoint. Currently, many users of FEA have limited understanding of theoretical foundation of this powerful method. The consequence is that quite often they use commercial codes inaccurately, and do not realize that their results may be flawed. The course is intended to address this limitation by making the student aware of the underlying mathematics in easy to understand format. The course is open to all engineering students who have at the minimum successfully completed two years of their B. Tech (or equivalent) degrees. The course is also open to all professionals in industry who wish to learn fundamentals of FEA in a semi-formal but structured setting, and plan to use this knowledge in their workplace.

ABOUT INSTRUCTOR :

Dr. Nachiketa Tiwari K is an Associate Professor of Mechanical Engineering at IIT Kanpur. He has a Ph.D in engineering mechanics from Virginia Tech. His doctoral thesis involved nonlinear analysis of composite structures through FE, analytical and experimental methods. Dr. Tiwari also has deep understanding of fundamentals of FEA as he has used several tools in industry for over a dozen years for producing world class products. His current areas of research interest are composite structures, noise, vibrations, and product design. He has established Dhwani, an Acoustics Lab at IITK, which is one of the best in the country.

COURSE PLAN :

Week 01 : Intro & concepts
Week 02 : Mathematical concepts
Week 03 : 1-D BVP problems of 2nd order
Week 04 : Applications: heat transfer/solid mechanics
Week 05 : Beams
Week 06 : Errors & convergence
Week 07 : Time dependent problems
Week 08 : Eigen value problems and closure

AUTOMATIC CONTROL

MECHANICAL ENGINEERING

PROF. ANIL KUMAR
Department of Mechanical Engineering
IIT Roorkee

TYPE OF COURSE : Rerun | Core | UG/PG
COURSE DURATION : 8 weeks (28 Jan'19 - 22 Mar'19)
PRE - REQUISITES : Completed first year of BE/BTech.
EXAM DATE : 31 Mar 2019
INTENDED AUDIENCE : UG students of Mechanical, Electrical, Automobile, Production, Aerospace, Civil Engineering and equivalent.

COURSE OUTLINE :

Automatic Control is the theory used in various applications, for example, manufacturing of a product, refrigeration and air conditioners, aircraft, missile, satellite launching, etc. The study of a dedicated course is required to understand the fundamental and advance concepts of automatic controls for engineers and designers. This course is of basic level. It introduces design and modelling of a control system, theory of transfer functions, poles, zeros, block diagram algebra, transient response analysis of first and second order systems, stability and Routh's criteria, error analysis, PID control, root locus techniques, compensation techniques, introduction to the state space method and application of MATLAB in automatic control.

ABOUT INSTRUCTOR :

Prof. Anil Kumar works as an Assistant Professor faculty in the Department of Mechanical and Industrial Engineering at IIT Roorkee for more than four years. He teaches subjects like, Automatic Control, Machine Design, Vibrations and Noise, etc. to UG students. His research area belongs to modal identification of structures, testing of piping joints, vibration mitigation.

COURSE PLAN :

Week 1 : Automatic Control System.

Week 2 : Mathematical Modelling.

Week 3 : Transient Response Analysis.

Week 4 : Stability and Steady State Error.

Week 5 : Root Locus Technique.

Week 6 : Design via Root Locus and Compensation Techniques.

Week 7 : State Space Method.

Week 8 : Application of MATLAB in Automatic Control.

MECHANICAL ENGINEERING

RADIATIVE HEAT TRANSFER

PROF. ANKIT BANSAL
Department of Mechanical and Industrial Engineering
IIT Roorkee

TYPE OF COURSE : New| Elective | PG
INTENDED AUDIENCE : ME/MS/PhD
PRE-REQUISITES : Heat Transfer
COURSE DURATION : 8 weeks (28 Jan'19 - 22 Mar'19)
EXAM DATE : 31 Mar 2019

INDUSTRIES APPLICABLE TO : BHEL Steel Industry NTPC and other power companies

COURSE OUTLINE :

This course offers a comprehensive treatment of Radiative heat transfer. The course starts with standard optics on Radiative transfer and radiant exchange between surfaces and introduces modern state-of-the-art topics including Radiative properties of gases and particles, P-N approximation, the Monte Carlo method and the prediction of radiation transfer in absorbing,emitting, and scattering media.

ABOUT INSTRUCTOR :

Dr Ankit Bansal received his PhD from the Pennsylvania State University in Mechanical Engineering with specialization in Radiative Heat Transfer. He has worked as Assistant Professor at IIT Mandi for two years from 2012-2014. For last three years he has been working as Assistant Professor in the Mechanical and Industrial Engineering Department of IIT Roorkee.He has taught courses on Thermodynamics, Fluid Mechanics, Gas Dynamics, Heat Transfer,CFD etc. He has authored more than ten papers in reputed journals.

COURSE PLAN :

Week 01 : Fundamentals of Thermal Radiation, Introduction, Basic Laws of Thermal Radiation, Introduction to Radiative Properties, Radiative Properties of Opaque Surfaces

Week 02 : View Factors, Evaluation Methods, Monte Carlo method

Week 03 : Radiative Exchange between Black surfaces, Radiative Exchange between Gray, Diffuse, Surfaces, Radiative Exchange between Non-Ideal Surfaces

Week 04 : Equation of Radiative Transfer for participating media

Week 05 : Solution Methods: Plane-Parallel Slab, Approximate Methods, Method of spherical harmonics and Discrete Ordinate Method.

Week 06 : Zone method and applications

Week 07 : Radiative Properties of Participating Media: Gas Properties, particle Properties

Week 08 : Spectral Models: Wide band model, Narrow-band models, k-distribution models

STEAM AND GAS POWER SYSTEMS

MECHANICAL ENGINEERING

PROF. RAVI KUMAR
Department of Mechanical Engineering
IIT Roorkee

TYPE OF COURSE : Rerun | Core | UG/PG
COURSE DURATION : 8 weeks (25 Feb'19 - 19 Apr'19)
PRE - REQUISITES : None
EXAM DATE : 28 Apr 2019
INDUSTRY SUPPORT : BHEL, NTPC and other private power industries.

COURSE OUTLINE :

This Course provides a simple understanding of the steam and gas power systems. The course contains the analysis of vapour power cycle i.e. Rankine cycle, steam generators and their accessories, Performance of Boilers and combustion of fuel, high pressure boilers, flow through steam and gas nozzles, different type of steam turbines for power generation and condensers. The gas turbine cycle, working of gas turbines, centrifugal compressors, axial compressors and combustion chamber of gas turbines.

ABOUT INSTRUCTOR :

Prof. Ravi Kumar is a Professor in the Department of Mechanical & Industrial Engineering, Indian Institute of Technology Roorkee. He has been teaching thermal engineering courses to UG and PG students of the Department. He is a member of ASME, ASHRAE and IIFIIR. He has supervised number of masters and doctoral students in this area.

COURSE PLAN :

Week 1 : Review of Thermodynamics, Rankine Cycle, Performance of Rankine Cycle, Binary Vapour Cycle and Co-generation, Problem Solving.

Week 2 : Steam Generators, Fire Tube Boilers, Water Tube Boilers, Boiler Mountings and Accessories, High Pressure Boilers- LaMont and Benson Boilers.

Week 3 : High Pressure Boilers- Loeffer and Velox Boilers, Draught, Performance of Boilers, Combustion of Fuel,Problem Solving.

Week 4 : Boiler Trial, Nozzles and Diffusers-Momentum and Continuity Equations, Nozzles and Diffusers-Efficiency and Critical Pressure, Nozzles and Diffusers-General Relationship and supersaturated Flow, Problem Solving.

Week 5 : Steam Turbines, Compounding of Steam Turbines, Impulse Steam Turbines, Impulse Steam Turbine Performance,Problem Solving.

Week 6 : Impulse-Reaction Steam Turbines, Impulse-Reaction Turbine Performance, Energy Losses in Steam Turbines,Condensers, Problem Solving.

Week 7 : Gas Turbine Cycles, Gas Turbine Cycles- Performance Evaluation, Gas Turbine Cycles- Modifications, Problem Solving,Centrifugal Compressors.

Week 8 : Centrifugal Compressor Characteristics, Axial Flow Compressors, Axial Flow Compressor Characteristics, Jet Propulsion,Problem Solving.

FUNDAMENTAL OF WELDING SCIENCE AND TECHNOLOGY

MECHANICAL ENGINEERING

PROF. PANKAJ BISWAS
Department of Mechanical Engineering
IIT Guwahati

TYPE OF COURSE : New | Core | UG/PG
COURSE DURATION : 8 weeks (28 Jan'19 - 22 Mar'19)
INTENDED AUDIENCE : BE, ME, M.S, Ph.D
EXAM DATE : 31 March 2019
PRE-REQUISITES : BE/BTech in mechanical/production/ manufacturing sciences/power plant Engg/naval and architecture Engg.

COURSE OUTLINE :

In manufacturing industry over 30% production costs is spent on welding.Knowledge of welding and technology is highly essential in most of the manufaturing industries.In this present course the primary focuse is on basic fundamental of welding and its importance in industries.This course will also cover welding defects and inspection with their remedies to improve the weld quality.This course will also highlight safety precautions to be followed in welding.It will give fundamental knowledge of physics in various welding processes and will also highlight the importance and application of welding techniques.

ABOUT INSTRUCTOR :

Dr. Pankaj Biswas is an Associate Professor in the Dept. of Mechanical Engineering, IIT Guwahati. He is working in the area of welding technology and forming by line heating for the past 14 years. His areas of research are on computational weld mechanics, similar and dissimilar friction stir welding, friction stir welding of steel, hybrid welding technology, Finite Element analysis of weld induced distortion and residual stresses, Analysis of large welding structure, forming by line heating and modeling of welding processes using soft computing techniques. He has guided 4 PhD scholars in the area of welding. Currently He is guiding 8 PhD students in the welding and line heating areas. He has already published about 50 journal articles, 50 conference proceedings, 10 book chapters and 2 patents. He also received the IEI Young Engineers Award 2013- 2014' in Mechanical Engineering discipline."

COURSE PLAN :

Week 01 : Introduction and Definition, Classification, Type of Welding Joints, Type of Edge Preparation

Week 02 : Nomenclature and Symbol of Welding Joints: Different types of nomenclature of welding joints, Industrial welding symbols.

Week 03 : Power Source of Welding: Type of power source and their characteristics, Welding heat sources.

Week 04 : Physics and Principle of Arc Welding: Welding arc and arc structure, Arc initiation, Type of arc, Forces affecting the arc and metal transfer, Arc stability and arc blow

Week 05 : Different type of welding methods and their characteristics: Oxy fuel gas welding, MIG, TIG, SMAW

Week 06 : Different type of welding methods and their characteristics: SAW, ESW, EGW, Resistance Welding – Spot Welding, Friction Welding

Week 07 : Welding Metallurgy: Effect of solidification rate on welding structure – Iron Carbon diagram, TTT diagram, Heat Flow in welding, Thermal Stages in welding

Week 08 : Welding defects and inspection: Different types of welding defects, Destructive testing, Non Destructive testing

JOINING TECHNOLOGIES FOR METALS

MECHANICAL ENGINEERING

PROF. D . K . DWIVEDI
Department of Mechanical Engineering
IIT Roorkee

TYPE OF COURSE : Rerun | Core | UG/PG
PRE - REQUISITES : None
COURSE DURATION : 8 weeks (25 Feb'19 - 19 Apr'19)
EXAM DATE : 28 Apr 2019

INTENDED AUDIENCE : It is a core course for UG/PG students, practicing engineers.

COURSE OUTLINE :

It is proposed to include following joining technologies of commercial importance under different groups of processes. Fundamentals of Metal Joining Technologies: mechanisms for obtaining metallic continuity: fusion, deformation, diffusion, chemical interactions. Fusion based processes: principle of fusion welding processes, oxy-fuel has welding, common arc welding processes, laser beam welding, spot welding processes, newer variants of fusion welding processes.Solid-liquid joining processes: brazing and soldering, braze welding, cold metal transfer welding,Solid state joining processes: diffusion bonding, ultrasonic welding and explosive welding.

ABOUT INSTRUCTOR :

Prof. D. K. Dwivedi Department of Mechanical & Industrial Engineering , Indian Institute of Technology Roorkee obtained BE (mechanical engineering) , in 1993 from GEC Rewa, ME (welding engineering) Univ. of Roorkee in 1997 and PhD in Met. Engineering from MNIT, Jaipur in 2003. He has about 9 years teaching experience at NIT Hamirpur and 12 years at IIT Roorkee of subjects related with manufacturing at UG level and welding engineering related subjects at PG level. He has published more than 95 research papers in SCI/SCIE indexed journals and undertaken 16 sponsored research and 48 industrial consultancy projects. Instructor has authored one book entitled "Production and Properties of Cast Al-Si Alloys with New Age International, New Delhi (2013).

COURSE PLAN :

Week 1: Introduction: Manufacturing and Joining Fundamental Mechanisms of joining, heat and pressure in joining Classification of joining processes,Heat generation and power density concept in welding Protection of the weld metal approaches, effect of gases on weld properties

Week 2: Principle of fusion welding processes, oxy-fuel gas welding Fundamentals of welding: type of weld, types of joint, welding position, arc heat generation Physics of welding arc: arc initiation, maintenance, shielded metal arc welding Electrode melting rate, effect of electrode polarity and welding parameters Gas tungsten arc welding: electrode, shielding gases, Introduction of gas metal arc welding

Week 3: Variants of Gas tungsten arc welding: GTAW, Hot wire GTAW, Flux assisted GTAW Variants of Gas metal arc welding: Pulse GMAW, CMT welding
Submerged arc welding Electro-slag and Electro-gas welding processes Laser beam welding

Week 4: Brazing Soldering and Braze welding, Fundamentals of resistance welding Resistance welding processes: spot, seam welding Flash butt welding

Week 5: Adhesive joining, Welding bonding, Solid state joining technologies: Fundamentals Ultrasonic joining, Diffusion bonding

Week 6: Explosive welding, Magnetic pulse welding, Weld thermal cycle, Heat affected zone and weld thermal cycle: I, Heat affected zone and weld thermal cycle: II

Week 7: Solidification of weld metal, Fundamentals of weldability of metals, Weldability of carbon & alloy steels: Fe-C, CCT, Weldability of stainless steels: schaeffler diagram, Metallurgical transformation in weld and heat affected zone of steels

Week 8: Weldability of aluminium alloys: porosity, HAZ softening, PMZ issues, Solidification cracking and their control, Residual stresses in weld joints: effect on joint performance, and control of residual stress, Cracking of welded joints: solidification and liquation cracks, Cracking of welded joint: cold cracking

PRINCIPLES OF CASTING TECHNOLOGY

MECHANICAL ENGINEERING

PROF. PRADEEP K. JHA
Dept. of Mechanical and Industrial Engineering
IIT Roorkee

TYPE OF COURSE : Rerun | Core | UG/PG
COURSE DURATION : 8 weeks (28 Jan'19 - 22 Mar'19)
INTENDED AUDIENCE : It is a core course for UG and PG.
EXAM DATE : 31 Mar 2019
INDUSTRIES APPLICABLE TO : Casting Industries like BHEL, Tata Steel, Jindal Steel, Foundry units of medium and large sizes

COURSE OUTLINE :

The course focuses on understanding the basics of science and technology of casting processes. Metal casting industries have evolved during the past hundred years because of advancements in technologies. The properties of the cast metals significantly depends upon the type of molding, melting, solidification and post treatment practices. This needs to be understood by the young students as well as practicing shop floor engineers so that products with superior qualities can be cast. The basic purpose of this course is to provide a sound understanding of concepts and principles of casting technology so as to enable them to be conversant with advances in these methods in the long run towards increasing the productivity of casting industries.

ABOUT INSTRUCTOR :

Dr. Pradeep K. Jha is presently working as Associate Professor in the Department of Mechanical & Industrial Engineering at IIT Roorkee. He has been teaching courses related to manufacturing technology and theory of production processes to undergraduate and postgraduate students for more than 12 years. He is actively involved in research work related to production processes, especially casting processes.

COURSE PLAN :

Week 01 : Introduction to Casting technology, Solidification analysis for metals and alloys
Week 02 : Technology of patternmaking, study of molding sands and their testing methods
Week 03 : Technology of mouldmaking and coremaking, Special sand moulding processes
Week 04 : Principles of gating design for castings
Week 05 : Principles of risering design for castings
Week 06 : Special casting methods, Melting furnaces
Week 07 : Melting and pouring practices for production of Cast Iron family, steel and non-ferrous metals and alloys
Week 08 : Fettling and Heat treatment of castings, Casting defect and its diagnostic methods

WELDABILITY OF METALS: MECHANISMS-WELD DEFECTS & PREVENTION

MECHANICAL ENGINEERING

PROF. D.K. DWIVEDI
Dept. of Mechanical and Industrial Engineering
IIT Roorkee

TYPE OF COURSE : New | Elective| PG
INTENDED AUDIENCE : UG and PG Students, Research Scholar & Practicing Engineers
COURSE DURATION : 8 weeks (25 Feb'19 - 19 Apr'19)
EXAM DATE : 27 April 2019

INDUSTRIES APPLICABLE TO : Manufacturing industry

COURSE OUTLINE :

The course content is designed to have systematic and comprehensive understanding on various aspects related with weldability of various metal systems of commercial importance. It is proposed to include weldability, factors affecting weldability of metals, weldability of plan carbon steel, alloy steel, and stainless steels. Presentations will be supported with case studies for effective communication of concepts and procedures. Case studies will be taken up regarding dis-continuities in metal systems like ferrous and non-ferrous metals.

ABOUT INSTRUCTOR :

D K Dwivedi obtained BE (Mechanical Engineering), in 1993 from GEC Rewa, ME (welding engineering) from Univ. of Roorkee in 1997 and PhD in Met. Engineering from MNIT, Jaipur in 2003. He has about 9 years teaching experience at NIT Hamirpur and 14 years at IIT Roorkee in subjects related with manufacturing at UG level and welding engineering related subjects at PG level. He has undertaken work of failure investigation valves, penstocks, bridges for many private and public sector industries especially in hydropower sector.

COURSE PLAN :

Week 01 : Understanding Weldability: Introduction I, II, Metal Properties & Weldability I, II, Weldability of Work Hardenable Metals

Week 02 : Weldability of Work Hardenable & Precipitation Strengthened Metals, Weldability of Precipitation Strengthened Metals, Weldability of Metals Strengthened by Grain Refinement, dispersion Hardening and Transformation Hardening, Weldability of Transformation Hardening Metals, Weldability of Metals: Combination of Strengthening Mechanisms

Week 03 : Weldability Consideration, Weldability of Carbon and Alloy Steel – I, II, III, Weldability of Low Carbon Steel and Mild Steel

Week 04 : Weldability of Medium Carbon Steel and High Carbon Steel, Weldability of Carbon and Welding Processes- I, II, III, Weldability of Carbon Steel and Radiation Welding and Thermal Cutting

Week 05 : Weldability of High Strength Low Alloy Steels, Weldability of Q & T Steels- I, II, III, IV

Week 06 : Weldability of HTLA Steel- I, II, Weldability of Cr-Mo steel I, II, III

Week 07 : Weldability of Pre-Coated Steel- I, II, Weldability of Stainless Steel- I, II, Weldability of Martensitic Stainless Steel I

Week 08 : Weldability of Martensitic Stainless Steel- II, Weldability of Ferritic Stainless Steel, Weldability of Austenitic Stainless Steel -I, II, Weldability of PH Stainless Steel

MECHANICAL ENGINEERING

MANUFACTURING GUIDELINES FOR PRODUCT DESIGN

PROF. INDERDEEP SINGH
Department of Mechanical and Industrial Engineering
IIT Roorkee

TYPE OF COURSE : New | Elective | UG/PG
INTENDED AUDIENCE : B. E./M. E/Ph. D/Mech
COURSE DURATION : 8 weeks (25 feb'19 - 19 Apr'19)
EXAM DATE : 27 Apr 2019

INDUSTRIES APPLICABLE TO : All the industries involved in product conceptualization, design and development

COURSE OUTLINE :

Competition in the key word in today's business environment. The major objective of the companies worldwide is to conceptualize, design and develop products that not only satisfy the customer's needs and wants but also are competitive from cost as well as quality point of view. But it has been observed that our product design and development cycle usually follows a traditional/conventional approach that leads to a lot of non-value added features in the product. Moreover, these features also increase the manufacturing cost of the product. Therefore, there is an imminent need to acquaint the engineers and managers with the concept of design thinking that involves an integrated approach of combining the functions of design and manufacturing (including assembly).

ABOUT INSTRUCTOR :

Dr. Inderdeep Singh is currently working as Associate Professor in the Department of Mechanical and Industrial Engineering at Indian Institute of Technology Roorkee. He has taught among others, the industrial engineering courses such as Production Planning and Control, Product Design and Development, Work System Design, Industrial Management and Quality Management. He has been actively involved in the National Mission Project on Education Through ICT (NME-ICT) of Government of India.

COURSE PLAN :

Week 01 : Product Design: Basics, Introduction of Manufacturing Processes, Manufacturing Processes Advantages and Limitations-I, Manufacturing Processes Advantages and Limitations-II, Process Capabilities: Basics.

Week 02 : Engineering Materials, Properties of Materials, Selection of Materials – I, Selection of Materials – II, Applications of Engineering Material.

Week 03 : Robust Design, Design for X, Product Design for Manual Assembly, DFMA Guidelines, Ergonomics in Product Design.

Week 04 : Selection of Processes-I, Selection of Processes-II, Process Capabilities, Design Guidelines for Sand Casting, Design Guidelines for Die Casting Process.

