ALAGAPPA UNIVERSITY, KARAIKUDI
SYLLABUS UNDER CBCS PATTERN FOR AFFILIATED COLLEGES
WITH EFFECT FROM THE ACADEMIC YEAR 2022-23 ONWARDS

B.Sc., ZOOLOGY
Programme Structure

Sem.	Part	Course Code	Courses	Title of the Paper	T/P	Credits	Hours/ Week	Max. Marks		
								Int.	Ext.	Total
I	I	2211T	T/OL	Tamil/Other Languages-I	T	3	6	25	75	100
	II	712CE	E	Communicative English -I	T	3	6	25	75	100
	III	22BZO1C1	CC	Invertebrata– I	T	5	5	25	75	100
		22BZO1P1	CC	Practical-I – Invertebrata I & II	P	4	4	40	60	100
		-	AL – IA	Botany/Chemistry/ Microbiology / Biochemistry	T	3	3	25	75	100
		-	AL - IA	Practical-Respective Theory Allied Course	P	2	2	40	60	100
	IV	22BVE1		Value Education		2	2	25	75	100
				Library			2			
				Total		**22**	**30**	**205**	**495**	**700**
II	I	2221T	T/OL	Tamil/Other Languages-II		3	6	25	75	100
	II	722CE	E	Communicative English - II		3	6	25	75	100
	III	22BZO2C1	CC	Chordata		5	5	25	75	100
		22BZO2P1	CC	Practical-II -Chordata		4	4	40	60	100
		-	AL – IB	Botany/Chemistry/ Microbiology/Biochemistry		3	3	25	75	100
		-	AL - IB	Practical-Respective Theory Allied Course		2	2	40	60	100
	IV	22BES2	SEC-II	Environmental Studies		2	2	25	75	100
				Library			2			
				Total		**22**	**30**	205	495	**700**
III	I	2231T	T/OL	Tamil/Other Languages-II		3	6	25	75	100
	II	2232E	E	English for Enrichment - I		3	6	25	75	100
	III	22BZO3C1	CC	Cell Biology and Biochemistry	T	3	3+1	25	75	100
		22BZO3C2	CC	Developmental Biology& Evolution	T	3	3+1	25	75	100
		22BZO3P1	CC	Practical-III Cell Biology, Biochemistry, Developmental Biology& Evolution	P	3	3	40	60	100
		-	AL – IB	Botany/Chemistry/ Microbiology/Biochemistry		3	3	25	75	100
		-	AL - IB	Practical-Respective Theory Allied Course		2	2	40	60	100
	IV	22BE3	SEC-III	Entrepreneurship		2	2	25	75	100
		-	SEC -IV	NME-I 1.Adipadai Tamil (or) 2.AdvanceTamil (or) 3.IT Skills for Employment (or) MOOC'S		2	2	25	75	100
				Total		**24**	**30**	**255**	**645**	**900**
IV	I	2241T	T/OL	Tamil/OtherLanguages -IV	T	3	6	25	75	100
	II	2242E	E	English for Enrichment - II	T	3	6	25	75	100
	III	22BZO4C1	CC	Genetics and Molecular biology	T	4	4	25	75	100
		22BZO4C2	CC	Economic Zoology	T	4	4	25	75	100
		22BZO4P1	CC	Practical-IV Genetics, Molecular biology and Economic Zoology	P	3	3	40	60	100
		-	AL – IB	Botany/Chemistry/ Microbiology/Biochemistry	T	3	3	25	75	100
		-	AL - IB	Practical-Respective Theory Allied Course	P	2	2	40	60	100
	IV	-	SEC-V	NME-II 1.Adipadai Tamil (or) 2.AdvanceTamil (or) 3. Small Business Management (or) MOOC'S		2	2	25	75	100
				Total		**24**	**30**	**230**	**570**	**800**

V	III	22BZO5C1	CC	Microbiology and Immunology	T	4	4	25	75	100
		22BZO5C2	CC	Animal Physiology	T	4	4	25	75	100
		22BZO5C3	CC	Ecology and Bio-statistics	T	4	4	25	75	100
		22BZO5C4	CC	Biotechnology	T	4	4	25	75	100
		22BZO5P1	CC	Practical-V Microbiology and Immunology& Animal Physiology	P	4	6	40	60	100
		22BZO5P2	CC	Practical-VI Ecology, Bio-statistics & Biotechnology	P	4	6	40	60	100
				Career development/ employability Skills			2			
				Total		**24**	**30**	**180**	**420**	**600**
VI	III	22BZO6I	DSE	Internship		24	30	**150**	**250**	**400**
				Or						
		22BZO6E1		Fisheries Biology	T	6	6	25	75	100
		22BZO6E2		Vermiculture	T	6	6	25	75	100
		22BZO6E3		Mushroom Culture	T	6	6	25	75	100
		22BZO6E4		Bioinformatics and Computer Application	T	6	6	25	75	100
				Library/Yoga etc			2			
				Career development/ employability skills/ Fieldtrip		-	4	-	-	
						24	30	**100**	**300**	**400**
				Or						
		22BZO6PR		Project		6	10	25	75	100
		22BZO6E5 22BZO6E6		(A)Poultry Science/ (B)Sericulture	T	6	6	25	75	100
		22BZO6E7 22BZO6E8		(A)Recombinant DNA Technology/ (B)Biology of Cloning Vectors	T	6	6	25	75	100
		22BZO6E9		Fermentation Technology	T	6	6	25	75	100
			others	Library/Yoga /Career development/employability skills / Field trip etc			2			
		Total				**24**	**30**	**100**	**300**	**400**
		Grand Total				**140**	**--**	**--**	**--**	**4100**

Sem.	Part	Course Code	Title of the Paper	Credits	Hours/ Week	Marks		
						Int.	Ext.	Total
I	III	71BEPL - I	Professional English for Life Science -I	4	5	25	75	100
II		72BEPL - II	Professional English for Life Science –II	4	5	25	75	100
III		*	Professional English for Life Science –III	4	5	25	75	100
IV			Professional English for Life Science –IV	4	5	25	75	100

*The Syllabus of Professional English for III & IV Semester will be provided after Receiving the syllabus from TANSCHE.