Week 05 : Product Design Guidelines: Compression Molding and Extrusion, Design Guidelines for Extrusion and Injection Molding, Design Guidelines for Sheet Metal Working, Design Guidelines for Machining, Design Guidelines for Powder Metal Processing

Week 06 : Assembly Processes: Introduction, Adhesive Joining: Guidelines, Design Guidelines for Mechanical Fasteners, Design Guidelines for Welding, Design Guidelines: Brazing and Soldering.

Week 07 : Induction Welding: Plastics, Ultrasonic Welding: Plastics, Vibration and Spin Welding: Plastics, Microwave Joining, Hole Making in Polymer and Polymer Matrix Composites.

Week 08 : Design for Environment, Design for Environment Process, Product Architecture, Rapid Prototyping, Product Design - Manufacturing Perspective.

ELECTRONIC PACKAGING AND MANUFACTURING

MECHANICAL ENGINEERING

PROF. ANANDAROOP BHATTACHARYA
Department of Mechanical Engineering
IIT Kharagpur

TYPE OF COURSE : New | Elective | UG/PG
INTENDED AUDIENCE : BE/ME (Mech, EE, EC, Chem)
COURSE DURATION : 8 weeks (28 Jan'19 - 22 Mar'19)
EXAM DATE : 31 March 2019
INDUSTRIES APPLICABLE TO : Intel, IBM, Dell, Cisco, GE, Bosch, HP, Qualcomm, HAL

COURSE OUTLINE :

Advanced packaging has permitted the integration of electronics into all manner of products and applications, embedding electronics into every facet of our lives and making them ubiquitous in every engineering system. We are facing an ever-increasing demand in the speed and amount of information we need to transmit, communicate and process. To meet this demand and compete in the international marketplace, we have to constantly seek methods to achieve early adoption of new and emerging technologies, improve quality and reliability, and reduce cost.

ABOUT INSTRUCTOR :

Anandaroop Bhattacharya is an Associate Professor of Mechanical Engineering at IIT Kharagpur. His research interests lie in the areas of electronics cooling, transport in porous media and gas turbine heat transfer. Prior to joining IIT, Anandaroop spent 12 years in the industry in USA and India working at Intel, General Motors and General Electric Research Centers

COURSE PLAN :

Week 01 : Introduction - Electronic Packaging, Levels of Packaging, Wafer fabrication, Recap of Basic Electronics

Week 02 : First level packaging – Package Taxonomy, Chip and chip carrier, lead frame, Interconnection types and methods, Flip-Chip bonding, area arrays

Week 03 : Second level packaging - Design and manufacture of Printed Wiring Boards, Types of circuit boards, Component placement, Routing, Lamination, Solder Masks

Week 04 : Third level packaging and System level integration – cables, connectors, chassis, display

Week 05 : Advanced Packaging - Chip Scale Packaging, Multi-chip Module, Stacked Package, System in package (SIP), system on chip (SOC) Specialized packages (RF, MEMS, Sensors, Harsh Environments, Wearable/Flexible)

Week 06 : Mechanical Design - Vibration analysis, Theorem of Castigliano; Fatigue and creep analysis

Week 07 : Thermal Design - Basics of heat transfer, Thermal Resistance, Thermal Interface Materials, Heat spreaders and Heat sinks, System level thermal challenges, modeling and analysis

Week 08 : Reliability - Design for reliability, Life cycle, Failure Modes and Mechanisms, Reliability Metrology and Analysis, Accelerated Degradation Modeling, Environmental Stress Screening.

MECHANICAL ENGINEERING

KINEMATICS OF MECHANISMS AND MACHINES

PROF. ANIRVAN DASGUPTA
Dept. of Mechanical Engineering
IIT Kharagpur

TYPE OF COURSE : New | Elective | UG/PG

COURSE DURATION : 8 weeks (28 Jan'19 - 22 Mar'19)

INTENDED AUDIENCE : Mechanical, Electrical, Aerospace Bio-Medical

EXAM DATE : 31 March 2019

PRE-REQUISITES : Engineering Mechanics, Undergraduate Mathematics

INDUSTRIES APPLICABLE TO : Automobile and Aerospace industries, Automation and robotic device manufacturers, Bio-Medical device manufacturers

COURSE OUTLINE :

This course will deal with kinematic analysis of mechanisms and machines. It will include motion and force transmission analysis of linkage mechanisms, open and closed-chain planar robots, and geared transmission. The discussion will start with an introduction to the subject matter and nomenclature, and will cover direct and inverse kinematics, velocity and acceleration analysis, kinematic path generation for robots, singularities in kinematic chains, principle of virtual work and force analysis, and kinematic analysis of differential and automatic gear transmission. The course will demonstrate various concepts by working out problems relevant to real life applications of mechanisms. The course is expected to help students in their basic understanding and use of kinematic analysis.

ABOUT INSTRUCTOR :

Dr. Anirvan DasGupta is a faculty in Mechanical Engineering at IIT Kharagpur since 1999. His interests are in the mechanics of discrete and continuous systems. He has extensively taught courses at undergraduate and postgraduate levels like Mechanics, Kinematics of Machines, Dynamics, Dynamics of Machines, Vibration Analysis, Wave Propagation in Continuous Media, and Rail Vehicle Dynamics.

COURSE PLAN :

Week 01 : Introduction to Mechanisms, Mobility Analysis

Week 02 : Mobility Analysis, Displacement Analysis

Week 03 : Displacement Analysis

Week 04 : Velocity Analysis

Week 05 : Velocity Analysis

Week 06 : Velocity Analysis, Acceleration Analysis

Week 07 : Force Analysis, Introduction to geared transmission

Week 08 : Analysis of gear trains

MECHANICAL ENGINEERING

SURFACE ENGINEERING OF NANOMATERIALS

PROF. KAUSHIK PAL
Department of Mechanical Engineering
IIT Roorkee

TYPE OF COURSE : Rerun | Core | UG/PG

COURSE DURATION : 8 weeks (28 Jan'19 - 22 Mar'19)

INDUSTRY SUPPORT : Nanoshel; Adnano Technologies; Mittal Enterprises; Ultrananotech; Reinste Nano Ventures; etc.

EXAM DATE : 31 Mar 2019

INTENDED AUDIENCE : It is a Core as well as Elective Course for UG & PG students of Metallurgy, Nano Science Nanotechnology, Chemical Engg, Chemistry, Aerospace Engg, Material Science and Mechanical Engg. etc.

COURSE OUTLINE :

Surface engineering (SE) is a sub-discipline of Materials Science and Materials Engineering which deals with the surface of a solid and its modifications. The primary goal of SE of nanomaterials is to modify the properties of surface to improve its electrical and thermal properties, and to improve the compatibility of nanomaterials with some matrix when they are used as reinforcing fillers in composites for high performance applications.

ABOUT INSTRUCTOR :

Prof. Kaushik Pal is an Associate Professor in Department of Mechanical and Industrial Engineering, IIT Roorkee since 2012. He has obtained his Ph.D Degree (2009) from IIT, Kharagpur and then joined Gyeongsang National University, South Korea for pursuing Post-Doc research. His fields of interests are surface modification of nano-materials and use of such materials in different electronic, mechanical and bio-medical applications. Currently, he is acting as reviewer of several internationally known journals and is an active member of National Academy of Sciences, American Chemical Society (ACS) and Royal Society of Chemistry (RSC). Also, He is also the recipient of Brain Korea (BK-21) fellowship award and DAAD fellowship award.

COURSE PLAN :

Week 1 : Tribology & its classification, Friction tribology, Wear & corrosion, Lubrication, Effect of tribology on surface of nanomaterials.
Week 2 : Conventional surface engineering, Types of surface modifications, Physical modifications, Chemical modifications, Applications of surface engineering towards nanomaterials.
Week 3 : Deposition and surface modification methods, Physical vapor deposition, Chemical vapor deposition, Advanced surface modification practices, Advantages of deposition for surface modification.
Week 4 : Synthesis, processing and characterization of nano-structured coatings, Functional coatings, Advanced coating practices, Characterization of nano-coatings, Applications of nano-coatings
Week 5 : Need of advanced methods for surface and coating testings, Size dependency in nanostructures of nanocoatings, Size effect in electrochemical properties of nanostructured coatings, Size effect in mechanical properties of nanostructured coatings, Size effect in physical and other properties of nanostructured coatings.
Week 6 : Thin films for surface engineering of nanomaterials, Sputtering techniques, Evaporation processes, Thin film deposition through gas phase techniques, Liquid phase techniques.
Week 7 : Microencapsulation: Processes, Microencapsulation: Kinetics of release, Plating of nanocomposite coatings, Advantages of microencapsulation over other conventional methods.
Week 8 : Current trends in surface modification of nanomaterials, Modified Nanomaterials: In-use for consumer products, Main problems in synthesis of modified nanomaterials.

INTRODUCTION TO MACHINING AND MACHINING FLUIDS

MECHANICAL ENGINEERING

PROF. MAMILLA RAVI SANKAR
Department of Mechanical Engineering
IIT Guwahati

TYPE OF COURSE : Rerun | Core | UG/PG

COURSE DURATION : 8 weeks (25 Feb'19 - 19 Apr'19)

PRE - REQUISITES : No Pre - requisites

EXAM DATE : 27 Apr 2019

INDUSTRY SUPPORT : Oil India Ltd., ONGC, TATA motors, ISRO, BARC, DRDL, NTPC, CMTI, CMERI, CGCRI, Grind Master, NRL

INTENDED AUDIENCE : BE/B.Tech, ME/M.Tech, PHD (Mechanical Engineering, Production Engineering). Faculty who teaches manufacturing.

COURSE OUTLINE :

Machining is one of the basic and very important courses for the mechanical undergraduate students. This process comes under the subtractive manufacturing processes where in material is removed. This course gives the basic understanding of the various machining processes and its physics.

ABOUT INSTRUCTOR :

Prof. Mamilla Ravi Sankar is currently an Assistant Professor in the Department of Mechanical Engineering, IIT Guwahati. He did his B.Tech from Sri Venkateswara University, Tirupati, and M.Tech as well as PhD from IIT Kanpur. His research group is focus on Sustainable Manufacturing, Eco-friendly Cutting fluids, Coatings, Advanced Manufacturing, Tribology and Rheology. MRS Lab also involves in development of lab scale Innovations to Commercial Manufacturing Products. He has published over 30 research articles in internationally reputed journals, 2 Patents, 2 Edited Books and 6 Book chapters.

COURSE PLAN :

Week 1: Introduction and Importance of Machining: Introduction to manufacturing, Top-down and bottom-up approaches, Machining and Various Machining Processes. Principles of Metal Cutting: Shear zone, Chip formation, chip thickness measurements, machining mechanics of ductile and brittle materials.

Week 2: Cutting tool: Tool Geometry, Tool signature. Cutting forces and Cutting velocities : Cutting forces, Merchant Circle, Empirical Models, Chip thickness ratio, Cutting velocities, Strain rates, Mathematical formulations.

Week 3: Tribology, Surface roughness in Machining: Chip-tool tribology, tool-workpiece tribology, Sticking and sliding zone, types of lubrication, Surface roughness, Materials removal rate, Machinability. Thermal Aspects of Machining: Cutting temperature, Measurement of temperature, heat generation, heat distribution, metallurgical and microstructural study.

Week 4: Tool Wear and Tool life: Carter wear, flank wear, nose wear, other tool wears, tool life criteria. Tool Materials and Coatings: Coating materials, PVD, CVD, RF, Laser coatings, Tool texturing.

Week 5: Cutting Fluids: Classification, Functions, Types of lubrication, Cutting fluid additives, Emissions, Health Hazards, Rheology and Biodegradability. Cutting fluid application: Standoff distance, angle of impingement, contact angle, area of cooling, Solid lubricants. Eco-friendly cutting fluids: Development of eco-friendly cutting fluids, bio degradation of these fluids, COD, BOD, HRT, Advantages of sustainable cutting fluids over mineral oil based cutting fluids.

Week 6: Multipoint Machining Processes: Milling, Drilling, Broaching, Tapping, Sawing, Gear Cutting.

Week 7: Abrasive machining processes: Grinding wheel specification, classification, Thermal aspects, Lapping, Honing, Super finishing, Drag finishing, vibratory finishing, Applications. Cutting fluids for abrasive machining processes: Cutting fluids in grinding, honing, super-finishing.

Week 8: Machining of Advanced Materials: Machining of Biomaterials, Aero Space materials, Smart Materials. Advances in Metal Cutting: Hard Machining, High Speed Machining, Diamond Turning, Double tool Machining, Machining with rotary tools, Thin wall machining, Laser Assisted Machining. Cutting fluids machining advanced materials: Cutting fluids for machining advanced materials, high speed machining, hard machining.

BIOMEMS AND MICROSYSTEMS

PROF. SHANTANU BHATTACHARYA
Dept. of Mechanical Engineering
IIT Kanpur

TYPE OF COURSE : Rerun | Elective | UG/PG
INTENDED AUDIENCE : BE/ME - Mechanical
COURSE DURATION : 8 weeks (25 Feb'19 - 19 Apr'19)
EXAM DATE : 28 Apr 2019

COURSE OUTLINE :

During the last several decades, micro-system research mainly addressed electromechanical systems and in recent years, the focus has shifted to Bio-Microelectromechanical Systems (BioMEMS). This shift is driven primarily by the potential applications of the micro-systems to chemistry, biology and medicine. In fact, a combination of BioMEMS and microsystems has made possible the realization of physical systems at scales and dimensions similar to biological entities such as bacterial and mammalian cells, viruses, spores, etc., and this has resulted in the development of a variety of diagnostic and therapeutic applications, intelligent biochips and sensors.

ABOUT INSTRUCTOR :

Prof. Shantanu Bhattacharya is currently a Professor at the Department of Mechanical Engineering at the Indian Institute of Technology Kanpur. Prior to joining IIT Kanpur he was associated with Suzuki Motors in the senior management level and has over 6 years of experience in various production capacities and positions. Prof. Bhattacharya currently takes care of the 4-I laboratory at IIT Kanpur as its coordinator and has also been associated with the TA 202 laboratory as coordinator from 2012 to 2015. Both these laboratories are very high end in terms of offering manufacturing training programs.

COURSE PLAN :

Week 01 : Introduction to BioMEMS and microfluidics, Bio nano technology, Biosensors, fluidics, device fabrication (Silicon and Polymers). Sensors, Transduction and Performance factors.

Week 02 : Important materials for fabrication of BioMEMS platforms | Introduction to silicon device fabrication | Some Fabrication Methods for soft materials | Transduction Methods. About cell potential and SHEs| Cell reaction, Nernst equation, Construction of Ion selective electrodes| Measurement and calibration of electrodes, ion-solvent interaction.

Week 03 : Design of ISE. Finding selectivity coefficient for a mixed ion system | ISE continued.. Gas sensing electrodes | Applications for biosensors in Diagnostics , Zeta potential and the model for electrode.

Week 04 : Introduction to Cell biology, Basic structure of DNA | DNA hybridization, , DNA polymerization, PCR.

Week 05 : Protein charging at different pH range, Amino acids, protein polymerization, Transcription , Translation | Antibody, Microencapsulation, Cyclic voltametry.

Week 06 : Micromixers: Design and mixing principales | Microvalves : Designing of pneumatic and thermo pneumatic valves | Hydrogel based valves. Electrochemical valves.

Week 07 : Etching techniques, evaporation and sputtering | Vacuum science and plasmas, Theory of plasma | Review of basic fabrication processes for polymers.

Week 08 : Photolithography techniques | Functionality of Polymer PDMS used in micro technology | Additive techniques, Thermal oxidation.

PRINCIPLES OF MECHANICAL MEASUREMENT

MECHANICAL ENGINEERING

PROF. DIPANKAR N BASU
Dept. of Mechanical Engineering
IIT Guwahati

TYPE OF COURSE : New| Core | UG

COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)

EXAM DATE : 27 April 2019

PRE-REQUISITES : No specific pre-requisite. Fundamental knowledge of mechanics and basics of mathematics should be sufficient.

INDUSTRIES APPLICABLE TO : Measurement is a topic of fundamental interest in engineering and hence any engineering firm & concerened should find this course interesting & valuable.

COURSE OUTLINE :

Measurement is always of fundamental significance to the practicing engineers.For the development of any mechanical design procedure,experiments are of paramount interest.Accordingly measurement and correct interpretation of the concerned observation are necessary part of any standard engineering task and also R&D.present course will introduce the student to the fundamentals of measurement, discussing about various relevant concepts&terminologies.The mathematical background requirement,categorize&analyze various measurement devices will be prepared and a very pertinent discussion on digitalization will be presenters of scientific interest,such as displacement,motion,stress,force,flow,pressure,temperature etc.,will be discussed in detail.

ABOUT INSTRUCTOR :

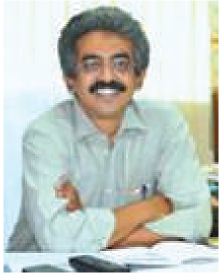
Dr. Dipankar N. Basu is an Assistant Professor in the Department of Mechanical Engineering at IIT Guwahati since June 2012. He received his undergraduate and postgraduate degrees from Jadavpur university, Kolkata, and completed his Ph.D from IIT Kharagpur in 2011. He served as an Assistant Professor at IIEST Shibpur for four years before joining IIT Guwahati.His principal research interest is in the field of nuclear thermalhydraulics, two-phase flow, supercritical heat transfer, optimization of thermal system and microchannel heat transfer. He is currently working on computational tool development for simulation of flows with free conference publications and also a book chapter on supercritical natural circulation loop. He is a regular reviewer of many reputed international journals and also asssociated with several sponsored projects.

COURSE PLAN :

Week 01 : Introduction to measurement
Week 02 : Response of measurement systems
Week 03 : Digital Techniques in measurement
Week 04 : Data processing
Week 05 : Displacement measurement
Week 06 : Stress and strain measurement
Week 07 : Force and Torque measurement
Week 08 : pressure measurement
Week 09 : Flow measurement
Week 10 : Temperature measurement
Week 11 : Motion measurement
Week 12 : Special Topics

MECHANICAL ENGINEERING

INDUSTRIAL AUTOMATION AND CONTROL



PROF. SIDDHARTHA MUKHOPADHYAY
Department of Electrical Engineering
IIT Kharagpur

TYPE OF COURSE : Rerun | Elective | UG/PG
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
INTENDED AUDIENCE : Any interested student
EXAM DATE : 27 Apr 2019
PRE-REQUISITES : Electrical Networks, Control Systems
INDUSTRIES APPLICABLE TO : All Process Control (Oil and Gas, Chemical), Manufacturing (Machine tools, Textile) etc.

COURSE OUTLINE :

This course provides an overall exposure to the technology of Industrial Automation and Control as widely seen in factories of all types both for discrete and continuous manufacturing. The course discusses a wide range of related topics from the advantage and architecture of automation systems, measurement systems including sensors and signal conditioning, discrete and continuous variable control systems, hydraulic, pneumatic and electric actuators, industrial communication and embedded computing and CNC Machines.

ABOUT INSTRUCTOR :

Prof. Siddhartha Mukhopadhyay has done his B. Tech, M. Tech and Ph. D., all from IIT Kharagpur in 1985, 1987 and 1991 respectively. In 1990 he joined the Electrical Engineering Department of IIT Kharagpur. He is currently a Professor in the Department. He has co-authored about 200 research papers, two books and two video courses. He has about 20 years experience of working with organisations like National Semiconductors, Texas Instruments, General Motors, Indian Railways, SAIL, DRDO, GE R&D and several others. Apart from his research interests he is interested in pedagogy and innovation.

COURSE PLAN :

Week 01 : Introduction | Architecture of Industrial Automation Systems | Measurement Systems Characteristics.
Week 02 : Data Acquisition Systems | Introduction to Automatic Control | P-I-D Control | PID Control Tuning.
Week 03 : Feedforward Control Ratio Control | Time Delay Systems and Inverse Response Systems.
Week 04 : Special Control Structures | Concluding Lesson on Process Control (Self-study).
Week 05 : Introduction to Sequence Control, PLC , RLL | Sequence Control. Scan Cycle, Simple RLL Programs.
Week 06 : Sequence Control. More RLL Elements, RLL Syntax | A Structured Design Approach to Sequence Control.
Week 07 : PLC Hardware Environment | Flow Control Valves | Hydraulic Control Systems - I.
Week 08 : Hydraulic Control Systems - II | Industrial Hydraulic Circuit | Pneumatic Control Systems - I.
Week 09 : Pneumatic Control Systems - II | Energy Savings with Variable Speed Drives.
Week 10 : Introduction To CNC Machines | The Fieldbus Network - I.
Week 11 : Higher Level Automation Systems.
Week 12 : Course Review and Conclusion.

MECHANICAL ENGINEERING

CONDUCTION AND CONVECTION HEAT TRANSFER

PROF. SANKAR KUMAR SOM
Department of Mechanical Engineering
IIT Kharagpur

PROF. SUMAN CHAKRABORTY
Department of Mechanical Engineering
IIT Kharagpur

TYPE OF COURSE : Rerun | Core | UG
INTENDED AUDIENCE : BE/ME/MS/MSc/PhD
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 27 Apr 2019
PRE-REQUISITES : Basic knowledge of Fluid Mechanics and Thermodynamics

COURSE OUTLINE :

This is an introductory course in conduction and convection heat transfer. The subject heat transfer has a wide scope and is of prime importance in almost all fields of engineering and biological systems. The course emphasizes the underlying concepts of the conduction and convection modes of heat transfer and enumerates the laws and governing equations relating to the rates of heat transfer, based on derivation from fundamentals. There is a well balanced coverage of physical concepts, mathematical operations along with examples and exercise problems of practical importance. After completion of the course, the students will have a strong foundation on conduction and convection heat transfer and will be able to apply the basic principles, the laws, and the pertinent equations to practical scenarios.

ABOUT INSTRUCTOR :

Prof. Sankar Kumar Som is currently an emeritus Professor (on re-employment) in the Department of Mechanical Engineering at the Indian Institute of Technology, Kharagpur. His field of expertise is thermo fluid sciences. His research interest is combustion science, and in particular, droplet and spray combustion. Apart from guiding 16 doctoral students and publishing more than 100 research papers in peer-reviewed international journals, he has served as principal investigator and chief consultant in several industrial projects with different government and private organizations.

Prof. Suman Chakraborty is a Professor in the Mechanical Engineering Department of the Indian Institute of Technology (IIT) Kharagpur, India, and Indian National Academy of Engineering Chair Professor. He is also currently the Head, School of Medical Science and Technology at IIT Kharagpur. He has offered a significant number of video courses through the NPTEL programme.

COURSE PLAN :

Week 01 : Introduction and Fundamental Concepts
Week 02 : Heat Conduction Equation; 1D Steady state Heat Conduction in Plane Wall
Week 03 : 1D Steady state Heat Conduction in Cylindrical Geometry
Week 04 : 1D Steady state Heat Conduction in Spherical Geometry; Heat Transfer from Extended Surfaces
Week 05 : 2D Steady state Heat Conduction in Plane Wall; Unsteady state Heat Conduction - Lumped Analysis
Week 06 : 1D Unsteady state Heat Conduction; Unsteady state Heat Conduction in Semi-infinite Medium
Week 07 : Review of Fluid Mechanics - I
Week 08 : Review of Fluid Mechanics - II
Week 09 : Review of Fluid Mechanics - III; Energy Equation
Week 10 : Thermal Boundary Layer; Energy Integral Method
Week 11 : Internal Forced Convection
Week 12 : Natural Convection

IC ENGINES AND GAS TURBINES

MECHANICAL ENGINEERING

PROF. PRANAB K. MONDAL
Department of Mechanical Engineering
IIT Guwahati

PROF. VINAYAK N. KULKARNI
Department of Mechanical Engineering
IIT Guwahati

TYPE OF COURSE : New | Core | UG/PG
INTENDED AUDIENCE : Undergraduate students of Mechanical/ Chemical/Aerospace engg. etc
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 27 April 2019
PRE-REQUISITES : Basic UG-level Fluid Mechanics & Thermodynamics

INDUSTRIES APPLICABLE TO : Tata Motors, Ashok Leyland, General Electric

COURSE OUTLINE :

This course deals with the gas power cycles. One part of the course is on IC engines and it focuses on the thermodynamic cycles for different fuels suitable for automobiles. Other part of the course has emphasis on thermodynamic cycle of aircraft engines and the components of the aircraft engine. Thus this course would provide an understanding on electricity generation or transportation application using gas as working medium.

ABOUT INSTRUCTOR :

Dr. Pranab K. Mondal is an Assistant Professor in the department of Mechanical Engineering at Indian Institute of Technology Guwahati since May 2015. He received his undergraduate and postgraduate degree from Jadavpur University, Kolkata, and completed his Ph.D. from Indian Institute of Technology Kharagpur in 2015. His principal research interest, encompassing the broad area of Microfluidics, has covered various facets of micro scale multiphase transport, electro kinetics and micro scale transport of heat. He is currently working on stability analysis of flows with free-surfaces, capillary filling of bio-fluids. He has co-authored more than 65 referred journals conference publications.

Dr. Vinayak N. Kulkarni is an Associate Professor in the Department of Mechanical Engineering of Indian Institute of Technology Guwahati since January 2015. He completed his undergraduate studies in Mechanical Engineering in the Shivaji University, Maharashtra, India. His post-graduation and PhD is from Aerospace Engineering Department of Indian Institute of Science Bangalore. His teaching interests are basic and applied thermodynamics, gas dynamics, aircraft propulsion and fluid mechanics. His research interests are experimental and computational compressible flows, IC engines and non-conventional energy.

COURSE PLAN :

Week 01 : Engine
Week 02 : IC engines
Week 03 : Air-standard cycles
Week 04 : Carburation
Week 05 : Fuel injection systems
Week 06 : Combustion in S.I. and C.I. engines
Week 07 : Introduction to Gas Turbines
Week 08 : Performance analysis of Bryton Cycle
Week 09 : Aircraft propulsion
Week 10 : Compressors
Week 11 : Compressors and Turbines
Week 12 : Nozzles and Diffusers

MECHANICAL ENGINEERING

THERMODYNAMICS

PROF. S.R KALE
Department of Mechanical Engineering
IIT Delhi

TYPE OF COURSE : New | Elective | UG

COURSE DURATION : 12 weeks (28 Jan19 - 19 Apr'19)

INTENDED AUDIENCE : BE - Mech/Aerospace

EXAM DATE : 27 Apr 2019

PRE-REQUISITES : 12 th standard science (PCM or PCB), and basic knowledge of differential calculus.

COURSE OUTLINE :

This course is on basic engineering thermodynamics. The first part, on single component systems, covers basic concepts and definitions, conservation of mass, 1 st and 2 nd laws of thermodynamics for closed and open systems, thermodynamic properties of a pure substance and practical applications. The second part covers physical behaviour of a mixture of ideal gases, psychrometry, thermodynamics of reacting systems, combustion, phase and chemical equilibrium, and applications. Lecture notes will be provided and supplemented with assignments that emphasize systematic problem solving.

ABOUT INSTRUCTOR :

Sunil R. Kale is Professor in the Department of Mechanical Engineering at IIT Delhi, and currently at Ahmedabad University as Dean, School of Engineering and Applied Science. Besides engineering thermodynamics, he has taught undergraduate heat & mass transfer and power plant technologies, amongst others. His research interests are combustion, fire dynamics, heat and mass transfer, and fluid mechanics.

COURSE PLAN :

Week 01 : Concepts & definitions. Heat. Work. Equilibrium. Reversible process. Steady state. System, boundary. Control mass, control volume. State. Properties

Week 02 : Conservation of mass for closed and open systems and Internal energy and Enthalpy

Week 03 : First Law of Thermodynamics

Week 04 : Second Law. Clausius inequality. Entropy. 2 nd law for closed and open systems.Carnot's cycle

Week 05 : Thermodynamic behavior of a pure substance and properties.

Week 06 : Carnot's cycle realization – in closed and open systems for ideal gas and vapour states

Week 07 : Thermodynamics of engineered equipment: turbine, compressor, pump, heat exchanger, diffuser, nozzle, throttling, flow through pipes/ducts, etc.

Week 08 : Practical cycles and processes. Rankine cycle and its modifications. Ideal gas cycles.Heat engine and heat pump/refrigeration cycles (VCR and VAM).

Week 09 : Mixtures of ideal gases

Week 10 : Psychrometry and its applications. Specific and relative humidity. Dew point.Saturation and wet bulb temperature. Psychrometric chart. Conditioning of air and applications (air-evaporative cooling, cooling towers, humidification,etc.

Week 11 : Mixtures of ideal gases – Reacting systems. 1-step reactions. Stoichiometry, equivalenc ratio. Enthalpy of formation. Conservation of mass. 1 st law analysis.Heat of reaction and properties. Adiabatic flame temperature. Work of reaction.Enthalpy of formation. 2 nd law analysis. Application to combustion, fuel cells.Introduction to multi-step reactions and minor species. (

Week 12 : Phase and chemical equilibrium. Phase equilibrium of single- and multi-component systems. Equilibrium constant for ideal-gas mixtures. Simultaneous reactions. Applications.

MECHANICAL ENGINEERING

CONCEPTS OF THERMODYNAMICS

PROF. SUMAN CHAKRABORTY
Department of Mechanical Engineering
IIT Kharagpur

PROF. ADITYA BANDYOPADHYAY
Department of Cryogenic Engineering
IIT Kharagpur

TYPE OF COURSE : New | Core | UG
INTENDED AUDIENCE : B.Tech students of all disciplines and teachers of undergraduate thermodynamics
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 28 April 2019

COURSE OUTLINE :

Thermodynamics is the basic building block of all of modern day industries (power generation, iron and steel, food processing etc.) and human convenience (refrigeration, engines, air conditioning etc.). Understanding and applying various ideas of thermodynamics is therefore at the heart of progress in science and engineering. The course aims at building strong fundamentals of work and heat interactions for various systems. Through various examples, the ideas of several industrial components and power/refrigeration cycles are further elucidated by addressing the problems from first principles. The ideas are extended to real systems where exergy or equivalently, the availability of a state is analyzed to give a feel of real problems to the students. Uniqueness of this course is a delicate balance between fundamental concepts and applications, in a manner consistent with the recently proposed AICTE Model Curriculum guidelines.

ABOUT INSTRUCTOR :

Dr. Suman Chakraborty is currently a Professor in the Mechanical Engineering Department as well as an Institute Chair Professor of the Indian Institute of Technology Kharagpur, India, and the Head of the School of Medical Science and Technology. He is also the Associate Dean for Sponsored Research and Industrial Consultancy. His current areas of research include microfluidics, nanofluidics, micro-nano scale transport.

Dr. Aditya Bandopadhyay is currently an Assistant Professor in the Mechanical Engineering Department at Indian Institute of Technology Kharagpur, India. His research interests include micro- and nanofluidics, transport through porous media, and electrohydrodynamics. He completed his Dual Degree from IIT Kharagpur (Insitute Silver Medal) in 2012 and received his Ph.D. from IIT Kharagpur in 2015

COURSE PLAN :

Week 01 : Fundamental definitions and concepts in thermodynamics
Week 02 : Properties of pure substances
Week 03 : Work and heat
Week 04 : First law of thermodynamics for closed systems
Week 05 : First law of thermodynamics for open systems – I
Week 06 : First law of thermodynamics for open systems – II
Week 07 : Second law of thermodynamics
Week 08 : Entropy transfer for closed systems
Week 09 : Entropy transfer for open systems
Week 10 : Irreversibility and exergy
Week 11 : Thermodynamic Cycles: Air Standard Cycles, Vapour Power Cycles
Week 12 : Thermodynamic Cycles: Vapour Power Cycles (contd), Refrigeration Cycles

INTRODUCTION TO FLUID MECHANICS

PROF. SUMAN CHAKRABORTY
Department of Mechanical Engineering
IIT Kharagpur

TYPE OF COURSE : Rerun | Core | UG
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
INTENDED AUDIENCE : BE/ME (Mechanical Engg.)
EXAM DATE : 28 Apr 2019
PRE-REQUISITES : Basic knowledge of Mathematics
INDUSTRIES APPLICABLE TO : Oil Companies (IOCL, SHELL, BPCL and others), Automobile and Aviation companies (GE, AIRBUS, TATA Motors and others)

COURSE OUTLINE :

This is an introductory course in Fluid Mechanics. The subject Fluid Mechanics has a wide scope and is of prime importance in several fields of engineering and science. Present course emphasizes the fundamental underlying fluid mechanical principles and application of those principles to solve real life problems. Special attention is given towards deriving all the governing equations starting from the fundamental principle. There is a well balanced coverage of physical concepts, mathematical operations along with examples and exercise problems of practical importance. After completion of the course, the students will have a strong fundamental understanding of the basic principles of Fluid Mechanics and will be able to apply the basic principles to analyze fluid mechanical systems.

ABOUT INSTRUCTOR :

Suman Chakraborty is a Professor in the Mechanical Engineering Department of the Indian Institute of Technology (IIT) Kharagpur, India, and Indian National Academy of Engineering Chair Professor. He is also currently the Head, School of Medical Science and Technology at IIT Kharagpur. He has offered a significant number of video courses through the NPTEL programme. These courses include: Introduction to Fluid Mechanics and Fluids Engineering, Computational Fluid Dynamics, and Microfluidics. He has also taught in an online programme (under NMEICT) titled "Talk to 10 Thousand Teachers".

COURSE PLAN :

Week 01 : Introduction and Basic Principles
Week 02 : Properties of Fluids
Week 03 : Properties of Fluids and Fluid Statics
Week 04 : Fluid Statics
Week 05 : Fluid Kinematics (Part I)
Week 06 : Fluid Kinematics (Part II)
Week 07 : Dynamics of Inviscid Flows (Part I)
Week 08 : Dynamics of Inviscid Flows (Part II)
Week 09 : Integral Forms of Control Volume Conservation Equations (Part I)
Week 10 : Integral Forms of Control Volume Conservation Equations (Part II)
Week 11 : Integral Forms of Control Volume Conservation Equations (Part III); Dynamics of Viscous Flows (Part I)
Week 12 : Dynamics of Viscous Flows (Part II)

MECHANICAL ENGINEERING

MANUFACTURING PROCESS TECHNOLOGY I & II

PROF. SHANTANU BHATTACHARYA
Department of Mechanical Engineering
IIT Kanpur

TYPE OF COURSE : Rerun | Core | UG/PG
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
PRE - REQUISITES : None
EXAM DATE : 28 Apr 2019
INDUSTRY SUPPORT : SMIL (Gurgaon), HAL (Kanpur and Lucknow), Cyeint (Hyderabad), Small and medium scale production industries.

INTENDED AUDIENCE : Students of BE/ME/MS/BSc/MSc stream

COURSE OUTLINE :

This is an introductory level course in Manufacturing Process Technology and is mostly meant for Undergraduate engineers. At the heart of any manufacturing system is a set of processes which change the size, shape and form of raw materials into the desirable thus giving an industrial nation the power of growing. This course is an introductory course for engineering professionals who would like to take up careers in manufacturing particularly at the process level and also for professionals who are already in manufacturing careers and would like to see the technological changes that the manufacturing processes have witnessed in the last about 5 decades.

ABOUT INSTRUCTOR :

Prof. Shantanu Bhattacharya is currently a Professor at the Department of Mechanical Engineering at the Indian Institute of Technology Kanpur. Prior to joining IIT Kanpur he was associated with Suzuki Motors in the senior management level and has over 6 years of experience in various production capacities and positions. Prof. Bhattacharya currently takes care of the 4-I laboratory at IIT Kanpur as its coordinator and has also been associated with the TA 202 laboratory as coordinator from 2012 to 2015. Both these laboratories are very high end in terms of offering manufacturing training programs.

COURSE PLAN :

Week 1 to 2 : Manufacturing properties of materials.

Week 3 to 4 : Casting Processes, Gating Design and Casting Defects.

Week 5 to 6 : Machining Processes e.g. turning, drilling, grinding etc. Tool life.

Week 7 to 8 : Advanced Machining Processes e.g. AJM, ECM, EDM, LBM, USM etc.

Week 9 to 10 : Metal Forming Processes such as rolling, forging, extrusion etc.

Week 11 to 12 : Micro-fabrication processes, Additive manufacturing.

MECHANICAL ENGINEERING

PRODUCT DESIGN AND MANUFACTURING

PROF. JANAKRANJAN RAMKUMAR
Department of Mechanical Engineering
IIT Kanpur

DR. AMANDEEP SINGH
Department of Mechanical Engineering
IIT Kanpur

TYPE OF COURSE : Rerun| Elective | UG/PG
PRE-REQUISITES : The student should have completed two semesters of UG Engineering or Science program.
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 28 Apr 2019
INDUSTRY SUPPORT : HAL, NAL, SAIL, ISRO
INTENDED AUDIENCE : BE/ME/MS/BSc/MSc

COURSE OUTLINE :

In the last few decades, the product development process has undergone a noticeable change, which is due to the global competition, international markets, and increasing customer needs. Managing the product development process, right from idea generation to final product manufacturing has to be systematic and effective to meet the customer needs, while incorporating the time-to-market constraint as well. This course presents an overview of the product design and development process, along with the manufacturing aspects.

ABOUT INSTRUCTOR :

Dr. Janakranjan Ramkumar is currently a Professor of Mechanical Engineering Department, and Design Program, Indian Institute of Technology, Kanpur. He teaches manufacturing science, micro/nano technology, new product development. He has a bachelors in Production Engineering with his doctorate in Defect quantification in drilling of composites from IIT Madras, India with a best thesis award.

Dr. Amandeep Singh is working as a Project Scientist in the Mechanical Engineering Department, and Design Program at Indian Institute of Technology, Kanpur, India. He holds PhD degree from Indian Institute of Technology Kanpur, India, and a bachelor degree in Production Engineering. Dr. Singh has ten years of industrial and academic experience. His research interests are Sustainable Manufacturing Processes and Systems, Simulation of Manufacturing Systems, Product Design and Manufacturing, and Applied Ergonomics.

COURSE PLAN :

Week 01 : Introduction to product design and manufacturing
Week 02 : Product design morphology
Week 03 : Visual Design, and Quality Function Deployment (QFD)
Week 04 : Value Engineering
Week 05 : Material, and Manufacturing process selection
Week 06 : Design for Manufacturing, Assembly, and Maintenance
Week 07 : Design for Environment
Week 08 : Patenting, and Creativity
Week 09 : Rapid Prototyping
Week 10 : Plant Layout Design
Week 11 : Computer Integrated Manufacturing
Week 12 : Reverse Engineering, and Managing Competitiveness

MECHANICAL ENGINEERING

RAPID MANUFACTURING

PROF. JANAKRANJAN RAMKUMAR
Department of Mechanical Engineering
IIT Kanpur

DR. AMANDEEP SINGH
Department of Mechanical Engineering
IIT Kanpur

TYPE OF COURSE : New | Elective | UG/PG
INTENDED AUDIENCE : All Engineering and Science disciplines
COURSE DURATION : 12 weeks (28 Jan 19 - 19 Apr 19)
EXAM DATE : 28 April 2019
PRE-REQUISITES : The student should have completed 2 semesters of UG Eng or Science

INDUSTRIES APPLICABLE TO : HAL, NAL, SAIL, ISRO

COURSE OUTLINE :

In the contemporary dynamic manufacturing era, to produce products that can be easily made and can offer typical competences is of utmost importance. Besides basic manufacturing processes, engineering students and manufacturers needs to bolster their skills in advanced technologies. This course is a step in this direction to make the students to learn design, development, and manufacturing using Rapid Manufacturing technologies. Along with specific Rapid Prototyping techniques, manufacturing concerns such as geometric modelling, design for manufacturing and assembly, developing modular designs, group technology, et cetera are included. Laboratory demonstrations are also induced for practical experience.

ABOUT INSTRUCTOR :

Dr. Janakarajan Ramkumar is Professor of Mechanical Engineering Department, and Design Program, at Indian Institute of Technology, Kanpur. He has worked for BOSCH group and improved the productivity of the company. His research and teaching focus is on nano technology and inclusive design. He has several international and national patents in his credit and has published more than 100 journal papers.

Dr. Amandeep Singh is working as a Project Scientist in the Mechanical Engineering Department, and Design Program at Indian Institute of Technology, Kanpur, India. He holds PhD degree from Indian Institute of Technology Kanpur, India, and a bachelor degree in Production Engineering. Dr. Singh has ten years of industrial and academic experience. His research interests are Sustainable Manufacturing Processes and Systems, Simulation of Manufacturing Systems, Product Design and Manufacturing, and Applied Ergonomics.

COURSE PLAN :

Week 01 : Introduction to Rapid Manufacturing
Week 02 : Feature based manufacturing
Week 03 : Design for modularity
Week 04 : Computer Integrated Manufacturing
Week 05 : 3D measurements, laboratory demonstration
Week 06 : Liquid based rapid manufacturing processes
Week 07 : Powder based rapid manufacturing processes
Week 08 : Solid based rapid manufacturing processes
Week 09 : Product costing and selection of material
Week 10 : Systems approach in rapid manufacturing
Week 11 : Software demonstration on process simulation
Week 12 : Green rapid manufacturing, market competitiveness

INTRODUCTION TO MECHANICAL MICRO MACHINING

MECHANICAL ENGINEERING

PROF. AJAY M SIDPARA
Department of Mechanical Engineering
IIT Kharagpur

TYPE OF COURSE : Rerun | Core | UG/PG

COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)

PRE - REQUISITES : Conventional machining processes (lathe, milling, drilling, etc.)

EXAM DATE : 28 Apr 2019

INDUSTRIES APPLICABLE TO : Bhabha Atomic Research Center (BARC), Mumbai, Central Mechanical Engineering Research Institute (CMERI), Durgapur Central Manufacturing Technology Institute (CMTI), Bangalore

INTENDED AUDIENCE : BE/ME

COURSE OUTLINE :

The emergence of miniature and micro products / components has increased the demand of the production of micro components with feature size from a few millimeters to tens of micrometers. Mechanical micro machining is one of the key technologies to enable the realization of high accuracy complex micro products made from a variety of engineering materials. Mechanical micro machining is capable to machine metals, polymers, and ceramics in very less time as compared to lithographic processes and other micro machining processes such as EDM, ECM, LBM, etc. As a result, it has found strong base in a wide array of practical applications.

ABOUT INSTRUCTOR :

Prof. Ajay M Sidpara is a faculty in Mechanical Engineering Department at IIT Kharagpur. His research interests are on surface finishing at nano scale and micro machining for different applications such as optics, biomedical, micro fluidics, etc. He has extensively worked on development of different tooling for nanofinishing, micro machining and improvement of process efficiency using different strategies. He has published 26 journal papers, 12 book chapters, and many conference papers related to nanofinishing and micro machining. 3 patents are filed related to his research work. He has received funding from SERB, BRNS and GE Power India. He has received Gandhian Young Technological Innovation Award 2013, Young Engineers Award 2015 from IE (India), and CSR innovation award from GE Power India Limited (erstwhile ALSTOM India Limited). He is a reviewer of more than 20 international journals and also delivered around 20 invited talks in the institutes, and research labs.