As per TANSCHE, the Professional English book will be taught to all four streams apart from the existing hours of teaching/additional hours of teaching (1hour/day) as a 4 credit paper as an add on course on par with Major paper and completion of the paper is a must to continue his/her studies further.

- T/OL-Tamil/Other Languages,
- E–English
- CC-Corecourse–Corecompetency,criticalthinking,analyticalreasoning,researchskill&teamwork
- Allied –Exposure beyond the discipline
- AECC—Ability Enhancement Compulsory Course (Professional English& Environmental Studies) - Additional academic knowledge, psychology and problem solving etc.,
- SEC-Skill Enhancement Course-Exposure beyond the discipline (Value Education, Entrepreneurship Course, Computer application for Science, etc.,
- NME -Non Major Elective–Exposure beyond the discipline
- DSE– Discipline specific elective –-Student choice– either or
    - Internship
    - If internship–Marks=Internal=150(75+75)two midterm evaluation throughVivavoce and External 250 marks(Report=150+VivaVoce=100)=Total 400 marks
    - Theory papers or
- Project +3 theory papers.
- MOOCs- Massive Open Online Courses
- T- Theory, P-Practical

Semester - I				
Course Code: 22BZO1C1	**Core Course - I**	**T/P**	**C**	**H/W**
	Invertebrata– I	**T**	**5**	**5**

Objectives	➢ To understand the taxonomy, relationship and evolution of animals. ➢ To identify the animals of invertebrate phyla and to recognize their distinguishing features. ➢ To appraise the diversity of animals in a phylogenetic context. ➢ To understand how different body designs solve biological problems related to physiological and environmental challenges. ➢ To develop an appreciation for the role of invertebrates in biological communities, ecological interactions, and conservation problems
Unit-I	Concept of five kingdom classification.Introduction to Protista & Animal kingdom. Types of symmetry and coelom. General characters of Protista & Classification up to class with examples. Type study: Paramecium. General topics: Life Cycle of Plasmodium. Porifera & Coelenterate: General Characters & classification up to class with examples. Type study: Obelia Colony. General topics: Canal system in sponges, Structure of coral polyp & coral reefs.
Unit-II	**Platyhelminthes** Classification up to classes and their characters and examples TypeStudy: *Taenia solium* Generaltopic: Life history of Liverfluke. **Aschelminthes** Classification up to classes and their characters and examples. TypeStudy:*Ascaris lumbricoides* Generaltopic: Nematode parasites & their adaptations.
Unit-III	**Annelida** Characters & classification up to class with examples. Type study: Megascolex *marutii* General topics: Metamerism in Annelida. Arthropoda Characters & classification up to class with examples. Type study: Prawn. General Topic: Mouth parts of Insects. Metamorphosisininsects. Integrated Pest Management, Sociallifeininsects and Crustacean larvae.
Unit-IV	**Mollusca** Classification up to classes and their characters with suitable examples TypeStudy:*Pila* General topic:Torsionin Gastropods.
Unit-V	**Echinodermata** Classification up to classes and their characters with suitable examples TypeStudy: Starfish Generaltopic: Watervascularsystemsin Echinoderms.

Textbooks:

Arumugam.N "*Textbook of Invertebrates''* Saras Publication.

Ekambaranatha Ayyar & T.N.Ananthakrishnan (1992) *Manual of Zoology Vol – I*, part I& IIS.Viswanathan Pvt.Ltd. Chennai.

Janakiraman.N. & PatchiRajan.G. "*Biodiversity of Invertebrates",* Seetha Lakshmi Ganesan Publishers, Devakottai

Jordan.E.L&Verma.P.S."*Invertebrate Zoology*"S.Chand&Co.NewDelhi.

Books for reference

Anderson TA, *Invertebrate Zoology*, Oxford University Press, New Delhi. Barnes, R.D. (1982) , *Invertebrate Zoology* Vi Edition. Holt Saunders International Edition. Barrington EJW*, Invertebrate Structure and Functions*. English Language Book Society. Kotpal RL, Agarwal SK & Khetarpal RP *Invertebrates*, Rastogi Publications, Meerut.	
Outcomes	➢ The learner will be able to understand the diversity and basic taxonomy of Non chordates. ➢ The learner will get an idea of adaptation and importance of non-chordates. ➢ The learner will be able to identify the animal at basic level. ➢ The paper will give a strong observation skill and prompt him to think about its conservation, sustainable economic utilization and its potentials in technological prospects.