COURSE PLAN :

Week 1 : Experimental observations and theoretical prediction of constituents of an atom

Week 2 : Scaling law

Week 3 : Mechanical micro machining (process, mechanism)

Week 4 : Burr formation, surface roughness, built up edge

Week 5 : Cutting fluid, run out, grain size

Week 6 : Micro machine structure - I

Week 7 : Micro machine structure - II

Week 8 : Fabrication of micro cutting tools

Week 9 : Miniature machine tools

Week 10 : Diamond Turning (process, types, mechanism, applications)

Week 11 : Metrology for micro machining

Week 12 : Sensor integration for process monitoring

MACHINERY FAULT DIAGNOSIS AND SIGNAL PROCESSING

MECHANICAL ENGINEERING

PROF. AMIYA RANJAN MOHANTY
Department of Mechanical Engineering
IIT Kharagpur

TYPE OF COURSE : Rerun | Elective | PG
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
PRE - REQUISITES : BE/B. Tech in Mechanical Engg
EXAM DATE : 28 Apr 2019
INDUSTRY SUPPORT : PSUs like SAIL, ONGC, BHEL, NALCO, EIL, RINL, BARC, Indian Railways, HAL, DRDO Organizations Private Industries like TATA Group, Jindals, Reliance, Birla Group
INTENDED AUDIENCE : BE/ME - Mechanical Engineering

COURSE OUTLINE :

The subject of machinery condition monitoring has been recently receiving considerable attention in India owing to concerns related to equipment reliability and safety. This increasing interest is primarily due to the significant impact of economic changes and strong competition in the global market. This course will provide students/engineers/managers with the state of the art techniques in machinery condition monitoring along with the recent developments in the field of signal processing, thermography, ultrasonics apart from the traditional noise and vibration monitoring. There will be demonstration of realtime machinery health monitoring by various condition monitoring aspects.

ABOUT INSTRUCTOR :

Professor A. R. Mohanty is a Professor and the Shyamal Ghosh and Sunanda Ghosh Chair Professor at the Mechanical Engineering Department of the Indian Institute of Technology Kharagpur with 30 years of experience in areas of noise control and machinery condition monitoring. He holds a PhD degree from the University of Kentucky, USA. He is a recipient of several awards, Fellow of the Indian National Academy of Engineering, Fellow of the Acoustical Society of India, Fellow of the Condition Monitoring Society of India and the International Society of Engineering Asset Management. He has conducted around 100 sponsored research and industrial consultancy projects.

COURSE PLAN :

Week 1 : Maintenance Principles, FMECA, Fault Prognosis

Week 2 : Vibration Analysis, Experimental Modal Analysis, Rotor Dynamics

Week 3 : Time domain Signal analysis, Data Acquisition, Filtering

Week 4 : Fourier Series, FFT, Modulation and Sidebands

Week 5 : Order Analysis, Orbits

Week 6 : Instrumentation, Data Recording

Week 7 : Vibration and Noise Monitoring

Week 8 : Rotating Machines, Bearings and Gears

Week 9 : Fans, Blowers, Pumps, IC Engines

Week 10 : Motor Current Signature Analysis, Wear Debris and Oil Analysis

Week 11 : NDT, Ultrasonics, EddyCurrent

Week 12 : Case Studies, Failure Analysis

MECHANICAL ENGINEERING

ATOMIZATION AND SPRAYS (SPRAY THEORY)

PROF. MAHESH V PANCHAGNULA
Department of Applied Mechanics
IIT Madras

TYPE OF COURSE : Rerun | Core | UG/PG

COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)

PRE - REQUISITES : fluid mechanics & differential equations.

EXAM DATE : 28 Apr 2019

INDUSTRY SUPPORT : DRDO, Defence, Spray drying users such as pharma, consumer product manufacturers such as Unilever, Proctor and Gamble, Patanjali etc., Aerospace industries, Agrotech for pesticide application etc.

INTENDED AUDIENCE : Both UG and PG students can take.

COURSE OUTLINE :

The goal of this course is to provide an overview of physics of liquid atomization, spray formation and propagation. The course will introduce the student to the theoretical models pertaining to jet breakup and drop formation. The application of multiphase models for studying spray transport will also be discussed. Finally, the course will present an overview of the design aspects as they pertain to spray nozzle and atomizers and discuss potential applications in combustion systems.

ABOUT INSTRUCTOR :

Prof. Mahesh V Panchagnula, Professor in Department of Applied Mechanics, Indian Institute of Technology, Madras B.S. - Mechanical Engineering, Indian Institute of Technology, 1992, M.S. - Mechanical Engineering, Purdue University, 1994, Ph.D.- Mechanical Engineering,Purdue University, 1998. He is currently Dean of International Relations and Alumni affairs at IITM.

COURSE PLAN :

Week 1 : Introduction to sprays and atomization

Week 2 : Drop size and velocity distributions

Week 3 : Atomizers and their designs

Week 4 : Atomizers and their designs

Week 5 : Atomization theory

Week 6 : Atomization theory

Week 7 & 8 : Spray theory

Week 9 : Practical aspects of atomizer fabrication and manufacturing

Week 10 : Multiphase flow models of sprays

Week 11 : Multiphase flow models of sprays

Week 12 : Spray evaporation and combustion

FINANCIAL MATHEMATICS

MECHANICAL ENGINEERING

PROF. PRADEEP K. JHA
Department of Mechanical & Industrial Engineering
IIT Roorkee

TYPE OF COURSE : New | Elective | UG/PG
INTENDED AUDIENCE : BE/Management/MSc
PRE-REQUISITES : Basic mathematics, probability
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 28 April 2019

INDUSTRIES APPLICABLE TO : Useful for most of the companies, specially for managers and persons in investment and finance sectors

COURSE OUTLINE :

The course on Financial Mathematics focuses on the mathematical properties and relations between concepts of financial and currency markets in investment and other economic activities. The course aims to enthuse confidence in participants to be able to address issues related to globalization of financial markets, development and feasibility of financial transactions, the increasing complexity of portfolio investments, analysing and forecasting market developments etc. Students in the course will gain an in-depth understanding of advanced economics concepts as well as knowledge of how the financial and banking sectors operate.

ABOUT INSTRUCTOR :

Dr Pradeep K. Jha is presently working as Associate Professor in the Department of Mechanical & Industrial Engineering at IIT Roorkee. He has been teaching the courses related to Engineering economics, manufacturing technology and theory of production processes to undergraduate and postgraduate students for more than 12 years.

COURSE PLAN :

Week 01 : Mathematical introduction, Growth and decay curves
Week 02 : Simple interest, bank discount
Week 03 : Compound interest, discrete compounding
Week 04 : Compounding frequency of interest, Economic equivalence
Week 05 : Method of comparison of alternatives, Project balance
Week 06 : Credit and loan, Cost of credit and amortization
Week 07 : Depreciation and depletion
Week 08 : Breakeven analysis, Leverage
Week 09 : Stocks and bonds, Valuation of stocks and bonds
Week 10 : Mutual funds, Options, Cost of capital and ratio analysis
Week 11 : Decision under risk & uncertainty, Risk premium, Portfolio diversification
Week 12 : Life Insurance, Endowment and annuities, Insurance policies

MECHANICAL ENGINEERING

INTRODUCTION TO COMPOSITES

PROF. NACHIKETA TIWARI
Department of Mechanical Engineering
IIT Kanpur

TYPE OF COURSE : Rerun | Elective | UG/PG
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
INTENDED AUDIENCE : UGs, PGs, professionals in industry who want to learn about basics of sound and acoustics
EXAM DATE : 27 Apr 2019
PRE-REQUISITES : should have completed at least second year of 4-year program.

INDUSTRIES APPLICABLE TO : Automotive, Composites, Aerospace, Sports, Railways, Power Generation and all industry that has to address issues related to noise.

COURSE OUTLINE :

This course is intended for all those who want to conduct experiments in area of NVH. Thus, the course is open to students of engineering and science, and also to all those who from the industry and research organizations – who are working in area of sound, NVH and acoustics. Each lecture will be followed by a quiz, which will help student the concepts better, and gain deeper insights to measurement process. The course is fairly generic so that there is no need for a particular background. Rather, what is needed is openness, and ability to learn and check out new ideas with comfort.

ABOUT INSTRUCTOR :

Dr. Nachiketa Tiwari K is an Associate Professor of Mechanical Engineering at IIT Kanpur. He has a Ph.D in engineering mechanics from Virginia Tech. His doctoral thesis involved nonlinear analysis of composite structures through FE, analytical and experimental methods. Dr. Tiwari also has deep understanding of fundamentals of FEA as he has used several tools in industry for over a dozen years for producing world class products. His current areas of research interest are composite structures, noise, vibrations, and product design. He has established Dhwani, an Acoustics Lab at IITK, which is one of the best in the country.

COURSE PLAN :

Week 01 : Intro and terminology
Week 02 : Concept Review
Week 03 : Fibers
Week 04 : Matrix materials
Week 05 & 06 : Short fiber composites - I, II
Week 07, 08 & 09 : Orthotropic lamina - I, II & III
Week 10, 11 & 12 : Composite laminates - I, II & III

METALLURGICAL AND MATERIALS ENGINEERING

METALLURGICAL AND MATERIALS ENGINEERING

04 weeks

01. Defects in Crystalline Solids (Part-II)
02. Creep deformation of materials

08 weeks

01. Material Science and Engineering
02. Fundamentals of electronic materials and devices
03. Solar Photovoltaics: Principles, Technologies & Materials
04. Friction and wear of materials: principles and case studies
05. Theory And Practice Of Non Destructive Testing

12 weeks

01. Introduction to Materials Science and Engineering
02. Surface Engineering for Corrosion and Wear Resistance Application
03. Material Characterization
04. Welding Processes

METALLURGICAL AND MATERIALS ENGG.

DEFECTS IN CRYSTALLINE SOLIDS (PART-II)

PROF. SHASHANK SHEKHAR
Department of Mechanical and Industrial Engineering
IIT Kanpur

TYPE OF COURSE : New | Core | UG

COURSE DURATION : 4 weeks (28 Jan 19 - 22 Feb 19)

INTENDED AUDIENCE : BE (Materials, Mechanical, Metallurgical, Industrial, Electrical)

EXAM DATE : 31 March 2019

PRE-REQUISITES : Under graduate level mathematics, thermodynamics

INDUSTRIES APPLICABLE TO : Manufacturing Companies, Iron and Steel companies, Automobile companies, Equipment manufacturers

COURSE OUTLINE :

This is a continuation of the course Defects in Crystalline Solids (Part-I). In this part of the course, students should be able to: Understand dislocations with respect to particular crystal system (eg. FCC, BCC, HCP and also superlattices), Relate dislocation to the plastic properties of the material, particularly, strengthening mechanisms

ABOUT INSTRUCTOR :

Prof. Shashank Shekhar is an Associate Professor at IIT Kanpur. He joined IITK in 2011 and has since taught manufacturing related courses to 2nd year, 3rd year as well as 4th year UG students. His research interest lies in physical-mechanical metallurgy of materials, particularly grain boundary engineering and severe plastic deformation.He has also taught courses on "Dislocation and Plasticity" and "Mechanical Behavior of Materials" to UG and PG students at IITK.

COURSE PLAN :

Week 01 : Dislocations in FCC; Partial Dislocations; Thompson's Tetrahedron; Cottrell Lock; Lomer-Cottrell Lock; Intersection of extended dislocations

Week 02 : Dislocations in BCC, HCP and other systems; Dislocations in Superlattices; Kear-Wilsdorf Locks

Week 03 : Interaction of dislocations with vacancies and its effect on plasticity; Strengthening mechanisms due to interaction of dislocations with interfaces, precipitates, inclusions; Dislocation generation mechanisms

Week 04 : Dislocations and Grain boundaries; Read-Shockley model for Low angle grain boundaries; A modified model for LAGB energy; Energy of LAGBs from dislocation model; CSL boundaries and secondary dislocations; Geometrically necessary dislocations (GNDs) and Statistically Stored Dislocations (SSDs)

CREEP DEFORMATION OF MATERIALS

METALLURGICAL AND MATERIALS ENGG.

PROF. SRIKANT GOLLAPUDI
Dept. of Metallurgical and Materials Engineering
IIT Bhubaneswar

TYPE OF COURSE : New | Elective | PG/PhD course
INTENDED AUDIENCE : ME/MS/PhD
EXAM DATE : 4 weeks (28 Jan'19 - 22 Feb'19)
COURSE DURATION : 31 Mar 2019

PRE-REQUISITES : Basics of mechanical metallurgy- to have an understanding of the concepts of stress, strain, dislocations, grain size effects, second phase distribution effects etc

INDUSTRIES APPLICABLE TO : Nuclear industry-BARC/IGCAR Aerospace industry-DRDO/ISRO/Boeing Automobile industry – General Motors/TATA Motors etc

COURSE OUTLINE :

This course aims to provide the audience an introduction to time dependent plastic deformation of materials (creep) especially at high homologous temperatures. The goal is for the audience to learn the rate controlling mechanisms of creep and their utility in predicting the remaining useful life of a structure. Other Parametric approaches such as Larson-Miller parameter, Theta-projection concept, Kachanov-Rabotnov model will also be introduced. The course will conclude by highlighting the importance of accounting for creep in development of technologically important materials such as titanium alloys, zirconium alloys and advanced materials such as nanocrystalline materials.

ABOUT INSTRUCTOR :

Prof. Srikant Gollupudi is currently on the faculty of the School of Minerals, Metallurgical and Materials Engineering at IIT Bhubaneswar. He is a Metallurgist by training and obtained his PhD in Materials Science and Engineering from NC State University with his doctoral thesis on Creep mechanisms in titanium alloy tubing. The instructor conducted his post doctoral research at Massachusetts Institute of Technology and has worked in different organizations such as General Motors, Defence Metallurgical Research Laboratory and Saint Gobain Research India. The industrial experience has helped the instructor gain a better appreciation of the real life applications of academic knowledge.

COURSE PLAN :

Week 01 : Basics of plastic deformation; role of dislocations, vacancies; microstructural effects on plastic deformation; effect of stress, temperature; Introduction to creep curve and equations describing creep; effect of stress and temperature on creep curve; Introduction to mechanisms of creep.

Week 02 : Mechanisms of creep: Newtonian viscous creep mechanisms (stress exponent 1) such as Coble creep/N-H creep/Harper-Dorn/Spingarn-Nix; Grain boundary sliding and superplasticity (stress exponent 2); Viscous creep or Alloy creep (stress exponent 3) Power law creep based on Weertman model, Jogged screw model and its modification etc (stress exponent 4-7).

Week 03 : Power law breakdown at high stresses;Rate controlling mechanisms (mechanisms in series and parallel); Creep constitutive equation (Bird-Mukherjee-Dorn equation); Deformation mechanism maps (Ashby maps; Mohamed-Langdon maps); Parametric approach to creep (Larson-Miller parameter, Sherby-Dorn parameter, Monkman-Grant parameter, θ-projection concept, Kachanov-Rabotnov model); Creep testing techniques: Conventional vs Impression creep testing techniques.

Week 04 : Creep fracture; Creep of technological important materials such as titanium alloys/ zirconium alloys/ magnesium alloys, Creep of advanced materials such as nano crystalline materials.

METALLURGICAL AND MATERIALS ENGG.

MATERIAL SCIENCE AND ENGINEERING

PROF. VIVEK PANCHOLI
Dept. of Mechanical and Industrial Engineering
IIT Roorkee

TYPE OF COURSE : Rerun | Core | UG

COURSE DURATION : 8 weeks (28 Jan'19 - 22 Mar'19)

EXAM DATE : 31 Mar 2019

INDUSTRIES APPLICABLE TO : Automobile companies, Auto ancillary companies, Manufacturing companies.

INTENDED AUDIENCE : B.E., B.Tech. students of Mechanical, Production Engineering, practicing engineers in manufacturing industry

COURSE OUTLINE :

The course is primarily designed for Mechanical and Production Engineering students. Therefore, focus of the course is on structural materials. The course covers three important parts of materials which students and practicing engineers should know. The course is hoping to address both theoretical and practical aspects of Materials Engineering. To serve this purpose, the course is divided into three broad categories. a) Crystallography and crystal defects – It covers crystal systems, crystal structures, indexing of planes and directions, vacancies, dislocations, grain boundaries and microstructures. b) Phase diagram and heat treatment – It covers, Gibbs phase rule, one component systems, binary phase diagrams, lever rule, invariant reactions, iron-carbon phase diagram and heat treatment. c) Mechanical properties – Elastic and plastic deformation, engineering and true strain and stress, ultimate tensile strength, ductility, toughness, cold/hot working and strengthening mechanisms.

ABOUT INSTRUCTOR :

Prof. Vivek Pancholi, B.Tech in 1995 from G.S.I.T.S. Indore, M.Tech. (Industrial Tribology) from IIT Delhi in 1997 and PhD in Metallurgical Engineering from IIT Bombay, in 2005. He joined IIT Roorkee as a faculty member in the Department of Metallurgical and Materials Engineering in 2006 and has about 12 years teaching experience.

COURSE PLAN :

Week 1 : Lattice, Crystal structures, Miller indices for planes and directions.
Week 2 : Microscopes, microstructures and quantitative metallography.
Week 3 : Defects, diffusion and phase diagram.
Week 4 : Equilibrium phase diagram, lever rule, phase transformation.
Week 5 : Iron-carbon phase diagram, TTT and CCT curves, heat treatments.
Week 6 : Introduction to mechanical properties, cold and hot working.
Week 7 : Strengthening mechanism Fracture, and Fatigue.
Week 8 : Creep, ceramics and plastic, NDT techniques, alloy designation.

METALLURGICAL AND MATERIALS ENGG.

FUNDAMENTALS OF ELECTRONIC MATERIALS AND DEVICES

PROF. PARASURAMAN SWAMINATHAN
Department of Metallurgical and Materials Engineering
IIT Madras

TYPE OF COURSE : Rerun | Elective | UG/PG

COURSE DURATION : 8 weeks (25 Feb'19 - 19 Apr'19)

INTENDED AUDIENCE : Preferable 3rd and final year UG and first year graduates in Chemical, Mechanical, Metallurgy, Materials Science & Physics.

EXAM DATE : 28 Apr 2019

PRE-REQUISITES : Preferably completed Physics of Materials or Solid state physics course but not required.

INDUSTRIES APPLICABLE TO : Semiconductor device companies like TSMC and Applied Materials will value this course

COURSE OUTLINE :

The course is intended to provide an understanding of the materials and devices used in the current semiconductor industry. It caters to undergraduate and graduate students with a diverse background in Chemical, Mechanical, Metallurgy, Materials Science, and Physics. The course provides the students with the basic physics behind semiconductor materials, types of semiconductors, and the reason for the dominance of silicon in the electronics industry. The course also covers the basics of devices with emphasis on their electronic characteristics. Optical devices like LEDs, lasers, solar cells, and their properties will also be explained.

ABOUT INSTRUCTOR :

Prof. Parasuraman Swaminathan joined the Department of Metallurgical and Materials Engineering, IIT Madras, in 2013. He has a B.Tech and M.Tech dual degree in Metallurgical and Materials Engineering from IIT Madras, and a PhD in Materials Science from the University of Illinois at Urbana-Champaign, USA. He then did a post doc in Johns Hopkins University and National Institute of Standards and Technology (NIST), USA on microelectronics device fabrication. He also worked in Intel Corp. for two years, primarily in their development fab facility. In IIT, Parasuraman and his group work on printed electronics, doped metal oxides, and vapor deposited thin films and nanoparticles.

COURSE PLAN :

Week 01 : Introduction, Energy bands in solids, Semiconductors band gap formation
Week 02 : Problem set on week #1 and Intrinsic semiconductors.
Week 03 : Extrinsic semiconductors, Fermi level variations, and conductivity.
Week 04 : Problem set on week #3. Metal-semiconductor junctions and Introduction to pn junctions
Week 05 : pn junctions under bias, Junction breakdown, and Heterojunctions. Problem set on week#4 and 5.
Week 06 : Transistors, Types of transistors, MOSFETs, Problem set on week#6.
Week 07 : Optoelectronic devices – Introduction. LEDs and Lasers.
Week 08 : Photo detectors and solar cells. Problem set on opto electronic devices, week #7 and 8.

SOLAR PHOTOVOLTAICS: PRINCIPLES, TECHNOLOGIES & MATERIALS

METALLURGICAL AND MATERIALS ENGG.

PROF. ASHISH GARG
Department of Materials Science and Engineering
IIT Kanpur

TYPE OF COURSE : New | Elective | UG/PG
INTENDED AUDIENCE : BE/ME/MSc/PhD
PRE-REQUISITES : Basic physics knowledge
COURSE DURATION : 8 weeks (28 Jan 19 - 22 Mar 19)
EXAM DATE : 31 March 2019

INDUSTRIES APPLICABLE TO : Most companies related to solar photovoltaic

COURSE OUTLINE :

This course is an introductory course on solar photovoltaics materials and devices covering basic physics of materials as well as devices, various solar photovoltaic technologies and their status with a brief discussion of the fabrication aspects of the devices followed by discussion of the pending materials and technologies issues and measurement techniques.

ABOUT INSTRUCTOR :

Ashish Garg is Professor of Materials Science and Engineering at IIT Kanpur. Details of his research and teaching can be accessed on http://home.iitk.ac.in/~ashishg

COURSE PLAN :

Week 01 : Introduction and Solar radiation fundamentals
Week 02 : Basic physics of semiconductors
Week 03 : Carrier transport, generation and recombination in semiconductors
Week 04 : Semiconductor junctions
Week 05 : Essential characteristics of solar photovoltaic devices
Week 06 : First Generation Solar Cells
Week 07 : Second Generation Solar Cells
Week 08 : Third Generation Solar Cells

METALLURGICAL AND MATERIALS ENGG.