SEMESTER–I				
Course Code:	**Core Practical - I**	**T/P**	**C**	**H/W**

22BZO1P1	INVERTEBRATA– I&II	P	4	4
SECTION-A Dissection:	Earthworm: ▪ Digestive system ▪ Nervous system (Earthworm should be cultured in the department with the help of students and specimen for the practical should be collected from the culture tray) Pila: ▪ Digestive system Cockroach: Demo only ▪ Digestive system ▪ Nervous system ▪ Male and female reproductive system			
SECTION-B Mountings	▪ Cockroach mouth parts ▪ Prawn-appendages, ▪ House fly Mouth parts ▪ Earthworm Body setae and Penial Setae			
SECTION-C Museum specimens/ slides/models and charts	▪ *Ameoba,Paramecium, Noctiluca, Plasmodium,Leucosolenia, Obelia* colony, *Madreporite*,*Fasciola, Ascaris* – male and female, Neries, Prawn, Nauplius, Zoea, Mysis larva, Pila,Octopus,Pearl oyster, Star fish, Bipinnarialarva.			
SECTION-D	▪ Preservation of insectpests			
SECTION-E	▪ BonafideRecordoftheworkdoneinlaboratorymustbesubmittedwhileattendingthe examination.			

SCHEME OF EVALUATION	
Dissect and display the digestive system of Pila/ Dissect and display the digestive system and nervous system of Earthworm/	**15 Marks**
unting cockroach/housefly mouth parts/shark Placoidscales/prawn appendages/ Earthworm Body setae and Penial setae [Sketch and label the parts]	**10 Marks**
Five Museum Specimen/ sporters	**15 Marks**
Preserve any two-insect pest and submit a descriptive report about the pest, infested plants, types of damage and natural way of control.	**10 Marks**
Bonafide Record of the work done in laboratory	**10 Marks**
Total	**60 Marks**

Semester - I				
Course Code: 22BZO2C1	**Core Course - II**	**T/P**	**C**	**H/W**
	Chordata	**T**	**5**	**5**
Objectives	➢ To understand the taxonomy, relationship and evolution of animals.			

	➢ To identify the classes of vertebrate animals and recognize their distinguishing features. ➢ To appraise the diversity of animals in a phylogenetic context. ➢ To understand how different body designs solve biological problems related to physiological and environmental challenges. ➢ To develop an appreciation for the role of vertebrates in biological communities, ecological interactions, and conservation problems
Unit-I	General characters and classification of Chordata (up to class) with examples. Type Study: Amphioxus and Scoliodon. General topics: Affinities of Hemichordates, Retrogressive metamorphosis in Ascidia, Accessory respiratory organs in fishes, Types of Fins and function, Migration of Fishes.
Unit-II	Amphibia Classification and characters (up to order with examples). Type Study: Frog General topics: Metamorphosis of Amphibian, Limbless Amphibians, Parental care in Amphibian, Paedomorphosis.
Unit-III	Reptilia: Classification and characters of Reptilia (up to order with examples). Type Study: Calotes. General topics: Identification of Venomous and non-venomous snakes – Venom apparatus and types of poison, Skull of Reptiles, Salient features of Chelonia & Crocodilia.
Unit-IV	Aves Classification and characters of Aves (up to order with examples). Type Study: Pigeon. General topics: Flightless Birds, Flight Adaptations in Birds, Feet and Beak modifications, Migration in Birds.
Unit-V	Mammals Classification and characters of Mammals (up to order with examples). Type Study: Rabbit. General topics: Diversity of Marsupials, Affinities of Prototheria, Aquatic mammals and its adaptation, Dentition in Mammals, Adaptive radiation in Mammals.

Textbooks:

Arumugam. N Textbook of chordates Saras Publication.

Ekambaranatha Ayyar & T.N.Ananthakrishnan (1992) Manual of Zoology Vol – I, part I& II S.Viswanathan Pvt. Ltd. Chennai.

Janakiraman.N.& Patchi Rajan.G."Biodiversity of Chordates", Seetha Lakshmi Ganesan Publishers, ShriShanmuga Lakshmi Nilayam, Annamalaiyar Street, Vivekanandhapuram North, Devakottai– 630 303

Jordan.E.L & Verma.P.S."Chordate Zoology" S.Chand & Co. New Delhi

Books for Reference:

Kotpal RL Mordern Text Book of Zoology Vertebrates, Rastogi Publications, Meerut.

Pough Harvey F, Christine M .Janis and John B. Heiser .2002. Vertebrate Life, Pearson Education Inc. New Delhi.

Thangamani A, Prasannakumar S, Narayanan LM, Arumugam N A Text Book of Chordates, Saras Publication, Nagercoil.

Verma PS, Chordate Zoology, S Chand Publishers, New Delhi

Young, J.Z. 1950. Life of Vertebrates. Clarendon Press, Oxford, UK.

Outcomes	➢ The learner will be able to understand the diversity and basic taxonomy of chordates. ➢ The learner will get an idea of adaptation and importance of chordates. ➢ The learner will be able to identify any vertebrate animal at basic level.

	➢ The paper will give a strong observation skill and prompt him to think about its conservation, sustainable economic utilisation and its potentials in technological prospects.

SEMESTER – II				
Course code:	**Core Practical**	**T/P**	**C**	**H/W**
22BZO2P1	**CHORDATA**	**P**	**4**	**4**

SECTION-A Dissection/experiment/ analysis	▪ Digestive system of any commercial fish
SECTION-B **Mountings**	▪ Scoliodon: Placoid scales
SECTION-C Museum specimens/ slides/models and charts	▪ Balanoglossus Tornaria larva, Ascidian Amphioxus, Petromyzon, Shark, Narcine, Sucker fish, Hippocampus, Bufo, Rhacoporus, Chamaeleon, any two venomous and non-venomous snakes, Drago, Pigeon, Kingfisher, bat, Ant eater.
SECTION-D	Identify and comment on the specimens given below Pigeon – Synsacrum, Rabbit: skull, Girdles, Vertebrae (atlas, cervical and sacral), fore limband hind limb skeleton.
SECTION-E	▪ Choose any commercial fish/amphibian/reptile/bird/mammal and do a project work on their generic identification, description and illustration with a note on its importance
SECTION-F	▪ Bonafide Record of the work done in laboratory must be submitted while attending the examination.