FRICTION AND WEAR OF MATERIALS: PRINCIPLES AND CASE STUDIES

PROF. B.V. MANOJ KUMAR
Department of Metallurgical and Materials Engineering
IIT Roorkee

PROF. BIKRAMJIT BASU
Materials Research Center
IISc, Bangalore

TYPE OF COURSE : New | Core | UG/PG
INTENDED AUDIENCE : BE, ME, MS, MSc, PhD
COURSE DURATION : 8 weeks (25 Feb'19 - 19 Apr'19)
EXAM DATE : 27 April 2019

INDUSTRIES APPLICABLE TO : Industries dealing in tribology: DUCOM, Bangalore

COURSE OUTLINE :

While the tribology is generally considered as related to mechanical engineering and design, the ever-increasing demand for the development of advanced materials for tribological applications necessitates a methodical understanding of tribology in materials science perspective. The proposed course is designed to provide knowledge on basic concepts of tribology as well as to understand the state of the art findings in friction and wear for a range of advanced material systems. The microstructure - properties - performance relationship is highlighted in understanding the behavior of the material in given wear conditions.

ABOUT INSTRUCTOR :

Dr. B.V. Manoj Kumar is currently working as Associate Professor in the Department of Metallurgical and Materials Engineering, Indian Institute of Technology Roorkee. He has been teaching courses related to materials science, engineering ceramics and composites, and tribology for the more than 7 years. His research interests include tribology of advanced materials, development of structural ceramics and composites.

Prof. Bikramjit Basu is currently a Professor at the Materials Research Center with joint appointment at the Centre for Biosystems Science and Engineering and Interdisciplinary center for Energy Research at Indian Institute of Science, Bangalore. He served on the faculty of IIT Kanpur during 2001-2011. As a researcher, he has made pioneering contributions towards innovative research at the intersection of multiple Engineering disciplines and Natural Sciences

COURSE PLAN :

Week 01 : Introduction; surfaces; friction; contact temperature; lubrication
Week 02 : Wear, wear mechanisms
Week 03 : Friction and wear of advanced metallic materials; basic fabrication concepts and overview of bioceramics and biocomposites
Week 04 : Processing concepts of ceramics, mechanical behavior of brittle materials; wear behavior of ceramic composites
Week 05 : Friction and wear of engineering polymers; Tribology of bioceramic composites, zirconia and dental restorative materials.
Week 06 : Wear of nanoceramic composites; erosive wear of ceramic composites
Week 07 : Cryogenic wear; Wear of high temperature ceramics
Week 08 : Friction and wear of coatings, computational analysis in assessing wear, Closure

METALLURGICAL AND MATERIALS ENGG.

THEORY AND PRACTICE OF NON DESTRUCTIVE TESTING

PROF. RANJIT BAURI
Department of Metallurgical and Materials Engineering
IIT Madras

TYPE OF COURSE : Rerun | Elective | UG/PG
COURSE DURATION : 8 weeks (28 Jan'19 - 22 Mar'19)
INTENDED AUDIENCE : Students, Researchers, Practicing Engineers
EXAM DATE : 31 Mar 2019
PRE-REQUISITES : BE/Diploma in Engg (Mech/Manufac/Production/Civil/Aerospace/App. Mech/Material Engg)
INDUSTRIES APPLICABLE TO : Manufacturing and Automotive Industries

COURSE OUTLINE :

Nondestructive Testing (NDT) plays an extremely important role in quality control, flaw detection and structural health monitoring covering a wide range of industries. There are varieties of NDT techniques in use. This course will first cover the fundamental science behind the commonly used NDT methods to build the basic understanding on the underlying principles. It will then go on to cover the process details of each of these NDT methods.

ABOUT INSTRUCTOR :

Dr. Ranjit Bauri is a Professor in the Dept. of Metallurgical and Materials Engineering, IIT Madras. He has more than nine years of experience in teaching NDT theory and practical courses. He is a life member of Indian Society for Non Destructive Testing (ISNT). He is also a seasoned researcher with more than a decade of research experience. His research areas include Composite materials, Al alloys, Friction stir welding and processing, Powder Metallurgy and Microscopy.

COURSE PLAN :

Week 01 : Introduction to NDT, Visual Optical methods, Dye penetrant testing, Basic principle, Types of dye and methods of application, Developer application and Inspection.
Week 02 : Magnetic particle testing, Basic theory of magnetism, Magnetization methods,Field indicators, Particle application, Inspection.
Week 03 : Eddy current testing, Basic principle; Faraday's law, Inductance, Lenz's law,Self and Mutual Inductance, Impedance plane, Inspection system and probes,System calibration.
Week 04 : Ultrasonic testing: Basics of ultrasonic waves, Pulse and beam shapes,Ultrasonic transducers.
Week 05 : Test method, Distance and Area calibration, Weld inspection by UT.
Week 06 : Acoustic emission testing: Basic principle, Sources of acoustic emission, Source parameters, Kaiser-Felicity theory, Equipment and Data display, Source location schemes.
Week 07 : Radiography: X-rays and their properties, X-ray generation, X-ray absorption and atomic scattering.
Week 08 : Image formation, Image quality, Digital Radiography, Image interpretation,Radiation Shielding. Comparison and selection of NDT methods, Concluding remarks.

METALLURGICAL AND MATERIALS ENGG.

INTRODUCTION TO MATERIALS SCIENCE AND ENGINEERING

PROF. RAJESH PRASAD
Department of Applied Mechanics
IIT Delhi

TYPE OF COURSE : New | Core| UG
PRE-REQUISITES : +2 in School
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 28 Apr 2019

INTENDED AUDIENCE : Undergraduate students from all disciplines in engineering. Could be useful for students of solid state physics and solid state chemistry as well as engineers in industry looking for fundamentals of materials science

INDUSTRIES APPLICABLE TO : Any industry concerned with materials, in particular automobile and manufacturing industry. Condensed versions of this course have been offered at Maruti Udyog Limited, Gurgaon and Terminal Ballistic Research Lab of CSIR, Chandigarh, India.

COURSE OUTLINE :

This course is designed as a first introduction to microstructure and mechanical properties of engineering materials for undergraduate engineering students. The focus will be on clear presentation of basic fundamentals of structure and defects of crystalline materials. This will then be used to understand the transformations, heat treatments and mechanical behavior of structural materials.

ABOUT INSTRUCTOR :

Prof. Rajesh Prasad, Department of Applied Mechanics, Indian Institute of Technology, Delhi began teaching Materials Science as a graduate student at University of Cambridge where he was supervisor and demonstrator for undergraduate course IA Crystalline Materials. He now has about three decades of experience of teaching materials science courses at both undergraduate and graduate levels at the Indian Institutes of Technology, at Varanasi, Kanpur and Delhi. He has been awarded a Teaching Excellence Award in 2012 by the Indian Institute of Technology Delhi. In 2013, he received the Distinguished Alumnus Award of the Department of Metallurgical Engineering, IIT-BHU, Varanasi.

COURSE PLAN

Week 1 : Lattice and crystal, 7 crystal systems, 14 Bravais lattices, Symmetry.
Week 2 : Miller indices of directions and planes, Weiss Zone Law, Bragg's Law, Close-Packed structures: CCP, HCP.
Week 3 : Voids in close-packed structures, Solid solutions: interstitial, substitutional, ordered, disordered. Hume-Rothery rules. Graphene, graphite and diamond.
Week 4 : Carbon nanotubes, Buckminsterfullerene.Ionic Solids: NaCl, CsCl, ZnS, BCC vs CsCl. Amorphous solids. Polymers: thermoplastic, thermosets, tacticity, copolymers, crystallinity.
Week 5 : Defects: zero-, one- and two-dimensional. Vacancies. Dislocations: edge, screw and mixed. Burgers vectors and burgers circuit. Constancy of Burgers vector. Elastic energy of a dislocation.
Week 6 : Dislocation cannot end abruptly inside a crystal, dislocation loop, dislocation node, dislocation motion: glide, climb and cross slip. 2D defects: free surfaces, grain boundaries, twin boundary, stacking faults, tilt and twist boundaries, ball bearing model.
Week 7 : Phase diagrams. Phases and components. Phases present in the system. Composition of phases: Tie-Line rule. Proportion of Phases: Lever Rule. Microstructure Evolution. Invariant reactions: eutectic, eutectoid, peritectic, peritectoid. Gibbs phase rule. Fe-C diagram.
Week 8 : Fe-C diagram (Continued). Eutectoid, hypoeutectoid and hypereutectoid steels. Diffusion: Fick's First and Second Laws. Error function solution of Fick's second law. Atomistic mechanisms of diffusion: interstitial and substitutional diffusion. Diffusion paths: lattice, grain boundary, dislocation and surface. Steady vs. unsteady state diffusion.
Week 9 : Phase transformation. Nucleation: Homogeneous and heterogeneous. Nucleation and capillary rise. Growth and overall transformation. TTT diagrams. Heat treatment of steels. TTT diagrams of eutectoid steels.
Week 10 : Quenching and martensite, Austempering and Bainite. Tempering and tempered martensite. Residual stresses and quench cracks. Marquenching and Martempering. TTT diagram of hypoeutectoid, hypereutectoid and alloy steels. Hardenability of steels. Glass ceramics.Mechanical behaviour of materials. Tensile test. Plastic deformation and crystal structure. Slip. Resolved shear stress and critical resolved shear stress. Schmid's law.
Week 11 : CRSS: theory vs. experiment. Strengthening mechanisms: strain hardening, grain size hardening, solid solution hardening and age hardening. Dislocation density. Frank-Read source. Annealing of cold-worked materials: Recovery, Recrystallisation, Grain Growth.
Week 12 : True stress and true strain. Creep. Effect of stress and temperature. Creep mechanisms. Composites: isostrain and isostress modulus. Fracture. Ductile and brittle fracture. Role of crack size: Griffith's criterion. Stress concentration. Ductile-to-brittle transition. Enhancing fracture resistance. Toughening of glass: tempering and ion-exchange. Fatigue. Sub-critical crack growth.

SURFACE ENGINEERING FOR CORROSION AND WEAR RESISTANCE APPLICATION

METALLURGICAL AND MATERIALS ENGG.

PROF. INDRANIL MANNA
Dept. of Metallurgical & Materials Engg.
IIT Kharagpur

PROF. JYOTSNA D. MAJUMDER
Dept. of Metallurgical & Materials Engg.
IIT Kharagpur

TYPE OF COURSE : New | Elective | UG/PG
INTENDED AUDIENCE : Metallurgical Engg., Mechanical Engg., Materials Science and Physics
COURSE DURATION : 12 weeks (28 Jan'19-19 Apr'19)
EXAM DATE : 28 April 2019
PRE-REQUISITES : Materials Science and Engineering

INDUSTRIES APPLICABLE TO : Tata Steel, Jamshedpur, Tata Metallics, Kharagpur, R&D Center for Iron and Steel (RDCIS), Ranchi,

COURSE OUTLINE :

Wear and corrosion are the major causes of degradation of engineering components for structural applications. Among different ways of minimizing the probability of failure of components by wear or corrosion or improving its lifetime is by optimum designing of surface, may be termed as surface engineering. However, the properties achieved on the surface depend on the techniques to be applied, process parameters to be chosen and the surface characteristics (surface roughness, microstructure and composition) achieved thereafter.

ABOUT INSTRUCTOR :

Prof. Majumdar is well known internationally for her research contribution in the field of Metallurgical and Material Engineering with focus on surface engineering and laser surface processing. She made fundamental contributions to a profound understanding of the metallurgy of rapid solidification of metals under the specific heat input of a laser source. Her works also concern a detailed structure-property correlation

Prof. Manna is a renowned academician and prolific researcher with wide ranging research interests concerning microstructure-property-parameter correlation in nanometric and amorphous solids, laser and plasma assisted surface engineered components, bainitic and ODS steel and nano-fluid.

COURSE PLAN :

Week 01 : Introduction to materials, surface, thermodynamics of surface, surface dependent engineering properties
Week 02 : Common surface initiated engineering failure; mechanism of surface degradation
Week 03 : Role of microstructure and materials behavior in controlling the surface dependent failure of components, importance of surface engineering, classification and scope of surface engineering of Materials. Introduction to surface modification and coating techniques.
Week 04 : Conventional surface modification methods: flame hardening, induction hardening, carburizing, nitriding, diffusion assisted surface alloying.
Week 05 : Advanced surface modification methods: Laser, Plasma and electron beam assisted surface modification. Advanced surface modification methods
Week 06 : Surface Coating by Chemical/electro-chemical Routes Electro/electroless deposition, anodizing, micro-arc oxidation
Week 07 : Surface Coating by Physical Routes: Physical vapor deposition, pulsed laser deposition, cathodic arc evaporation.
Week 08 : Surface Coating by chemical Routes: Chemical vapor deposition, laser assisted chemical vapor deposition.
Week 09 : Hot dipping, (galvanizing, tinning, aluminizing, babitting, etc.)
Week 10 : Thermal Spraying (flame spraying, HVOF spraying, wire arc spraying, kinetic spraying)
Week 11 : Weld overlaying, laser surface cladding
Week 12 : Surface characterization and Testing

METALLURGICAL AND MATERIALS ENGG.

MATERIAL CHARACTERIZATION

PROF. S. SANKARAN
Department of Mechanical and Industrial Engineering
IIT Madras

TYPE OF COURSE : Rerun | Core | UG
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
INTENDED AUDIENCE : Undergraduate students of Metallurgical and Materials, Physics, Chemistry and biological sciences
EXAM DATE : 27 Apr 2019

INDUSTRIES APPLICABLE TO : All the Metallurgical and automotive industries

COURSE OUTLINE :

It is the first course at the under graduate level on microstructural characterization of materials. This course will cover the basic principles and techniques of X-ray diffraction, optical, scanning electron and transmission electron microscopy along with demonstrations of the instrument details and imaging experiments through videos. This course also deals with the sample preparation techniques for the microstructural analysis with practical examples through videos.

ABOUT INSTRUCTOR :

Prof. S. Sankaran is presently a Professor in the Department of Metallurgical and Materials Engineering, IIT Madras. His research interests are deformation processing of materials, mechanical behavior of materials and electron microscopy. He is also presently the faculty in-charge of central electron microscopy of IIT Madras.

COURSE PLAN

Week 1 : Fundamentals of optic; Optical microscope and its instrumental details
Week 2 : Variants in the optical microscopes and image formation; Phase contrast, Polarised light, Differential interference contrast, Fluorescence microscopy
Week 3 : Sample preparation and applications of optical microscopes
Week 4 : Introduction to Scanning electron microscopy (SEM)
Week 5 : Instrumental details and image formation of SEM
Week 6 : Various imaging techniques and spectroscopy; Sample preparation and applications of SEM
Week 7 : Fundamentals of X-ray scattering; Bragg's law derivation and the factors affecting the intensity
Week 8 : Crystallite size, effect of strain on the intensity; Profile fit, indexing, peak broadening
Week 9 : Quantitative analysis, residual stress analysis; Instrumentation details and demo experiments of XRD
Week 10 : Introduction to transmission electron microscopy (TEM)
Week 11 : Diffraction and image formation; Various imaging techniques and spectroscopy
Week 12 : Sample preparation and applications of TEM; Instrumentation details and demo experiments of TEM

METALLURGICAL AND MATERIALS ENGG.

WELDING PROCESSES

PROF. MURUGAIYAN AMIRTHALINGAM
School of Minerals, Metallurgical and Materials Engineering
IIT Madras

TYPE OF COURSE : New | Core | PG
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 27 Apr 2019
INTENDED AUDIENCE : Masters students in Metallurgical, Mechanical, Automobile and Production Engineering.

INDUSTRIES APPLICABLE TO : Construction, Fabrication, Automobile and Power generation industries and research labs

COURSE OUTLINE :

The modern material assemblies require the combined use of alloys for a given commercial application. Welding technologies are of critical importance for the construction of virtually all components of the assemblies. This course aims to elaborate the physical principles of arc, plasma, laser, resistance spot, electron beam and solid state welding processes. This includes, physics of electric arc-plasma, engineering the arc-plasma for welding, metal transfer and mass flow in the weld pool, laser/electron beam - material interactions, pressure and force balance in keyhole mode power beam welding, fundamentals of heat generation by Joule heating and process principles and overview on types of resistance and solid state welding processes.

ABOUT INSTRUCTOR :

Prof. Murugaiyan is currently working as an Assistant Professor in IIT-Madras. His research and teaching interests include welding metallurgy, welding processes development, steel product development and additive manufacturing.

COURSE PLAN :

Week 01 : Introduction to the course, learning outcomes, general survey and classification of welding processes, Conventional fusion welding processes, Principal heat sources.
Week 02 : Physics of welding arc – Part I
Week 03 : Physics of welding arc – Part II
Week 04 : Introduction to arc welding processes – Part I
Week 05 : Electrical power sources for welding - General characteristics, conventional and electronic power regulator systems - Tapped transformers, Moving-iron control, Variable inductor, Magnetic amplifier, SCR phase control, Transistor series regulator, Secondary switched transistor power supplies, Primary rectifier-inverter, hybrid designs and microprocessor controlled power sources.
Week 06 : Introduction to arc welding processes – Part II
Week 07 : Fundamentals of resistance welding – Part I
Week 08 : Fundamentals of resistance welding – Part II
Week 09 : Introduction to power beam welding processes : Plasma, laser and electron beam welding processes - principles and modes of operation, applications and advantages.
Week 10 : Principles of power beam welding processes : Keyhole formation, power densities, forces acting in keyhole, pressure balance for a generalised keyhole, heat transfer in laser and electron beam welding processes.
Week 11 : Introduction to pressure welding processes - solid state bonding, friction welding, friction stir welding, ultrasonic welding, explosive welding, diffusion bonding and adhesive bonding.
Week 12 : Principles and operational considerations of pressure welding processes

MINING ENGINEERING

MINING ENGINEERING

04 weeks

01. Network Analysis for Mines and Mineral Engineering

MINING ENGINEERING

NETWORK ANALYSIS FOR MINES AND MINERAL ENGINEERING

PROF. KAUSHIK DEY
Department of Mining Engineering
IIT Kharagpur

TYPE OF COURSE : New | Elective | UG/PG

COURSE DURATION : 4 weeks (25 Feb'19 - 22 Mar'19)

INTENDED AUDIENCE : BE in Mining/Mineral Engineering, ME, Ph.D

EXAM DATE : 28 April 2019

INDUSTRIES APPLICABLE TO : All Mining Industries send their Engineers/Managers to attend similar courses conducted mostly by Management Institutes/IE Departments. They may think of this online course

COURSE OUTLINE :

This course covers the basics of Program evaluation and review technique (PERT) & Critical Path Method (CPM) related to Mining and Mineral engineering situations. It is a part of quantitative decision making techniques, Optimization techniques and probabilistic approach. This course is basically designed to give a substantial understanding of the network analysis for mining/mineral and allied engineers or students. The course will start with the basics. Then it will cover the theoretical understanding of the problems along with a number of tutorials of simulated problems. Both the deterministic and probabilistic approach is covered in the syllabus. The software programming related to the network analysis will also be covered.

ABOUT INSTRUCTOR :

Kaushik Dey is an Assistant Professor, Department of Mining Engineering Indian Institute of Technology, Kharagpur, India. He has obtained B.E. (Mining), M. Tech (Opencast Mining) and Ph.D. (Mining) prior to work in the field of Tunneling and Mining sector for few years. Prior to join I. I. T. Kharagpur, Dr. Kaushik Dey was an Assistant Professor in Department of Mining Engineering at National Institute of Technology, Rourkela and at Indian School of Mines, Dhanbad. His research area includes excavation of rock by blasting or by mechanical cutting, mining operations, surface mining, whole body vibration etc. He has published around thirty five research papers in different journals apart from many others presented in the national/international conferences.

COURSE PLAN :

Week 01 : Introduction to PERT and CPM and basic understanding
Week 02 : Detailed understanding of CPM and optimization techniques
Week 03 : Detailed understanding of PERT and probabilistic approach
Week 04 : Critical analysis of the networks, computer programming

MULTIDISCIPLINARY

MULTIDISCIPLINARY

04 weeks

01. Effective Engineering Teaching In Practice
02. Teaching And Learning in Engineering (TALE)
03. Introduction To Professional Scientific Communication
04. Current regulatory requirements for conducting clinical trials in India
05. Regulatory requirements for medical devices and IVD (invitro diagnostic) kits in India
06. Designing Learner - Centric MOOCs

08 weeks

01. Health Research Fundamentals
02. Introduction to Research
03. Fuzzy Logic and Neural Networks
04. Entrepreneurship Essentials
05. Roadmap for patent creation
06. Matlab Programming for Numerical Computation
07. Manage TB

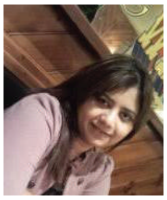
12 weeks

01. Qualitative Research Methods and Research Writing
02. Non-Conventional Energy Resources

MULTIDISCIPLINARY

EFFECTIVE ENGINEERING TEACHING IN PRACTICE

PROF. G.K SURAISHKUMAR
Department of Biotechnology
IIT Madras



PROF. RICHA VERMA
Teaching Learning Centre
IIT Madras

PROF. EDAMANA PRASAD
Department of Chemistry
IIT Madras

PROF. SHREEPAD KARMALKAR
Dept. of Electrical Engg.
IIT Madras

TYPE OF COURSE : Rerun | Elective | PG
INTENDED SUPPORT : Any industry or start-up interested in education
COURSE DURATION : 4 weeks (28 Jan'19 - 22 Feb'19)
EXAM DATE : 31 Mar 2019
INTENDED AUDIENCE : All engineering teachers and aspiring teachers.

COURSE OUTLINE :

Traditionally, teachers are not trained to teach professional courses. Thus, they learn even the essential principles of teaching through experience, 'on the job'. This leads to a less than satisfactory in-class learning experience for most students in many courses, except if the teacher has a natural orientation to teaching. This course is aimed to introduce the essentials of facilitation of student learning ('teaching') in an interesting way to any teacher of professional courses, with a special focus on engineering. Further, education is a vast, old area of research, with rigorous, evidence-based knowledge that is useful for the facilitation of learning. However, the knowledge is not in an easily accessible form for teachers without experience in education research.