SCHEME OF EVALUATION	
Dissect and display the digestive system of a given bony fish	**15 Marks**
Mount any one of the item given in Section B (Sketch and lable the parts)	**5 Marks**
Identify, sketch and comment on the 5 spotters given	**15 Marks**
Comment on the biological specimen given. Rabbit skull, Girdles, Vertebrae (atlas, cervical and sacral), fore limband hind limb skeleton Bird synsacrum	**5 Marks**
Choose any commercial fish/amphibian/reptile/bird/mammal and do a project work on their generic identification, description and illustration with a note on its importance	**10 Marks**
Bonafide Record of the work done in laboratory	**10 Marks**
Total	**60 Marks**

Semester - III				
Course Code:	**Core Course - III**	**T/P**	**C**	**H/W**
22BZO3C1	**CELLBIOLOGY AND BIOCHEMISTRY**	**T**	**3**	**4**

Objectives	➢ To give an insight to the ultra-structure of cellular components. ➢ To give an idea about the biochemistry major nutrients and enzyme actions. ➢ To give a clear idea about how the basic metabolism occur inside the cell.
Unit-I	Introductory Cytology Cell theory - Prokaryotic and Eukaryotic cells. Cell Junctions - Ultrastructure and functions of plasma membrane.Principle, resolving power & uses of compound microscope, confocal microscope and electron microscope. Cytological techniques: Fixation, Sectioning & Staining.
Unit-II	Cell Organelles: Nucleus, ultrastructure and functions of Endoplasmic Reticulum, Golgi Body.DNA structure and function - DNA Replication - Chromatin – Nucleosome. Chromosomes: Structure, types and Giant chromosomes.
Unit-III	Biochemistry& Cell Cycle: Ultrastructure and functions of Lysosomes, centrosomes, Mitochondria. Glycolysis and Krebs cycle. Electron transport system and formation of ATP. Cell cycle:Mitosis, Meiosis& interphase its regulation. Apoptosis& Cancer (brief outlines)
Unit-IV	Protein Synthesis: Types & role of RNA- Structure of t-RNA. Ultra-structure, function and types of ribosomes. Properties of Genetic code - Detailed study of Protein synthesis – Polysome – differences in eukaryotes – Short outline of post transcriptional modifications.
Unit-V	Enzymes & Metabolism: Enzymes: - mechanism of action – classification and factors influencing enzyme action – Enzyme Inhibition. Structure, Classification and properties of Carbohydrates, Protein and lipids. Glycogenesis –Glycogenolysis, Gluconeogenesis and HMP shunt. Deamination & Transamination. Beta oxidation of fats.

Text Books:

Arumugam N, Cell Biology & Molecular Biology, Saras Publications, Nagercoil.

Arumugam N, Cell Biology, Saras Publications, Nagercoil.

Fatima D , Narayanan LM , Meyyan RP, Nallasingam K, Prasannakumar S, Arumugam N. Biochemistry, Saras Publication, Nagercoil.

REFERENCE BOOKS:

Pawar CB, Cell Biology, Himalaya Publications.

Gupta PK, Cell Biology, Rastogi Publications, Meerut.

Jain JL, Jain N & Jain S, Fundamentals of Biochemistry, S. Chand Publications, New Delhi.

Ramadevi K, AmbikaShanmugam Fundamentals of Biochemistry for Medical Students, Lippincott Williams & Wilkins

Verma PS & Aggarwal VK Cell Biology S. Chand Publishers, New Delhi.

De Robertis EDP &De Robertis EMF, Cell and Molecular Biology, Lippincott Williams & Wilkins.

Outcomes	➢ Students can understand the structures and purposes of basic components of cells, especially biomolecules, membranes, and organelles. ➢ Students will develop an idea how cellular components are used to generate and utilize energy in cells. ➢ Students will explain the cellular components underlying mitotic cell division. ➢ Students will be able apply their knowledge of cell biology to selected examples of changes or losses in cell function. ➢ These can include responses to environmental or physiological changes, or alterations of cell function brought about by mutation. ➢ Students will understand the basics of biochemistry of food and its metabolism.

Semester– I I I				
Course code: 22BZO3C2	**CORE COURSE-IV**	**T/P**	**C**	**H/W**
	DEVELOPMENTALBIOLOGY& EVOLUTION	**T**	**4**	**4**