COURSE PLAN

Week 1
An inexperienced engineering teacher's view
From traditional lecturing to helping students learn
Better learning (Bloom's taxonomy)
Problem based learning (PBL) and problem solving

Week 2
Learning outcomes
Active learning
Co-operative group learning

Week 3
Flipped classroom
Lab courses
Evaluations/assessments

Week 4
How can we use research in education?
Class composition
Psychological type and learning
Models of cognitive development
Learning theories
Feed-back and Reflection

MULTIDISCIPLINARY

TEACHING AND LEARNING IN ENGINEERING (TALE)

PROF. N.J. RAO
Department of DESE
IISc Bangalore

TYPE OF COURSE : New | Elective | PG
COURSE DURATION : 4 weeks (25 Feb'19 - 22 Mar'19)
PRE-REQUISITES : Degree in Engineering
EXAM DATE : 27 April 2019
INTENDED AUDIENCE : Working and aspiring engineering teachers
INDUSTRIES APPLICABLE TO : Educational Institutions, Corporate Training

COURSE OUTLINE :

The quality of Teaching And Learning in Engineering (TALE) has come to be an important issue in India to all stakeholders including teachers, students, parents, Managements, University, AICTE, NBA and Industry. The quality of learning of the graduating engineers determines the quality of their placements. While there has been significant increase in the last few decades in our understanding of how people learn, there has not been much intersection of this knowledge with the instructional practices at institutions of higher learning.

ABOUT INSTRUCTOR :

Prof. Rao was previously the Chairman of CEDT (Centre for Electronics Design and Technology, IISc during 1981 – 1996), and Chairman, Department of Management Studies during 1998 – 2006, and superannuated in July 2006. He is presently a Consulting Professor at International Institute of Information Technology (IIIT), Bangalore, a member of several committees associated with NBA, and a member of the Core Committee that defined the new Accreditation processes of NAAC.

COURSE PLAN :

Week 01 : Overview of TALE and Good Engineer,Education, Teaching, Learning, Instruction and Assessment, What is OBE?, Accreditation, Outcomes

Week 02 : Program Outcomes 1, Program Outcomes 2, Taxonomy of Learning, Cognitive Levels 1, Cognitive Levels 2

Week 03 : General Categories of Knowledge, Metacognitive Knowledge, Vincenti Categories of Engineering Knowledge, Affective and Psychomotor Domains, Taxonomy Table

Week 04 : Course Outcomes 1, Course Outcomes 2, Course Outcomes – POs and PSOs, Attainment of COs, Attainment of POs and PSO

MULTIDISCIPLINARY

INTRODUCTION TO PROFESSIONAL SCIENTIFIC COMMUNICATION

PROF. S. GANESH
Department of Biology, Genetics and Genomics
IIT Kanpur

TYPE OF COURSE : Rerun | Core | PG

COURSE DURATION : 4 weeks (28 Jan'19 - 22 Feb'19)

INTENDED AUDIENCE : Science and engineering stream students interested or pursuing R&D related activities.

EXAM DATE : 31 Mar 2019

PRE-REQUISITES : Basic level of understanding on concept and methodology in scientific research

INDUSTRIES APPLICABLE TO : This course is meant for professional development, and hence applicable to all R&D related industries and academia

COURSE OUTLINE :

The objective of this course is to introduce undergraduate and postgraduate students to the different aspects of professional science communication including written and oral communication, and publication ethics in research.

ABOUT INSTRUCTOR :

Prof. S. Ganesh teaches biology, genetics and genomics at IIT Kanpur. His research interests include human molecular genetics and neuroscience. He works on genetic forms of neurodegenerative disorders in humans to understand their genetics and disease mechanisms, and to develop therapeutics. He has been serving on the editorial boards of journals, and offers courses on professional and scientific communication at IIT Kanpur. For more information, visit his group's website: http://home.iitk.ac.in/~sganesh/

COURSE PLAN :

Week 01 : Introduction to Professional Scientific Communication, Discussion of creativity, research ideas and where to find them, Inductive reasoning versus deductive reasoning.

Week 02 : Hypothesis, reasoning and testing the hypothesis, Peer review process, Structure of a scientific report.

Week 03 : Structure of a Research article, Title, abstract, methods, results, and discussion.

Week 04 : Structure of a Research article contd., Schematic diagrams, figures, tables and flow charts – rationale and usage, Ethics in biomedical research, Different forms of writing: scientific report, proposal, and reviews, Presentations-thumb rules and good practice.

MULTIDISCIPLINARY

CURRENT REGULATORY REQUIREMENTS FOR CONDUCTING CLINICAL TRIALS IN INDIA

DR. A.B. RAMTEKE
Dept. of Regulatory Affairs
CDSA, THSTI, DBT

DR. SUCHETA B. KURUNDKAR
Training
CDSA, THSTI, DBT

DR. NANDINI K. KUMAR
Adjunct Faculty
CDSA, THSTI, DBT

TYPE OF COURSE : New | Elective | UG/PG
INTENDED AUDIENCE : Personnel working in new drug development
COURSE DURATION : 4 weeks (25 Feb 19 - 22 Mar 19)
EXAM DATE : 28 April 2019
PRE-REQUISITES : MBBS/BDS//BSc/B.Pharm and PG in said degrees, who are engaged in drug research, regulatory affairs.

INDUSTRIES APPLICABLE TO : Pharmaceutical Companies, Research Institutions, Biomedical research organizations, Drug regulators

COURSE OUTLINE :

Demonstration of safety and efficacy of the drug product for use in human being is essential before the drug can be approved for import or manufacturing and marketing in the country. The Rules 122A, 122B and 122D, 122 DA, 122DB, 122DAA, 122 DAB, 122 DD, and 122E of Drugs and Cosmetics Rules and Appendix I, IA and VI of Schedule Y, describe the information/data required for approval of clinical trial and/or to import or manufacture of new drug for marketing in the country. Recently, there are few amendments made related to the new drug rules. and " New Drugs and ClinicalTrial Rules, 2018. (Draft) published by the CDSCO.

ABOUT INSTRUCTOR :

Shri. Arunkumar B. Ramteke retired as a senior drugs regulatory officer (Joint Drugs Controller, India, CDSCO) with 31 years of experience in drug regulatory aspects in the office of the Drugs Controller General of India (DCGI).

Dr. Sucheta Banerjee Kurundkar joined CDSA as Director Training in 2012. She has 20+ years of experience in research and CRO Industry. Prior to this, she was Chief Scientific Officer at a multinational Clinical Research Organization. She is involved in training, quality assurance (pre-clinical, clinical & medical labs) and regulatory affairs at CDSA.

Dr. Nandini K. Kumar completed her MBBS and Post Graduate Diploma in Clinical Pathology from GMC, Trivandrum, and is a Fogarty Fellow graduate in Bioethics from University of Toronto. She worked as a researcher in the Gastroenterology Dept. of GMC, Trivandrum and in the Liver Clinic of Madras Medical College, Chennai.

COURSE PLAN :

Week 01 : Introduction, Definitions, Drug Regulatory Authorities

Week 02 : Drugs & Cosmetic Act & Rules (Relevant Act and Rules), Drugs & Cosmetics Rules (Relevant Guidelines issued by CDSCO), Drug development Overview

Week 03 : Good Clinical Practice (Indian), Schedule Y: Overview, Schedule Y: Appendices

Week 04 : Ethical considerations, Recent amendments, Special concerns (Approval procedure for Medical device, Biologicals, Phytopharmaceuticals, r-DNA derived products)

REGULATORY REQUIREMENTS FOR MEDICAL DEVICES AND IVD (IN VITRO DIAGNOSTIC) KITS IN INDIA

MULTIDISCIPLINARY

DR. MALAY MITRA
Former Dy.Drugs Controller
CDSCO

DR. ARUN B. RAMTEKE
Regulatory Affairs
CDSA, THSTI, DBT

TYPE OF COURSE : New | Elective | UG
EXAM DATE : 27 April 2019
COURSE DURATION : 4 weeks (25 Feb 19 - 22 Mar 19)
INTENDED AUDIENCE : Personnel working in medical device industry, Investigators, Regulatory Affairs personnel
PRE-REQUISITES : MBBS/BDS/ BE /ME/MSc/M.Pharm and above

INDUSTRIES APPLICABLE TO : Medical device companies, Research Institutions, Biomedical research organizations, Drug regulators, etc.

COURSE OUTLINE :

Demonstration of safety and efficacy of medical device and in vitro diagnostic (IVD) kit for use in humans is essential before the product can be approved for import or manufacturing and marketing in the country. Medical devices are currently regulated under the definition of DRUG. The Rules are :- Rules 109-A - Labeling of medical devices, Rule 125-A - Standards for medical devices, Schedule M III - QMS requirements, Schedule R- Standard for mechanical contraceptives, Schedule R1-Standards for medical devices, Schedule DII -Annexure B - IVD

ABOUT INSTRUCTOR :

Shri. Mitra completed his Pharmaceutical education from Jadavpur University, Calcutta in 1974. He worked in the area of pharmaceutical manufacturing in various capacities up to 1982. He joined Central Drugs Standard Control Organisation (CDSCO), Directorate General of Health Services, Ministry of Health & Family Welfare, Govt. of India in 1982. He has audited around 1500 institutions till date including China. He was an active member during the formation of Schedule M (GMP, Drugs and Cosmetic Rules, 1945).

Shri. Arunkumar B. Ramteke retired as a senior drugs regulatory officer (Joint Drugs Controller, India, CDSCO) with 31 years of experience in drug regulatory aspects in the office of the Drugs Controller General of India (DCGI). He has in-depth knowledge of Indian Drugs & Cosmetics Act, Rules and of regulations of Global Drug Regulatory norms. He started his career at Central Research Institute, Kasauli, as Deputy Assistant Director, BSQC Division and faculty for B.Sc. (Microbiology) H.P. University. As Drug Regulator he has extensive experience with new drugs, vaccines and biotech products/pharmaceuticals, medical devices regulatory approvals and development experience.

COURSE PLAN :

Week 01 : Introduction, Classification of medical devices, Types of medical devices including combination device

Week 02 : Standards of medical device and testing, How to obtain a license to manufacture a medical device, Technical personnel required for manufacturing

Week 03 : Import and export, Local manufacturer: How to apply?, Schedule M-III and other standards like ISO 13485

Week 04 : Quality Assurance, Inspection and fees, Inspection before licensing

MULTIDISCIPLINARY

DESIGNING LEARNER - CENTRIC MOOCS

PROF. SRIDHAR IYER
Department Computer Science and Engineering
IIT Bombay

PROF. SAHANA MURTHY
Faculty at Inter-Disciplinary Programme
in Educational Technology
IIT Bombay

DR. JAYAKRISHNAN M
Senior Scientist
IIT Madras

PROF. SAMEER S SAHASRABUDHE
Dept. of Computer Science and Engineering
IIT Bombay

TYPE OF COURSE : New | Elective | PG
EXAM DATE : 27 April 2019
COURSE DURATION : 4 weeks (25 Feb 19 - 22 Mar 19)
INTENDED AUDIENCE : Teachers, MOOC creators

INDUSTRIES APPLICABLE TO : Companies creating online courses.L&D (Training) divisions in companies across various sectors.

COURSE OUTLINE :

Massive Open Online Courses (MOOCs) have become a popular avenue for diverse learners to upgrade their knowledge and skills. Instructors who are new to creating MOOCs tend to focus on the use of technology features to mimic their classroom actions. While it is necessary to be aware of the technology affordances, it is more important to focus on the pedagogy of how to use the MOOC features effectively to foster student engagement and learning. Hence MOOC instructors need a set of design principles and guidelines to create a learner-centric MOOC.

ABOUT INSTRUCTOR :

Sridhar Iyer is a faculty member in the Inter-Disciplinary Program in Educational Technology, His current research interests include: Technology enhanced learning environments for thinking skills, Pedagogies for effective use of educational technologies, development of ICT tools for educational applications, and Computer science education research.

Sahana Murthy is a faculty member in the Inter-Disciplinary Programme in Educational Technology a Prior to that she was a lecturer at the Experimental Study Group in MIT from 2006-09 during which she implemented and evaluated innovative teaching methods. Her current research interests lie in students' development of thinking skills through technology enhanced learning environments.

Jayakrishnan M is a Senior Scientist, He completed his PhD in "A Model for Large-scale In-service Teacher Training in Effective Technology Integration in Engineering Education" from the Inter-Disciplinary Programme in Educational Technology at IIT Bombay. His research interests in the field of Educational Technology include Teacher Technology Integration, Massive Open Online Learning, Sustainability in Teacher Professional Development and Computer Supported Collaborative Learning.

Sameer S Sahasrabudhe works as Senior Project Research Scientist, He has a graduation in fine arts, post graduate diplomas in animation film making and distance education, and a doctorate in the area of eLearning animation. He has a cumulative experience of 18 years, in the areas of advertising, animation film production, eLearning content creation, research, and teaching. As an evangelist of open source 3D animation software: Blender, he has conducted several workshops, on Blender animation, and has presented at various conferences. His courses on IITBombayX platform have been well received.

COURSE PLAN :

Week 01 : The LCM model
Week 02 : Creating LeDs
Week 03 : Creating LbDs and LxTs
Week 04 : LxIs and Orchestration

MULTIDISCIPLINARY

HEALTH RESEARCH FUNDAMENTALS

TYPE OF COURSE : Rerun | Elective | UG

PRE-REQUISITES : Undergraduate students in medical/dental/nursing/AYUSH streams
Graduate in any discipline

INDUSTRY SUPPORT : Government/ private sector, public health service institutions

COURSE DURATION : 8 weeks (28 Jan'19 - 22 Mar'19)

EXAM DATE : 31 Mar 2019

COURSE OUTLINE :

National Institute of Epidemiology [NIE], Indian Council of Medical Research [ICMR] is offering online programmes on conduct of human bio-medical research. The programme will be offered as NIE-ICMR e-Certificate – NIeCer - Courses.

ABOUT INSTRUCTOR :

Multifaculty
National Institute of Epidemiology

COURSE PLAN

Week 1 : Conceptualizing a research study | Introduction to health research.
Formulating research question, hypothesis and objective | Literature review – Dr. P Ganeshkumar

Week 2 : Epidemiological considerations in designing a research study | Measures of disease frequency | Descriptive study designs | Analytical study designs.

Week 3 : Epidemiological considerations in designing a research study | Experimental study designs: Clinical trials | Validity of epidemiological studies | Qualitative research methods: An overview.

Week 4 : Bio-statistical considerations in designing a research study | Measurement of study variables | Sampling methods | Calculating sample size and power.

Week 5 : Planning a research study | Selection of study population | Study plan and project management | Designing data collection tools.

Week 6 : Planning a research study | Principles of data collection | Data management | Overview of data analysis.

Week 7 : Conducting a research study | Ethical framework for health research | Conducting clinical trials.

Week 8 : Writing a research protocol | Preparing a concept paper for research projects | Elements of a protocol for research studies.

INTRODUCTION TO RESEARCH

MULTIDISCIPLINARY

PROF. G. PHANIKUMAR
Dept. of Metallurgical and Materials Engg.
IIT Madras

PROF. PRATHAP HARIDOSS
Dept. of Metallurgical and Materials Engg.
IIT Madras

PROF. ABHIJIT P. DESHPANDE
Dept. of Chemical Engg.
IIT Madras

PROF. BALAJI C
DEPT. OF MECHANICAL ENGG.
IIT MADRAS

PROF. FEROZ ALI
CHAIR PROFESSOR ON INTELLECTUAL PROPERTY RIGHTS
IIT MADRAS

PROF. M.S ANANTH
DEPT. OF CHEMICAL ENGG.
IIT MADRAS

PROF. ARUN K. TANGIRALA
DEPT. OF CHEMICAL ENGG.
IIT MADRAS

PROF. KANNAN
DEPT. OF CHEMICAL ENGG.
IIT MADRAS

PROF. SREEKUMAR N
DEPT. OF HUMANITIES & SOCIAL SCIENCE
IIT MADRAS

TYPE OF COURSE : Rerun |Elective | PG
INTENDED SUPPORT : Students of ME/MTech/MS/MSc/PhD can benefit.
COURSE DURATION : 8 weeks (25 Feb'19 - 19 Apr'19)
EXAM DATE : 28 Apr 2019
PRE-REQUISITES : Students who have completed undergraduate studies (in Engineering or Science) will be in a better position to benefit from this course

COURSE OUTLINE :

Large numbers of students are actively considering and taking up research and associated higher studies. This course aims to introduce students to the important aspects of research. The intent of the course is to make students aware of the details associated with formal research and to help students overcome common misconceptions that may be present in their minds. By going through this course, students are likely to be able to take up research activities in a more systematic and formal manner right from the beginning.

ABOUT INSTRUCTOR :

Multifaculty
Coordinated by Prof. Prathap Haridoss
Department of Mettallurgical & Material Engineering

COURSE PLAN :

Week 1 : A group discussion on what is research; Overview of research;
Week 2 : Literature survey , Experimental skills;
Week 3 : Data analysis, Modelling skills;
Week 4 : Technical writing; Technical Presentations; Creativity in Research
Week 5 : Creativity in Research; Ethics in Research
Week 6 : Design of Experiments
Week 7 : Intellectual Property
Week 8 : Department specific research discussions

FUZZY LOGIC AND NEURAL NETWORKS

MULTIDISCIPLINARY

PROF. DILIP KUMAR PRATIHAR
Department of Mechanical Engineering
IIT Kharagpur

TYPE OF COURSE : New| Core| UG/PG
INTENDED AUDIENCE : Engineering, Researchers and practicing Engineers
COURSE DURATION : 8 weeks (25 Feb'19 - 19 Apr'19)
EXAM DATE : 28 April 2019

INDUSTRIES APPLICABLE TO : RDCIS, Ranchi CMERI, Durgapur Reliance Industries, Mumbai C-DAC.

COURSE OUTLINE :

This course will start with a brief introduction to fuzzy sets. The differences between fuzzy sets and crisp sets will be identified. Various terms used in the fuzzy sets and the grammar of fuzzy sets will be discussed, in detail, with the help of some numerical examples. The working principles of two most popular applications of fuzzy sets, namely fuzzy reasoning and fuzzy clustering will be explained, and numerical examples will be solved. Fundamentals of neural networks and various learning methods will then be discussed. The principles of multi-layer feed forward neural network, radial basis function network, self- organizing map, counter-propagation neural network, recurrent neural network, deep learning neural network will be explained with appropriate numerical examples.

ABOUT INSTRUCTOR :

Prof. Pratihar received BE (Hons.) and M. Tech. from REC (NIT) Durgapur, India, in 1988 and 1994, respectively and Ph.D. from IIT Kanpur, India in 2000. He completed his post-doctoral studies in Japan and then, in Germany under the Alexander von Humboldt Fellowship Programme. He is now a Professor at IIT Kharagpur, India. His research areas include robotics, soft computing and manufacturing science. He has guided 18 Ph.D.s. and is in editorial board of 14 International Journals. He has been elected as FIE, MASME and SMIEEE.

COURSE PLAN :

Week 01 : Introduction to Fuzzy Sets
Week 02 : Introduction to Fuzzy Sets (contd.); Fuzzy reasoning
Week 03 : Fuzzy reasoning (contd.); Fuzzy clustering
Week 04 : Fuzzy clustering (contd.); Fundamentals of Neural Networks
Week 05 : Multi-layer Feed-Forward Neural Network; Radial Basis Function Network
Week 06 : Self-Organizing Map; Counter-Propagation Neural Network; Recurrent Neural Networks; Deep Learning Neural Network
Week 07 : Genetic-Fuzzy system; Genetic-Neural System
Week 08 : Neuro-Fuzzy System; Concepts of Soft Computing and Computational Intelligence; Summary of the Course

ENTREPRENEURSHIP ESSENTIALS

MULTIDISCIPLINARY

PROF. MANOJ KUMAR MONDAL
Rajendra Mishra School of Engineering Entrepreneurship
IIT Kharagpur

TYPE OF COURSE : New | Elective | UG/PG
INTENDED AUDIENCE : All students with education up to higher secondary
COURSE DURATION : 8 weeks (25 Feb'19 - 19 Apr'19)
EXAM DATE : 27 April 2019

INDUSTRIES APPLICABLE TO : All start-ups, companies in emerging technology domains, companies adopting corporate entrepreneurship', professionally managed companies.

COURSE OUTLINE :

The course provides foundational knowledge on various aspects of entrepreneurial venture creation and management during its life-cycle. It has been designed to address multidisciplinary audiences. The objective of the course is to teach key issues faced by entrepreneurs and managers at different stages of the life-cycle of an enterprise and is relevant both for aspiring entrepreneurs and for decision makers in established enterprises. Topics can be classified in some major themes such as: Making a choice to create an entrepreneurial venture, current trend of technology entrepreneurship, how to start a start-up, identifying opportunities, factors driving competitive advantages, organizational structure, basic knowledge of financial statements and project report

ABOUT INSTRUCTOR :

Manoj K Mondal, Assistant Professor, Rajendra Mishra School of Engineering Entrepreneurship IIT Kharagpur, is a senior financial professional, an academician and an innovator with several patents to hiscredit. He has received several laurels for his innovations including goldmedal for Best Innovation (2008) awarded jointly by Lockheed Martin,Stanford University, University of Texas at Austin USA and FICCI India,and the best innovation award by Ministry of Chemicals & Fertilizers(2014). Dr. Mondal is presently teaching entrepreneurship at IITKharagpur and has been mentoring many aspiring entrepreneurs for more than a decade. He is also an active member of an entrepreneurial venture (nucleodyne.com).

COURSE PLAN :

Week 01 : Definition, Innovation and entrepreneurship, Contributions of entrepreneurs to the society, risk-opportunities perspective and mitigation of risks. Corporate entrepreneurship or intrapreneurship.