Objectives	➢ To make an awareness to the students about the theories, concepts and basics of Developmental Biology. ➢ To provide students about the idea of sex cells, fertilization, cleavage, differentiation and development of organs. ➢ To make an awareness of the induction, organizers and development of extra embryonic structures. ➢ To provide adequate explanation to students about the late embryonic developments and post embryonic development and ageing. ➢ To develop an idea of the animal adaptations and its significance in relation to evolution. ➢ To develop an idea of the distribution of the various faunal components. ➢ To develop an idea regarding the evolution of various vertebrate forms
Unit -I	Spermatogenesis – Oogenesis. Fertilization – mechanism, theories and significance – Parthenogenesis. Types of egg and its membrane. Mammalian egg - Egg membranes. Blastulation& Gastrulation and Cleavage**:** Planes & Patterns, Factors controlling cleavage - Fate map& its construction. Blastulation**:** Morphogenetic movements **of cell** - Gastrulation of frog & chick.
Unit -II	Organogenesis: Development of Brain, Eye and Heart in frog. Development of Nervous system in chick & Foetal membranes in chick. Placentation in Mammals. Development of Protonephric, Mesonephric &Metanephric kidneys.
Unit -III	Applied Embryology Organizer concept –Structure – mechanism of induction and competence. Regeneration: types - events and factors. Embryonic stem cells & its significance. Reproductive cycles: Oestrous cycle , Menstrual cycle and menopause. Erythroblastosis foetalis -Twins and its types. Infertility – causes - Test tube baby and Assisted Reproductive Technology . Amniocentesis.
Unit -IV	Evidences of Evolution: Morphological & Anatomical, Embryological, Physiological , Biochemical and paleontological evidences. Theories of Organic Evolution: Lamarckism, Neo Lamarckism, Darwinism, Neo Darwinism, Mutation theory& New version of mutation theory. Modern Synthetic theory of evolution. Convergent & Divergent evolution. Speciation: Isolation Mechanism & Speciation. Hardy Weinberg Equilibrium - Genetic drift. Basic outlines of Molecular evolution.
Unit -V	Animal Distribution Zoogeographical regions – Palaearctic, Nearctic, Neotropical, Oriental, Australian and Ethiopian regions - their Climatic and faunal peculiarities. Wallace line, Discontinuous distribution Continental Drift. Evolution of Higher forms Evolutionary significance of Dipnoi – Origin of Amphibia – Golden age of Reptiles - Major types of Dinosaurs and reason for extinction, Affinities of Archaeopteryx, Outlines of evolution of Man

Text Books

Arumugam NA Text Book of Embryology, Biotechnology Saras Publication Nagercoil.

Majumdar NN Vetebrate embryology; Tata McGraw-Hill, New Delhi.

Verma PS & Agarwal VK Chordate Embryology, S. Chand Publishers, New Delhi.

Arumugam N Organic Evolution, Saras Publication, Nagercoil**.**

Janakiraman.N., ”Evolution”, Text Book Publishers, 11, Subramaniapuram First St.,Karaikudi

Books for Reference:

Balnisky BI An Introduction to Embryology, W.B. Saunders and Co.

BerrilNJ,Kars G(1986). Developmental biology, McGrawHills

Barton NH, Briggs DEG, Eisen JA, Goldstein DB and Patel NH, Evolution. Cold Spring, Harbour Laboratory Press.

Hall BK & Hallgrimsson B, Evolution, Jones and Bartlett Publishers.	
Outcomes	➢ The learner will be able to understand methodological approaches to the study of embryonic development and the characteristics of the principal experimental models. ➢ The learner will be able to understand the derivatives of embryonic structures. ➢ The students will be able to explain the clinical implications of development and the mechanisms that intervene in developmental alterations. ➢ Students will be able to the mechanisms by which evolution occurs. ➢ Students will be able to understand how new species occur and reasons for species extinction. ➢ Students will have an insight on how major vertebrate forms and humans are evolved in the earth.

SEMESTER – III				
Course code 22BZO3P1	**PRACTICAL III CELL BIOLOGY, BIOCHEMISTRY, DEVELOPMENTAL BIOLOGY & EVOLUTION**	**T/P**	**C**	**H/W**
		P	**3**	**3**
SECTION-A Dissection/experiment/analysis	▪ Action of salivary amylase of man in relation to the temperature variation ▪ Mounting of Mitotic stages in the onion root tip ▪ Mounting of Meiotic stages from the testis of grasshopper. ▪ Mount any one of the chick embryo and comment on it 18Hours, 24Hours, 48Hours,72hours and 96 Hours.			
SECTION-B Mountings/ Analysis	• Determination of Rf values of amino acid – Paper Chromatography: ▪ Mounting of Giant Chromosomes in Chironomous larva ▪ Mounting of Squamous epithelial cells from the oral mucosa ▪ Mounting of Blood cells / Haemin crystals			
SECTION-C Museum specimens/ slides/models and charts	• Nucleus, Mitochondria, Endoplasmic Reticulum, Golgi Apparatus, Ribosomes, Nucleus, Mitochondria, Endoplasmic Reticulum, Golgi Apparatus, Ribosomes, Cleavage, Blastula, Placenta of Mammals – Pig, sheep, Man & Rabbit. Fossils: Trilobite, Nautilus. Animals of evolutionary importance:, Archaeopteryx, Darwin's finches, Mimicry: Leaf insects, Stick insects, Monarch and Viceroy butterfly, Adaptive colouration: Chamaeleon, Lycodon.			
SECTION-D	• Identify and comment on 18, 24-, 33-, 48- & 72-hours chick embryo. / Cleavage, Blastula, Gastrula stages of Frog/ Living fossil Limulus and Peripatus.			
SECTION-E	▪ Find out the presence or absence of carbohydrates/ protein/lipid/nitrogenous waste products in the given sample			
SECTION-F	▪ Bonafide Record of the work done in laboratory must be submitted while attending the examination.			

SCHEME OF EVALUATION	
Action of salivary amylase of man in relation to the temperature variation	**15 Marks**
Mount ,Sketch and lable the parts of Giant Chromosomes in Chironomous larva/ Squamous epithelial cells from the oral mucosa/ Blood cells / Haemin crystals	**10 Marks**
Identify, sketch and comment on the 5 spotters given in section C	**15 Marks**
Identify and comment on the living fossil/chick embryo / developmental stages of frog	**5 Marks**
Find out the presence or absence of carbohydrates/ protein/lipid/nitrogenous waste products in the sample (qualitative test)	**5 Marks**
Bonafide Record of the work done in laboratory	**10 Marks**
Total	**60 Marks**

Semester–IV				
Course code: 22BZO4C1	**CORECOURSE-V**	**T/P**	**C**	**H/W**
	GENETICS &MOLECULAR BIOLOGY	T	4	4

Objectives	➢ Students will learn the basic principles of inheritance at the molecular, cellular and organismal levels. ➢ Students will understand causal relationships between molecule/cell level phenomena ("modern" genetics) and organism-level patterns of heredity ("classical" genetics). ➢ Students will learn the mechanism of Mutation and will able to understand how mutations bring changes in an organism.
Unit -I	Definition and scope of Genetics. Mendelian Genetics: Mendelian Laws of Inheritance –Test cross & Back Cross - Multiple alleles – Polygenic inheritance -Incomplete dominance – Co-dominance – Importance of drosophila in genetics – sex identification – Mutants of Drosophila.
Unit -II	Linkage & Crossing Over: Linkage in Drosophila, Crossing over - Mechanism and theories. Epistasis, Lethal genes. Chromosomal maps& its construction. Chromosomal Aberrations, Gene Mutations– Physical & Chemical mutagens – DNA repair mechanism
Unit -III	Sex determination and sex linked inheritance: Sex determination in animals, X linked & Y linked inheritance – Genic Balance theory - Barr bodies -Chromosomal variation & Nondisjunction – Euploidy, Aneuploidy, Monosomy, Trisomy (Klinefelter, Turner & Down syndromes)– Cytoplasmic inheritance.
Unit -IV	Mutations- Sickle cell anemia, Inborn errors of Metabolism:Phenylketonuria – Alkaptonuria– Albinism. Pedigree Analysis, Eugenics, Euthenics, Genetic Counselling, Inbreeding and Out breeding.
Unit -V	Cistron – split gene. – promoter – repetitive DNA – Transposons.Bacterial genome-Transformation – Conjugation – F factor -Sexduction – Transduction – Generalized&Specialized - Plasmids. –Operon concept- Lac vs Trp operons (outlines).

TextBooks:

Patchirajan,G.,"Genetics and Molecular Biology" Seetha Lakshmi Ganesan Publishers,ShriShanmugaLakshmiNilayam,AnnamalaiyarStreet,Vivekanandhapuram North, Devakottai– 630 303.

Agarwal,V.K.,"Genetics",S.Chand&CompanyLtd.,7361RamNagar,New Delhi–55.

MeyyanR.P.2013 "Genetics" Saraspublications

Meyyan RP Fundamendals of Genetics, Saras Publication Nagercoil.

Rastogi.V.B.2013PrinciplesofGeneticsRastogipublications.

Books for Reference:

Gardner EJ Principles of genetics. London, UK, John Wiley & Sons, Inc..

Primrose SB, Twyman R. Principles of gene manipulation and genomics. John Wiley & Sons; 2013 May 28.

Strickberger MW, Genetics, Pearson publishers. 5. Verma PS & Agarwal VK Genetics, S. Chand Publishers, New Delhi.

Outcomes	➢ Students will be able to describe and apply the principles of Mendelian genetics. ➢ Students will be able to describe the flow of genetic information from DNA to RNA to protein. ➢ Students will be able to explain how genes are regulated. ➢ The students will able to explain how mutation occur and how its role in adaptation and speciation.

Semester–IV				
Course code:	**Core Course-VI**	**T/P**	**C**	**H/W**
22BZO4C2	**ECONOMIC ZOOLOGY**	**T**	**4**	**4**

Objectives	➢ The course is intended to make an awareness of the students about the economic importance of various animals ➢ The course will give an insight on to how to commercialize animal based products. ➢ The course will create awareness on the basics of animal husbandry based self employment. ➢ The course motivate the students to explore the opportunities to commercialize animal based products. ➢ The course will create awareness on waste recycling, waste utilization, conversion of waste in to wealth.
Unit-I	*Introduction to Economic Zoology, Economic Importance of Protozoa, Corals, Coral Reefs, Aschelminthes, Annelida, Orthopoda. Mollusca, Echinodermata and Vertebrates in general. Brief description of commercial Products of Insects and beneficial Insects. ,*
Unit-II	Poultry: Economic Importance of Poultry. General principles of building poultry house. Sexingindayoldchicks. Debeaking. Management of growers, layers and broilers (Cage House and deep litter system).Feed formulation for chicks, growers, layers and Broilers.
Unit -III	Sericulture and Apiculture: Introduction to mulberry and non-mulberry silk worm. Methods of industrial egg production. Rearing: House appliances, Operation-disinfection, feeding, cleaning, moulting, maintenance of temperature and humidity. Diseases: protozoan, bacterial, fungal & viral. Pests: Uzifly, beetles, mites, ants, nematodes, lizards,birds, squirrels & rats. Apiculture: Species of Honey Bee, Bee colony and its members and their roles and responsibility, Life cycle and development, Modern methods of bee keeping, Parts of typical bee hive. Honey extraction equipments, Products of apiculture. Pest and diseases.
Unit -IV	Vermiculture: Different species of earth worms suitable for composting –Roll of earth worms in soil fertility. Raw materials required, composting methods, General problems in production of vermi-composting. Prospects of vermi-culture as self-employment venture.
Unit -V	Fish culture: Types–Hybridization–Induced spawning of Indian carps–Paddy cum fish culture, Monoculture, Composite fish culture, sewage – fed fisheries, cage fish culture – culture of Prawn, pearl – Oyster and Catla – Catla(Common carp). Ornamental fish culture.