Week 02 : Opportunity Identification, factors determining competitive advantage, Market segment, market structure, blue ocean strategy, Marketing research, Demand-supply analysis

Week 03 : Value proposition, Business Model Canvas, Developing an Effective Business Model, Legal forms of business.

Week 04 : Design Thinking, Design-Driven Innovation, TRIZ (Theory of Inventive Problem Solving), Zero-based

Week 05 : design, Systems thinking, SPRINT Lean product development, Lean entrepreneurship, Lean manufacturing, Go-to-market strategy

Week 06 : What is a balance team and why is it important, Recruiting early employees, Writing a business plan, Pitching.

Week 07 : Preparing financial statements, analysis of opportunities based on financials, break-even & margin of safety analysis

Week 08 : Government incentives for entrepreneurship, Incubation, acceleration, Funding new ventures, Legal aspects of business

MULTIDISCIPLINARY

ROADMAP FOR PATENT CREATION

PROF. GOURI GARGATE
Rajiv Gandhi School of IP law
IIT Kharagpur

TYPE OF COURSE : New | Elective | UG/PG
COURSE DURATION : 8 weeks (28 Jan'19 - 22 Mar'19)
INTENDED AUDIENCE : Any discipline
EXAM DATE : 31 March 2019
INDUSTRIES APPLICABLE TO : Almost all industry sectors need this course

COURSE OUTLINE :

For every science and technology individual, or for any inventive mind,there is a possibility of creating novel product or process. This course will help such intellectual minds to identify and protect their intellectual efforts. This course is an introduction to one of the important types of intellectualproperty, patent. The course is a good blend of theoretical and practical aspects of patenting activity. The course is focused on inventor/researcher perspective with an objective how to generate a patent. This course provides various guidelines to inventor/researcher to convert his research into patent.

ABOUT INSTRUCTOR :

Dr. Gouri has a wide experience in intellectual property law, industry and academia. Her background in IPR is LLM from University of Mumbai (Goldmedal), PhD in IP management from IIT Bombay (MHRD scholarship),Post Graduate Diploma in patent law from NALSAR University,Registered patent agent (IN/PA 1930), TIFAC (Technology InformationForecasting and Assessment Council, DST) scientist and DL 101 certification. Her background in technology is M.Sc. in Microbiology (GoldMedal), PG Diploma in Medical Laboratory Technology and short term training in IVF (In Vitro Fertility). She has presented research papers at international technology management conferences such as PICMET (2012, Canada), IAMOT(2018, Birmingham, UK) and published research papers in reputed journals like 'World Patent Information', 'JWIP', 'IJIPM' and filed her own patent in March 2015.

COURSE PLAN :

Week 01 : Introduction to patent – Definition and concepts
Week 02 : Patent analytics- Introduction, How to a read patent?
Week 03 : Use of patent data for research gap analysis
Week 04 : Identification of potential patent - various tools
Week 05 : Research planning and patent filing activity
Week 06 : Types of patent and patent timelines
Week 07 : Maintenance of laboratory notebook and patenting activity
Week 08 : Interaction with patent attorney at various stages of patent filing and related timelines to be followed

MATLAB PROGRAMMING FOR NUMERICAL COMPUTATION

MULTIDISCIPLINARY

PROF. NIKET KAISARE
Dept. of Chemical Engineering
IIT Madras

TYPE OF COURSE : Rerun | Elective | UG/PG

COURSE DURATION : 8 weeks (28 Jan'19 - 22 Mar'19)

INTENDED AUDIENCE : B.E/M.E/ M.S,M.Sc,PhD

EXAM DATE : 31 Mar 2019

PRE-REQUISITES : The students for this course are expected to know basics of linear algebra and calculus. These are covered in Introductory Math course(s) for Engineers (typically done in first year).

COURSE OUTLINE :

MATLAB is a popular language for numerical computation. This course introduces students to MATLAB programming, and demonstrate it's use for scientific computations. The basis of computational techniques are expounded through various coding examples and problems, and practical ways to use MATLAB will be discussed.

ABOUT INSTRUCTOR :

Prof. Niket Kaisare is a Professor of Chemical Engineering in IIT Madras. He works in the area of modeling, design and control for energy applications. He has over 5 years of research/teaching experience in academia, and three-year experience in Industrial R&D. He uses computational software, including MATLAB, FORTRAN, Aspen and FLUENT extensively in his research and teaching.

COURSE PLAN :

Week 1 : Introduction to MATLAB Programming

Week 2 : Approximations and Errors

Week 3 : Numerical Differentiation and Integration

Week 4 : Linear Equations

Week 5 : Nonlinear Equations

Week 6 : Regression and Interpolation

Week 7 : Ordinary Differential Equations (ODE) – Part 1

Week 8 : Ordinary Differential Equations (ODE) – Practical aspects

MANAGE TB

MULTIDISCIPLINARY

DR. MOHAN NATRAJAN
Scientist F & Head, Department of Clinical Research
NIRT

TYPE OF COURSE : Rerun | Elective | UG
INTENDED AUDIENCE : MBBS
COURSE DURATION : 8 weeks (25 Feb'19 - 19 Apr'19)
EXAM DATE : 28 Apr 2019

DR. V.V. BANU REKHA
Scientist D, Department of Clinical Research
NIRT

INDUSTRIES APPLICABLE TO : Government/ Private Sector, Public Health Service Institutions/ Agencies and Medical Colleges/ Universities.

COURSE OUTLINE :

The National Institute for Research in Tuberculosis (NIRT), Chennai is one of the premier institutes of the Indian Council of Medical Research (ICMR), Department of Health Research (DHR) of Govt. of India. It is an internationally reputed institution for Tuberculosis (TB) research and a WHO Collaborating Centre for TB Research and Training. ICMR-NIRT is offering an Online course for Doctors on TB. Manage TB is an Online course designed to provide basic information about TB and its management. The participants will be provided with an overview of the extent of the TB burden globally and nationally, its pathogenesis, diagnostic modalities, treatment regimens, prevention strategies and efforts towards TB elimination. National and International guidelines will be elaborated and new TB drugs, vaccines and diagnostics will be discussed.

ABOUT INSTRUCTOR :

Dr. Mohan Natrajan - Course Director
Dr. V.V. Banu Rekha - Course Co-ordinator

COURSE PLAN :

Week 01 : Epidemiology and Pathogenesis of Tuberculosis: How is Tuberculosis affecting public health globally and nationally? | The Epidemiology of Tuberculosis | Pathogenesis of Tuberculosis | Clinical manifestations of Tuberculosis.

Week 02 : Bacteriological Diagnosis of Tuberculosis smear and culture | Video demonstration of smear and culture techniques | Phenotypic drug susceptibility testing in Tuberculosis | Video demonstration of Phenotypic drug susceptibility testing techniques |Video demonstration of genotypic methods for TB diagnosis and drug susceptibility testing | Radiology in diagnosis of Tuberculosis.

Week 03 : Approach to diagnosis of Pulmonary TB | Case discussion | Approach to diagnosis of Extra-pulmonary TB | Diagnosis of Childhood Tuberculosis | Video – demonstration of gastric fluid aspiration technique in a child.

Week 04 : Management of Tuberculosis: Drugs for treating Tuberculosis and Principles of Chemotherapy | Treatment of Drug Sensitive Pulmonary Tuberculosis | Case discussion | Management of drug resistant Tuberculosis.

Week 05 : Management of Extra - Pulmonary Tuberculosis | Panel discussion |Management of patients with HIV-TB coinfection | Case discussion | Management of TB in special situations.

Week 06 : Treatment of Pediatric Tuberculosis | Management of Adverse effects to anti-TB drugs | Case discussion | Non-tuberculosis Mycobacteria: Diagnosis & Clinical Management | Newer Anti-TB drugs and regiments.

Week 07 : Prevention of Tuberculosis: Management of Latent TB Infection | Airborne infection control in Tuberculosis | Vaccine for Tuberculosis.

Week 08 : Towards Tuberculosis Elimination: Service offered by Revised National TB Control Programme | Tuberculosis notification | Addressing social barriers in Tuberculosis control | Standards for TB care in India | Global Tuberculosis control strategies.

MULTIDISCIPLINARY

QUALITATIVE RESEARCH METHODS AND RESEARCH WRITING

PROF. ARADHNA MALIK
Department of Management
IIT Kharagpur

TYPE OF COURSE : Rerun | Elective | UG/PG
INTENDED AUDIENCE : Anyone can take this course.
PRE-REQUISITES : Must have UG degree
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 28 Apr 2019
INDUSTRIES APPLICABLE TO : Education.

COURSE OUTLINE :

Qualitative research methods serve to explore the grey areas that remain outside the confines of quantitative predictive research in human behavior. Training in qualitative research is absolutely essential to understand and explore the dynamic nature of the society in which we function.This course introduces students to qualitative research and helps them understand how qualitative research supplements quantitative inquiry in human behavior and the social sciences.

ABOUT INSTRUCTOR :

Aradhna Malik earned her Masters in Child Development from Panjab University, Chandigarh, India and PhD from University of Denver, USA. She has been serving Indian Institute of Technology Kharagpur as faculty in the School of Management since 2008. She teaches intercultural communication, business ethics and organizational behavior to Undergraduate, Masters and Doctoral level students. Her research and academic interests include, ageing, orality, human technology interaction, intercultural communication, communication disorders, management of public health and neuro linguistic programming (NLP).

COURSE PLAN :

Week 01 : Introduction to qualitative research : Introduction | The Qualitative Researcher | Quantitative vs. qualitative research | History of qualitative research | The process of qualitative research.
Week 02 : Major paradigms & perspectives : Dominant paradigms of qualitative research | Interpretivist thinking Verstehen | Constructivism | Properties of constructions | Constructivism: Sub paradigms |Criticisms of interpretivism & constructivism.
Week 03 : Major paradigms & perspectives : Critical theory | Characteristics of critical theory | Critiques of critical theory.
Week 04 : Strategies of inquiry : Introduction to qualitative inquiry | Qualitative research design | Ethnography | Autoethnography | Case studies | Analyzing interpretive practice.
Week 05 : Strategies of inquiry : Grounded Theory | Participatory Action Research.
Week 06 : Methods of collecting & analyzing empirical materials : Observations | Interviewing | Interpretation of documents & material culture | Images & visual methods | Autoethnography, personal narrative & reflexivity.
Week 07 : Methods of collecting & analyzing empirical materials : Analyzing talk & text | Data management & analysis methods | Software & qualitative research.
Week 08 : Interpretation, evaluation & presentation : The problem of criteria | Interpretation | Writing | Evaluation and social programs | Qualitative research and social policy | Conclusion.
Week 09 : What, why and how of technical and research writing.
Week 10 : Literature review
Week 11 : Writing about methods, results, and discussion of results.
Week 12 : Referencing, academic integrity, and writing for different types of readers (Research proposals, Dissertations, Journal articles, Magazine articles)

MULTIDISCIPLINARY

NON-CONVENTIONAL ENERGY RESOURCES

PROF. PRATHAP HARIDOSS
Dept. of Metallurgical and Materials Engineering
IIT Madras

TYPE OF COURSE : Rerun | Elective | UG/PG
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
INTENDED AUDIENCE : B.E, M.E, M.S, M.Sc, Ph.D
EXAM DATE : 28 Apr 2019
PRE-REQUISITES : Course will be accessible to most students who have completed their first two years of study at an Undergraduate level.

COURSE OUTLINE :

This course looks at the operating principle of a range of non-conventional energy resources, materials used, characterization, and key performance characteristics. The technologies looked at will include, Solar energy, Wind, Batteries, Fuel cells, and Geothermal conversion. The advantages and limitations of these technologies in comparison to conventional sources of energy will also be examined.

ABOUT INSTRUCTOR :

Dr. Prathap Haridoss is a Professor in the Department of Metallurgical and Materials Engineering at IIT Madras. He works in the areas of Fuel Cell and Carbon nanomaterials. He has a B.Tech in Metallurgical Engineering from IIT Madras, and a PhD in Materials Science and Engineering from the University of Wisconsin-Madison, USA. Before he joined as a faculty at IIT Madras, he served as a Senior Scientist at Plug Power, a Fuel Cell company in New York. He has 4 patents, several International Journal publications, and has published a book titled "Physics of Materials, Essential Concepts of Solid State Physics"

COURSE PLAN :

Week 01 : Scale of quantities, Impact of current energy usage, Conventional sources of energy
Week 02 : Overview of non-conventional energy resources, Consumption by sector
Week 03 : Solar energy incident on earth, solar spectrum
Week 04 : Overview of solar energy technologies, Solar Thermal devices
Week 05 : Solar Photovoltaic devices, Performance and durability of solar devices
Week 06 : Wind energy, technology and geographical aspects
Week 07 : Geothermal and Biomass
Week 08 : Battery basics, types
Week 09 : Testing, performance of batteries
Week 10 : Fuel cell types, Fuel processing, concept to product.
Week 11 : Characterization and durability of fuel cells
Week 12 : Flywheels and super capacitors

OCEAN ENGINEERING

OCEAN ENGINEERING

12 weeks

01. Offshore Structures Under Special Loads Including Fire Resistance

OFFSHORE STRUCTURES UNDER SPECIAL LOADS INCLUDING FIRE RESISTANCE

OCEAN ENGINEERING

PROF. SRINIVASAN CHANDRASEKARAN
Department of Ocean Engineering
IIT Madras

TYPE OF COURSE : Rerun | Elective | UG/PG

COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)

INTENDED AUDIENCE : Applied Mech, Aerospace Engg, Civil Engg, Structural Engg, Mech. Engg, Naval Arch, Ocean Engg, Petroleum Engg, Chem Engg, Engineering Design

EXAM DATE : 27 Apr 2019

INDUSTRIES APPLICABLE TO : All oil companies and Structural consultancy organizations, both in India and abroad

COURSE OUTLINE :

This course deals with novelty of offshore structures and their response behaviour under special loads. These loads include earthquake loads, ice loads, shock and impact loads, ringing and springing wave loads and loads caused by crticial sea states. The course also deals with advanced structural analyses methods including unsymmetric bending and estimate of shear centre. It also deals with analysis of curved beams, crane hooks, chain links and rings and marine risers under Vortex induced motion. Fire in one of the major hazard in offshore industry. Fire-resistant design is a mandatory requirement for members exposed to high fire hazards. This course will expose participants to fundamentals and explain the fire-resistant design concepts through a variety of examples.

ABOUT INSTRUCTOR :

Dr. Srinivasan Chandrasekaran is currently a Professor in the Dept. of Ocean Engineering, Indian Institute of Technology Madras, India. He has teaching, research and industrial experience of about 23 years during which he has supervised many sponsored research projects and offshore consultancy assignments both in India and abroad. His active areas of research include dynamic analysis and design of offshore platforms, Development of geometric forms of complaint offshore structures for ultra-deep water oil exploration and production, sub-sea engineering, Rehabilitation and retrofitting of offshore platforms, structural health monitoring of ocean structures, seismic analysis and design of structures and risk analyses and reliability studies of offshore and petroleum engineering plants.

COURSE PLAN

Week 1 : Novelty of offshore structures
Week 2 : Environmental loads
Week 3 : Special loads-I
Week 4 : Special loads-II
Week 5 : Advanced structural analysis-I
Week 6 : Advanced structural analysis -II
Week 7 : Advanced structural analysis - III
Week 8 : Advanced structural analysis - IV
Week 9 : Fire safety
Week 10 : Blast resistance
Week 11 : Material properties
Week 12 : Fire resistant design

PHYSICS

PHYSICS

04 weeks

01. A brief course on Superconductivity

08 weeks

01. Fiber Optics

12 weeks

01. Experimental Physics - I
02. Introduction to Solid State Physics
03. Quantum Mechanics - I
04. Statistical Mechanics
05. Semiconductors Optoelectronics

PHYSICS

A BRIEF COURSE ON SUPERCONDUCTIVITY

PROF SAURABH BASU
Department of Physics
IIT Guwahati

TYPE OF COURSE : New | Elective | PG/Ph.D
INTENDED AUDIENCE : BE/ME (Material Science) and M.Sc(Physics, Material Science)
PRE-REQUISITES : Solid State Physics
COURSE DURATION : 4 weeks (25 Feb'19 - 22 Mar'19)
EXAM DATE : 27 April 2019

INDUSTRIES APPLICABLE TO : Companies into material science and ceramic research will be benefitted.

COURSE OUTLINE :

The course mainly concerns with the electrodynamics response of the conventional superconductors, both at low and high frequencies. Besides, the course aims to introduce state of the art topics like, Josephson junctions, SQUID etc. More over the course provides introduction to the modern superconducting materials, such as the High-Tc CuO 2 based superconductors, Carbon based and Iron superconductors. Especially with the prospects of realizing room temperature superconductivity discovered in nanostructures by scientists at IISc Bangalore, the course will gain importance among interested audience.

ABOUT INSTRUCTOR :

Dr. Saurabh Basu is a Professor at the Department of Physics, IIT Guwahati. The area of expertise is Theoretical Condensed Matter Physics, with special emphasis on the correlated boson and fermion systems, topological insulators. He has about 90 research publications in different refereed international journals.

COURSE PLAN :

Week 01 : Basics of superconductivity
Week 02 : Electrodynamics of Superconductors
Week 03 : Josephson Junctions, SQUIDS
Week 04 : Unconventional Superconductors

FIBER OPTICS

PHYSICS

PROF. VIPUL RASTOGI
Department of Mechanical & Industrial Engineering
IIT Roorkee

TYPE OF COURSE : Rerun | Elective | UG/PG

PRE-REQUISITES : A basic course on Electromagnetic Theory

COURSE DURATION : 8 weeks (28 Jan'19 - 22 Mar'19)

EXAM DATE : 31 Mar 2019

INTENDED AUDIENCE : It is an elective course for Undergraduate students of Electronics and Communication Engineering, Computer Science and Engineering, Electrical Engineering, Information Technology, Engineering Physics, and Industry Personnel of Optical Fiber and Communication Industry

INDUSTRY APPLICABLE TO : Sterlite Technologies Ltd., Tejas Networks, Ciena Networks, Infinera India Pvt. Ltd, Eagle Photonics, Nest Photonics, etc, may recognize the course.

COURSE OUTLINE :

The course is aimed at equipping the undergraduate Engineering and Physics students with the basic understanding of optical fibers and optical fiber communication. The course provides knowledge of optical fiber waveguide at fundamental level, essentials of an optical fiber communication system and understanding of various components of an optical fiber telecommunication system.

ABOUT INSTRUCTOR :

Prof. Vipul Rastogi Department of Mechanical & Industrial Engineering Indian Institute of Technology Roorkee, received PhD degree from the Indian Institute of Technology, Delhi, India in 1998. He carried out post-doctorate in Université de Nice Sophia Antipolis, France during 1998 – 1999. From 2000 to 2003 he worked in the Department of Electronic Engineering in City University of Hong Kong as a Research Fellow. In November 2003 he joined Department of Physics at Indian Institute of Technology Roorkee, where he is now an Associate Professor. His current research interests are in optical fiber designs for high power lasers and high data rate optical communication, erbium doped fiber amplifier for SDM communication system, optical fiber sensors, and optoelectronic devices.

COURSE PLAN :

Week 1: Introduction, need for optical communication, salient features of optical fibers, ray theory of light guidance, numerical aperture, modes of a fiber, single and multimode fibers, step-index and graded-index fibers, fiber fabrication techniques

Week 2: Transmission characteristics of optical fibers, attenuation, pulse broadening mechanism, intermodal dispersion, bit rate - length product, material dispersion, electromagnetic wave analysis of light propagation in an infinitely extended medium, em waves in dielectrics, boundary conditions

Week 3: Electromagnetic analysis of planar optical waveguides, TE and TM modes, planar mirror waveguide, dielectric symmetric step-index, planar waveguide, symmetric and anti-symmetric modes, b-V curves, modal fields

Week 4: Power associated with modes of dielectric symmetric planar waveguide, asymmetric planar waveguide, single polarization single mode waveguide, excitation of guided modes by prism coupling technique, radiation modes, optical fiber waveguide, EH and HE modes, weakly guiding fibers, LP modes, mode cut-offs, b-V curves

Week 5: Optical fiber modes, field patterns, degeneracies, fractional power in the core, single mode fiber, cut-off wavelength, mode field diameter, bend loss, splice loss, waveguide dispersion, group delay

Week 6: Total chromatic dispersion, pulse broadening and chirping, dispersion in graded-index and multilayer fibers, optical fiber components and devices, directional coupler, power splitter, WDM coupler, polarization controllers, fiber Bragg gratings

Week 7: Various types of fiber Bragg gratings, fabrication methods, applications, long period gratings, optical fiber amplifier, erbium doped fiber amplifier, dispersion management, dispersion shifted fiber, dispersion compensating fiber, sources for optical fiber communication, light emitting diode, internal and external quantum efficiencies, LED characteristics, laser diode

Week 8: Detectors for optical communication, p-i-n photodetector, APD, System design, dispersion and attenuation limited systems, BER, power budgeting of fiber link, recent advances

PHYSICS

EXPERIMENTAL PHYSICS - I

PROF. AMAL KUMAR DAS
Department of Physics
IIT Kharagpur

TYPE OF COURSE : New | Core | UG
COURSE DURATION : 12 weeks (28 Jan'19-19 Apr'19)
INTENDED AUDIENCE : B. Sc in Physics / all science BE/BTech in all Engineering and Technology
EXAM DATE : 27 April 2019
INDUSTRIES APPLICABLE TO : The industries of electronics, telecommunication and instrumentation will specially recognize this course.