Text Book:

Arumugam N, A. Thangamani, S. Prasanna kumar, L.M. Narayanan, N.C Nair, S. Leelavathy, N. Soundara Pandian, T. Murugan, J. Johnson Rajeswar, R. Ram Prabhu, Jayasurya, Economic Zoology. Saras Publication

Ullal,SR.,&Narasimhanna,Dr,M.N."HandbookofpracticalSericulture",publishedbythecentral silk board,39, M.G. Road,Bangalore-560 001.

Ganga,G.,&Sulochanachetty,J."AnIntroductiontoSericulture",Oxford&IBHPublishingCo.Pvt., Ltd.,66, Janpath, New Delhi-110 001

Gnanamani M.R, Modern Aspects of Poultry Keeping, Deepam Publication, Madurai.

Books for Reference:

Chandy. N, "Fishes", National Book Trust.

Jhingran V.G, 'Fish and Fisheries of India', Hindustan Publishing Corp. Delhi.

Norman J.R,'A History of Fishes' Earnest Benn Limited, London.

Marshall N.B,'The life of Fishes'Weidnefeld & Nicholson, London

Bhatnagar R.K. & Palta R.K, "Earthworm Vermiculture and Vermicomposting", Kalyani Publishers, No. 1, Mahalakshmi Street, T.Nagar, Chennai-600017.

Gupta P.K,"VermiComposting for Sustainable Agriculture", AGROBIOS(India),Agro House, Behind Nasrani Cinema, Chopasani Road, Jodhpur–342 002.12. P.Senevirrantna, "Diseases of

Poultry", Published by Bristol, john wright &Sons Ltd.	
Outcomes	➢ Students can start animal based small scale industry ➢ Students will get self-employment through animal-based income generation. ➢ Students will learn to start location specific animal rearing and income generation units. ➢ Students will start small business based on waste to wealth ➢ The natural manure produced will help to improve soil fertility and help to minimize chemical fertilizers in agriculture. ➢ The efforts to start small animal based business will give employment to local people

SEMESTER – IV				
Course code: 22BZO4P1	**PRACTICAL IV**	**T/P**	**C**	**H/W**
	GENETICS, MOLECULAR BIOLOGY AND ECONOMIC ZOOLOGY	**P**	**3**	**3**
SECTION-A Experiment/analysis	▪ Experiments to study Mendel's law using beads. ▪ Observation of minimum 10 Mendelian characters for self & class Students			
SECTION-B Mountings/Demonstration/Observation	▪ Preparation of Pedigree chart for any two known visible characters for self. ▪ Demonstration of inactive X-chromosome in buccal epithelial cells of human female ▪ Study of phenotypic characters of Drosophila ▪ Mounting of mouth parts of Silk worm. ▪ Honey bee mouth parts ▪ Sting apparatus of Honey Bee ▪ Silk gland Mounting			
SECTION-C Museum specimens/ slides/models and charts	▪ Spotters : Drosophila, Cis-Trans linkage types, Gynandromorph, Syndromes –Down, Turner, Klinefelter & Cri-du-Chart, Bacteriophage, E.coli., DNA, Feeders, Waterers and drinkers of different types. Identification of eggs, pupa, cocoon and male and female adults, defective cocoons of silk worm. Identification of Mulberry and Non-Mulberry Silk worms. Identification of earthworm cocoons and vermi casts.			
SECTION-D	▪ Identify and comment on Breeds of poultry (photographs)/ Parasites of poultry (Tics, mites, lice, ascaris worm)/ Identification of commercially important fishes Tilapia, Channa punctatus, Mystus vitatus, Lepidocephalus thermalis, Common carp, Grass carp, Silver carp.			
SECTION-E	▪ Visit any one of the Sericulture/ Fish culture /Vermiculture/Poultry Science units and submit a field study report			
	▪ Bonafide Record of the work done in laboratory must be submitted while attending the examination.			

SCHEME OF EVALUATION	
Experiments to study Mendel's law of inheritance using beads/	**15 Marks**
Find out the trait type of the given Mendelian trails in man (Reasons should be given)	**5 Marks**
Identify, sketch and comment on any five spotters given in section C	**15 Marks**
Indentify and comment on given animal (specimen/Photographs)	**5 Marks**
Visit any one of the Sericulture/ Fish culture /Vermiculture/Poultry Science units and submit a field study report	**10 Marks**
Bonafide Record of the work done in laboratory	**10 Marks**
Total	**60 Marks**

Semester– V				
Course code: 22ZO5C1	**CORE COURSE-VII**	**T/P**	**C**	**H/W**
	MICROBIOLOGY AND IMMUNOLOGY	**T**	**4**	**4**