COURSE OUTLINE :

The course is designed in three modules:
(I) Experimental Physics-I : Experiments on Mechanics, General properties of matter, Thermal properties of matter, Sound, Electricity and magnetism. (II) Experimental Physics-II : Experiments on Optics and Modern Physics. (III) Experimental Physics-III : Experiments on Solid state physics and Modern Optics. This course is not only suitable for undergraduate students of physics, rather it is compulsory for all undergraduate students of science, engineering and technology , who have to deal with instruments in any point of time during their carrier and profession. This course will make the student understand the working principle of many common devices through their applications in different experiments

ABOUT INSTRUCTOR :

After completion of B.Sc (Hons) in Physics and M.Sc in Physics in 1994, Prof. Amal Kumar Das did his Ph.D on experimental physics and material science from Institute of Physics, Bhubaneswar. After completing post-doctoral research on experimental physics from Paul Drude Institute, Berlin, Germany, he joined as a Faculty in Department of Physics, Indian Institute of Technology Kharagpur in 2004 and taught different subjects to UG and PG students including experiments in teaching laboratory. Prior to joining here, he took experimental physics laboratory for four years to B.Sc students in an undergraduate college named Malda College under North Bengal University, West Bengal.

COURSE PLAN :

Week 01	:	Basic tools in a laboratory
Week 02	:	Basic apparatus in a laboratory
Week 03	:	Basic analysis of data in a laboratory
Week 04	:	Experiments on Mechanics
Week 05	:	Experiments on General properties of matters
Week 06	:	Experiments on Thermal properties of matter
Week 07	:	Experiments on Thermoelectricity and Sound
Week 08 - 10	:	Experiments on Electricity
Week 11 - 12	:	Experiments on electromagnetism

INTRODUCTION TO SOLID STATE PHYSICS

PHYSICS

PROF. MANOJ HARBOLA
Department of Physics
IIT Kanpur

PROF. SATYAJIT BANERJEE
Department of Physics
IIT Kanpur

TYPE OF COURSE : New | Core | UG
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 28 April 2019

COURSE OUTLINE :

The course deals with introducing concepts of condensed matter physics to advanced undergraduate and postgraduate students. The course will be pitched at the level of a first year course in MSc in Physics. For this course, an exposure to undergraduate level of: (a) quantum mechanics, (b) statistical and thermal physics and (c) electromagnetic theory, is expected. It is hoped that through this course, the student will understand the quantum theory of solids which is used to describe the thermal and electrical properties of a solid.

ABOUT INSTRUCTOR :

Dr. Satyajit Banerjee is a faculty member in the Department of Physics at IIT Kanpur; Professor from 2012 onwards, Associate Professor from 2007 to 2012 and Assistant Professor from 2004 to 2007. He was a Feinberg Postdoctoral Fellow. Between 2000 - 2004, in the Dept. of Condensed Matter Physics at Weizmann Institute of Science, Israel. He obtained his Ph.D degree from the Department of Condensed Matter Physics and Materials Science, from Tata Institute of Fundamental Research, Mumbai, India in 2000.

Dr. Manoj Kumar Harbola joined the Department in 2000. He obtained his doctoral degree at the City University of New York, USA, Subsequently he carried out postdoctoral research at the University of North Carolina, Chapel Hill, USA before joining the Centre for Advanced Technology, Indore as a Scientist.

COURSE PLAN :

Week 01 : Introduction to Drudes free electron theory of metals, electrical conductivity Ohms law and Hall effect
Week 02 : Specific heat of an electron gas
Week 03 : Behaviour of thermal conductivity of a solid and relationship with electrical conductivity
Week 04 : Periodic Arrays of Atoms, Fundamental Types of Lattices, Index System for Crystal Planes
Week 05 : Direct Imaging of Atomic Structure, Diffraction of Waves by Crystals, Reciprocal lattice, Brillouin Zones
Week 06 : Vibrations of Crystals with Monatomic Basis, Acoustic and Optical modes
Week 07 : Two Atoms per Primitive Basis, Quantization of Elastic Waves, Phonon Momentum
Week 08 : Phonon contribution to heat capacity, Einstein and Debye theory of specific heat.
Week 09 : Bloch Functions, Nearly Free Electron Model, Kronig-Penney Model
Week 10 : Wave Equation of Electron in a Periodic Potential,Band Gap
Week 11 : Equations of Motion, effective mass, concept of a hole, Intrinsic Carrier Concentration, Impurity Conductivity
Week 12 : Superconductivity

QUANTUM MECHANICS - I

PHYSICS

PROF. RAMADEVI
Department of Physics
IIT Bombay

TYPE OF COURSE : New | Core | UG

COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)

INTENDED AUDIENCE : B.Tech Engineering Physics, B.Tech Electrical Eng, MSc Physics, M.Sc – 5 year integrated Chemistry BE (EP/EE), M.Sc (Phy/Chem)

EXAM DATE : 28 April 2019

PRE-REQUISITES : Must have done the sophomore course on quantum physics and applications where Schrodinger equation, wavefunction and expectation values are taught

COURSE OUTLINE :

This course is a first level course in the Dirac's bra(ket) notation which will set foundation to take up advanced level courses.

ABOUT INSTRUCTOR :

I work on the interface of mathematics and physics using the tools of quantum physics

COURSE PLAN :

Week 01 : Introduction to Quantum Mechanics | Review of Particle in Box | Potential Well, Barrier, Harmonic Oscillator
Week 02 : Bound States | Conditions and Solutions for One Dimensional Bound States.
Week 03 : Linear Vector Space (LVS) | Basic for Operators and States in LVS.
Week 04 : Function Spaces | Postulates of Quamtum Mechanics.
Week 05 : Classical Vs Quantum Mechanics | Compatible Vs Incompatible Observables.
Week 06 : Schrodinger and Heisenberg Pictures | Solutions to Other Coupled Potential Energies.
Week 07 : Hydrogen Atom Wave Functions | Angular Momentum Operators | Identi-cal Particles | Identical Particles | Quantum Computer.
Week 08 : Harmonic Oscillator | Ladder Operators.
Week 09 : Stern-Gerlach Experiment | Oscillator Algebra Applications.
Week 10 : Angular Momentum-1 | Rotations Groups.
Week 11 : Addition of Angular Momentum | Clebsch-Gordan Coe_cient.
Week 12 : Clebsch-Gordan Coe_cient | Tensor Operators & Wigner-Eckart Theorem.

STATISTICAL MECHANICS

PHYSICS

PROF. ASHWIN JOY
Department of Physics
IIT Madras

TYPE OF COURSE : New | Core | UG/PG
INTENDED AUDIENCE : M.Sc/B.Sc/B.E
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 28 April 2019

COURSE OUTLINE :

The course is designed to give the students a firm understanding of statistical mechanics at the advanced undergraduate/beginning graduate level. After a discussion of the concepts of probability, the postulates of classical mechanics are developed in various ensembles of physical relevance. The ideas thus developed for the classical systems will be shown to have serious limitations when applied to quantum systems. Finally, we develop the correct theory of statistical mechanics for quantum systems and show that classical results can be recovered from the quantum theories in the high temperature - low density limit.

ABOUT INSTRUCTOR :

Prof. Joy works as a faculty member at the Department of Physics, IIT Madras and is very much interested in the problems of non-equilibrium statistical mechanics and turbulence. He did his doctoral work at IPR Gandhinagar with Prof. R. Ganesh and post-doctoral work with Prof. Itamar Procaccia, Weizmann Institute of Science, Israel.

COURSE PLAN :

Week 01 : Random Variables
Week 02 : Moments & Cumulants
Week 03 : Important Probability Distributions
Week 04 : Maximum Entropy Principle.
Week 05 : Micro-canonical Ensemble
Week 06 : Canonical Ensemble
Week 07 : Gibbs Canonical Ensemble
Week 08 : Grand Canonical Ensemble
Week 09 : Ideal Gas of Mass-less Particles (Photons & Phonons)
Week 10 : Ideal Gas of Real Particles (Fermions & Bosons)
Week 11 : Electrons in Metals
Week 12 : Classical Limit of Quantum Gases

SEMICONDUCTORS OPTOELECTRONICS

PHYSICS

PROF. M.R. SHENOY
Department of Physics
IIT Delhi

TYPE OF COURSE : Rerun | Elective/Core | UG/PG
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 28 April 2019
INTENDED AUDIENCE : IIIrd, IVth year B.Tech / M.Sc (Physics/ Electronics/ Electronic Sciences) students, M.Tech Ist Sem students
PREREQUISITES : Basic undergraduate-level knowledge of Semiconductors, Optics, Electronics and Quantum Mechanics would be required.

INDUSTRIES APPLICABLE TO : Companies and R&D Laboratories working on Laser Applications, Optoelectronic and Optical Communication are expected to value this course.

COURSE OUTLINE :

This course introduces the students to the field of Semiconductor Optoelectronics, which deals with the physics and technology of semiconductor optoelectronic devices such as light emitting diodes, laser diodes and photodiodes, which are becoming important components in consumer optoelectronics, IT and communication devices, and in industrial instrumentation. Assuming a general science/engineering undergraduate level background, the course begins with a recap of essential (to this course) semiconductor physics, followed by the study of interaction of photons with electrons and holes in a semiconductor, leading to the realization of semiconductor photon amplifiers, sources, modulators, and detectors. A variety of designs and configurations of these devices have been emerging with application-specific characteristics. The course is 'applied' in nature, and could be offered at the level of B.E/B.Tech IIIrd/ IVth Year, M.Sc IInd/ M.Tech. I Year.

ABOUT INSTRUCTOR :

M. R. Shenoy received the M. Sc. in Physics in 1979 from Mysore University and the PhD in the field of Fiber and Integrated Optics from IIT Delhi in 1987. He joined the faculty of IIT Delhi in 1988, where he is currently Professor in the Department of Physics. Dr. Shenoy was a Visiting Scientist with the Department of Electrical and Electronic Engineering, University of Glasgow, Glasgow, U.K., in 1990 for 10 months, and on short- duration visits at the University of Nice – Sophia Antipolis, Nice, France, in 1992, 1997, 2006 and 2008 for collaborative research on Integrated Optical Devices. He has authored/co- authored a number of research papers and book chapters, and has supervised a large number of student projects at the B.Tech, M.Sc. M.Tech and Ph.D. levels. He is a co-editor of the book Fiber Optics Through Experiments (Viva Publications, New Delhi, 1994, 2008).

COURSE PLAN :

Week 01 : Introduction, Energy bands in solids, Density of states
Week 02 : Occupation probability and Carrier concentration, Quasi Fermi levels
Week 03 : Semiconductor optoelectronic materials and Heterostructures
Week 04 : Heterostructure p-n junctions, Schottky junctions, Ohmic contacts
Week 05 : Interaction of photons with electrons and holes in a semiconductor
Week 06 : Amplification by stimulated emission, The semiconductor laser amplifier
Week 07 : Absorption in semiconductors and quantum wells, Electro-absorption modulator
Week 08 : Injection electroluminescence, Light emitting diode and their characteristics
Week 09 : Semiconductor laser: Device structure and characteristics
Week 10 : Single frequency lasers, VCSEL and Quantum well lasers
Week 11 : Semiconductor photodetectors, General characteristics
Week 12 : Photodiodes: PIN diode and APD. Photonic Integrated Circuits

TEXTILE ENGINEERING

TEXTILE ENGINEERING

8 weeks

01. Testing of Functional and Technical Textiles
02. Theory of Yarn Structure
03. Advanced Textile Printing Technology

12 weeks

01. Textured Yarn Technology
02. Evalutions of Textile Materials

TEXTILE ENGINEERING

TESTING OF FUNCTIONAL AND TECHNICAL TEXTILES

PROF. APURBA DAS
Department of Textile Technology
IIT Delhi

TYPE OF COURSE : New | Elective | UG/PG
COURSE DURATION : 8 weeks (28 Jan'19 - 22 Mar'19)
INTENDED AUDIENCE : UG and PG Students of Textile, Clothing and fashion technology, Material science etc.
EXAM DATE : 31 Mar 2019
PRE-REQUISITES : Basic courses on Textiles

COURSE OUTLINE :

The course in specially designed for PG students, teachers and professionals.Testing of functional and technical textile materials is an extremely important activity for production, product and process development, research and application.During selection of textile materials for their functional and technical applications the testing of different performance characteristics is necessary. To meet up the customer requirement,specification is very useful. In this concept, testing plays a vital role.In research and development field the evaluation of textile materials helps us to decide the next route. Research Institute, pilot plants can achieve process development through testing or exact investigation into better, cheaper and quicker methods.Certain standard level should be maintained to control the production process. By evaluation of textile materials one can easily detect the faults of machinery and materials.

ABOUT INSTRUCTOR :

Dr. Apurba Das is Professor in the Department of Textile Technology, Indian Institute of Technology, Delhi. He completed his Ph. D. from the same department in the year 1994. He joined Indian Institute of Technology, Delhi in 2002 as a faculty after serving in the textile industries and in research organization for about 11 years. He has published more than 260 research papers in journals and conferences, authored and edited 05 books and written chapters in 18 books.He has successfully completed many research and consultancy projects from industries and government funding agencies. He has filed several patent applications. He has developed several instruments for characterization of textile materials.

COURSE PLAN :

Week 01 : Objectives of Testing of Functional and Technical Textiles Testing and Analysis of Functional Textiles
Week 02 : Testing of Fabric Handle Characteristics,Subjective assessment,Objective assessment,KESF and FAST methods,Nozzle extraction principle
Week 03 : Testing of Transmission characteristics,Moisture transmission (Vapour form and Liquid form),Thermal transmission,Testing and Analysis of Technical Textiles
Week 04 : Testing of extreme heat, fire and cold protective clothing
Week 05 : Testing of geotextiles,Testing of filter fabrics
Week 06 : Testing of fibre reinforced composites
Week 07 : Testing of electromagnetic shielding textiles,Testing of compression bandages
Week 08 : Testing of ballistic protective textiles,Testing of UV protective textiles,Special Testing for Nonwoven and Technical Textiles

THEORY OF YARN STRUCTURE

TEXTILE ENGINEERING

PROF. DIPAYAN DAS
Department of Textile Technology
IIT Delhi

TYPE OF COURSE : New | Core | PG
INTENDED AUDIENCE : ME/MTech, PhD
PRE-REQUISITES : BE/BTech in Textile Technology
COURSE DURATION : 8 weeks (28 Jan'19 - 22 Mar'19)
EXAM DATE : 31 Mar 2019

INDUSTRIES APPLICABLE TO : Trident, Arvind, Welspun

COURSE OUTLINE :

This course deals with a system of theoretically derived inherent laws of structures and properties of yarns. Each module of this course is started with definitions, terminologies and fundamental relations. Then, the theoretical models are presented namely from the initial assumptions through the mathematical derivation to the final relations. Such theoretical results are mostly compared with the experimental ones. The topics in this course include basic characteristics of fibers and yarns; relation among yarn count, twist, and diameter; helical model of fibers in yarns; mass irregularity of yarns; yarn shrinkage due to washing; and tensile mechanics of yarns.

ABOUT INSTRUCTOR :

Dr. Dipayan Das is currently working as Associate Professor at the Department of Textile Technology of Indian Institute of Technology Delhi. He received PhD from Technical University of Liberec, Czech Republic in 2005. This was followed by a position as post-doc research associate in the NC State University, USA. He joined IIT Delhi as Assistant Professor in 2008. He served as Adjunct Assistant Professor at the Department of Textile Engineering,Chemistry & Science of NC State University from 2008 to 2009.At IIT Delhi, he has taught several courses, including Yarn Manufacturing, Textile Structures,Nonwoven Technology, Design of Experiments and Statistical Techniques, at undergraduate and postgraduate levels. His research interest lies in the areas of Textile structures,Nonwovens, and Product and Process Optimization.

COURSE PLAN :

Week 01 : Fiber – The Building block of yarns
Week 02 : Basic characteristics of yarns
Week 03 : Relation among yarn count, twist, and diameter
Week 04 : Helical model of fibers in yarns
Week 05 : Mass irregularity of yarns
Week 06 : Radial fibre migration in yarns
Week 07 : Yarn shrinkage due to washing
Week 08 : Tensile mechanics of yarns

TEXTILE ENGINEERING

ADVANCED TEXTILE PRINTING TECHNOLOGY

PROF. KUSHAL SEN
Department of Textile Technology
IIT Delhi

TYPE OF COURSE : New | Elective | UG/PG
COURSE DURATION : 8 weeks (25 Feb'19 - 19 Apr'19)
INTENDED AUDIENCE : Students, teachers and persons working in textile industry, textile chemical processing
EXAM DATE : 27 Apr 2019
PRE-REQUISITES : Should have basic knowledge of dyeing and printing, would help if he/she has studied courses in textile chemical processing.

INDUSTRIES APPLICABLE TO : All textile processing industries would value

COURSE OUTLINE :

This course would cover the fundamentals of conventional printing, the complexities and limitations; introduce the concept of transfer printing and mainly cover the sublimation transfer printing which is commercially being used. The next logical development in textile printing has been the direct digital printing of textiles. The concept, the advantage,principles of ink-jet technology, complexities involved, general machinery, the inks and requirements of pre- and post treatments would also be covered.

ABOUT INSTRUCTOR :

Currently a Professor in the Department of Textile Technology, IIT Delhi. Areas of specialization include textile chemical processing, texturing, and structure-property correlation.

COURSE PLAN :

Week 01 : Recall conventional printing, colourants: dyes and pigments

Week 02 : Thickeners, viscosity, rheology, discharge –resist style

Week 03 : Transfer printing, transfer paper printing, dyes and inks

Week 04 : Mechanism of sublimation transfer, Free path length , general machinery

Week 05 : Introduction to digital printing, ink-jet printing principles: continuous jetting

Week 06 : Drop-on-demand principle, general machinery

Week 07 : Pre-treatment, ink-types and substrate, pigment inks

Week 08 : Disperse inks, acid inks , reactive inks

TEXTURED YARN TECHNOLOGY

TEXTILE TECHNOLOGY

PROF. KUSHAL SEN
Department of Textile Technology
IIT Delhi

TYPE OF COURSE : New | Elective | UG/PG
COURSE DURATION : 12 weeks(28 Jan'19 - 19 Apr'19)
EXAM DATE : 28 Apr 2019
INTENDED AUDIENCE : Students, teachers and persons working in textile industry, especially in man-made fibre industry
PRE-REQUISITES : Should have knowledge of Fibres, manufacturing of manmade fibres
INDUSTRIES APPLICABLE TO : No industry in particular, however, the man made fibre industry should value

COURSE OUTLINE :

This course would cover the fundamentals of twist texturing of fully drawn yarns. The need and the solutions that emerged because of material challenges and machine limitations leading to the evolution of draw-texturing and friction texturing. Emergence of Air - jet texturing, interlacement and bulked continuous yarns is also covered. Hi-bulk yarns principles and production of the same. Also covered would be the interesting possibilities of using solvents and chemicals to produce textured yarns.

ABOUT INSTRUCTOR :

Currently a Professor in the Department of Textile Technology, IIT Delhi, areas of specialization include textile chemical processing, texturing, and structure-property correlation.

COURSE PLAN :

Week 01 : Introduction , general classification of textured yarns
Week 02 : False twist texturing, principles mechanism
Week 03 : False twist texturing process parameters
Week 04 : Draw-texturing, need
Week 05 : Draw –texturing process parameters
Week 06 : Friction texturing principles
Week 07 : Friction texturing NCV drives
Week 08 : Air Jet Texturing
Week 09 : Air jet Texturing process parameters
Week 10 : Interlacement; need and principles , Bulked continuous filament (BCF) yarns
Week 11 : Hi-bulk yarns, principle and processes
Week 12 : Solvent and chemical texturing

EVALUTIONS OF TEXTILE MATERIALS

TEXTILE ENGINEERING

PROF. APURBA DAS
Department of Textile Technology
IIT Delhi

TYPE OF COURSE : New | Core| UG
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
INTENDED AUDIENCE : UG and PG Students of Textile, Clothing and fashion technology, Material science etc.
EXAM DATE : 27 Apr 2019
PRE-REQUISITES : Suitable of 2nd year/3 rd Year UG Textile Physics, Mathematics 10+2 level, basic statistics

COURSE OUTLINE :

Evaluation of textile materials is an extremely important activity for textile production, product and process development, research, distribution and consumption. During selection of raw materials, intermediate materials and finished products the evaluation of characteristics of textiles is necessary. To meet up the customer requirement, specification is very useful. In this concept, testing plays a vital role. In research and development field the evaluation of textile materials helps us to decide the next route. Research Institute, pilot plants can achieve process development through testing or exact investigation into better, cheaper and quicker methods.Certain standard level should be maintained to control the production process. By evaluation of textile materials one can easily detect the faults of machinery and materials. Continuous test of the textiles results an enhanced and efficient output of the production.

ABOUT INSTRUCTOR :

Prof. Apurba Das is Professor in the Department of Textile Technology, Indian Institute of Technology, Delhi. He has completed his Ph. D. from the same department in the year 1994. He has joined Indian Institute of Technology, Delhi in 2002 as a faculty after serving in the textile industries and in research organization for about 11 years. He has guided many Ph.D., M. Tech., B. Tech. students and presently guiding several Ph.D., M. Tech. and B. Tech. students. He has published more than 260 research papers in journals and conferences,authored and edited 05 books and written chapters in 18 books. He has successfully completed many research and consultancy projects from industries and government funding agencies. He has filed several patent applications. He has developed several instruments for characterization of textile materials.

COURSE PLAN :

Week 01 : Objectives of Testing
Week 02 : Selection of Samples for Testing & Numerical on Elements of Statistics
Week 03 : Fibre Length
Week 04 : Fibre Fineness and Maturity
Week 05 : Evenness Testing of Laps, Slivers, Rovings and Yarns & Numerical on Evenness of Textile Materials
Week 06 : Hairiness of Yarns and Fabrics
Week 07 : Tensile Testing of Fibres, Yarns and Fabrics
Week 08 : Tear Strength of Fabrics
Week 09 : Bursting Strength of Fabrics
Week 10 : Abrasion and Pilling Test of Fabrics
Week 11 : Fabric Bending, Shear and Drape
Week 12 : Moisture in Textile

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