Objectives	➢ The course is intended to make an awareness of the students about the classification, diversity, organization, application and pathogenicity of the microorganisms existing the ecosystem. ➢ The course will help the students to learn about the various microbial culture techniques and its handling. ➢ The course will give an idea that how microbes are used in various industries for generation of various products related to day-to-day life. ➢ The course will give an insight to the cellular components involved in the immunity. ➢ The course will give an awareness of the mechanism, types and concepts regarding immune response.
Unit-I	Definition and Scope of Micro-biology. Characters and basic classification of Kingdom Monera and Fungi. Classification and types of structure of bacteriophage, Viroids and Prions and E. coli. General structure of fungi.
Unit-II	Bacterial culture, Sterilization- Types of Culture medium – Culture of Bacteria and factors influencing bacterial growth. Maintenance & Characteristics of colonies. Staining of bacteria, Bio-fermenters and its role in mass culture.
Unit -III	Applied Microbiology: Preservation of Milk –Microbes in Food Spoilage. Culture of Yeast & economic importance. Nitrogen fixing bacteria and Phosphate solubilizing bacteria. Stages, types and methods of fermentation& products. Basic concepts of Probiotics. Bacterial (Cholera, Typhoid), Viral (Rabies, HIV) & Fungal (Candidiasis, Dandruff) diseases in man.
Unit -IV	Immunity. Lymphoid organs &Cells of immune system - Types of Immunity – immune response – immunoglobulin – Structure of IgG. Epitopes, Paratopes, Haptens & Adjuvants. Antigen-antibody reactions - T-Cell and B-Cell activation - Monoclonal antibodies.
Unit -V	Basic concepts of major his to compatibility complex. - Basic properties and functions of Cytokines, Interferons and complement proteins. Types of hyper sensitivity. Concepts of autoimmunity and immunodeficiency. Vaccines & Immunization. Brief description of autoimmune disorders.

Text Books :

Mani A, SelvarajA.M , Narayanan L.M , Arumugam A, Microbiology, Saras Publication, Nagercoil.

Books for reference:

Dubey RC & Maheshwari DK, A Textbook of Microbiology, S. Chand Publishers, New Delhi.

Pelczar MJ, Chan EC, Pelczar MF. Elements of microbiology. McGraw-Hill International Book Company.

Ryan KJ, Ray CG, editors. Sherris medical microbiology. McGraw-Hill Education.

Willey JM, Sherwood L, Woolverton CJ. Prescott's microbiology. Singapore: McGrawHill.

Abul Abbas Andrew H. Lichtman Basic Immunology, Saunders.

Delves PJ, Martin SJ, Burton DR, Roitt IM. Essential immunology. John Wiley & Sons.

Ramesh SR, Immunology, Mcgraw Higher Ed.

Outcomes	➢ The students will be able to explain the taxonomy, diversity and general structure of micro-organisms. ➢ They will develop knowledge about the culture, sterilization, handling, identification and assessing growth characters of microorganisms. ➢ The students will develop knowledge about the general microbial techniques for

	isolation of pure cultures of bacteria, fungi and algae and will master the aseptic techniques to perform routine culture handling tasks safely and effectively. ➢ The students will get idea about the microbial spoilage and the potentials in the usage of microbes in agriculture. ➢ The students will develop an awareness about the various microbial diseases and the causative organisms. ➢ The students will be able to develop an idea about the cellular and molecular basis of immune response. ➢ The students will be able to understand the principles of self-tolerance and autoimmunity and will be able to relate the potentials of immunology in relation biotechnology and applied sciences.

Semester–V				
Course code: 22BZO5C2	**CORECOURSE-VIII**	**T/P**	**C**	**H/W**
	ANIMAL PHYSIOLGY	**T**	**4**	**4**

Objectives	➢ To familiarize students with the principles and basic facts of Animal Physiology. ➢ To give students an insight about the molecular and cellular basis of physiological functions in animals. ➢ To give an idea about the regulation of organ system functions in a whole animal using a conceptual model of feedback to explain homeostasis. ➢ To make an awareness to the students about how the structure-function relationships synchronize along with the molecular signals.
Unit-I	Nutrition & Respiration: Digestion and absorption of carbohydrates proteins and lipids. Minerals& Vitamins – their deficiency. Hormonal control of digestion. Respiratory pigments, structure of hemoglobin, Transportation of gases - Bohr effect - Regulation of respiration - bronchitis, asthma - physiological effects of smoking
Unit-II	Circulation & Excretion: Blood- composition and functions, Mechanism of clotting. Types of Hearts – Heartbeat & pace maker – Cardiac cycle – ECG - Pulse and blood pressure. Nephron structure & mechanism of urine formation, -. Excretory products, Osmo-regulation in fishes.
Unit -III	Muscle & Nerve Physiology: Types of muscles - ultra structure of striated muscle, muscle contraction & relaxation, properties of muscles. Neurons – structure & types - Impulse propagation, synaptic transmission, neuro transmitters - Reflex action, Nervousdisorders: Epilepsy, Alzheimer's disease, Parkinson's disease.
Unit -IV	Sense Organs: Structure of eye, physiology of vision, visual elements and pigments, photo chemistry of vision - Eye defects: myopia, hyperopia, presbyopia, astigmatism, cataract - Structure of ear and mechanism of hearing: Hearing impairments, deafness, labyrinthine disease . Olfactory, gustatory and tactile sense organs
Unit -V	Reproductive Physiology Endocrine glands in man - Hormones, action and disorders - Feed-back mechanism, Outlines of mechanism of hormonal activity. Puberty, adolescence, pregnancy, parturition, lactation and birth control.

Text Book:

Patchirajan,G.,"AnimalPhysiology"SeethaLakshmiGanesanPublishers,ShriShanmugaLakshmi Nilayam,AnnamalaiyarStreet,VivekanandapuramNorth,Devakottai630303.

AnanthakrishnanT.N.AnanthasubramanianandParameswaran,"AnimalPhysiology', Viswanathan &Co. Chennai.

Verma&Agarwal, "Animal Physiology" S.Chand&Co, New Delhi.

Arumugam.N2013"AnimalPhysiology"Saraspublication

Books for Reference:

Arumugam N &.Mariakuttikan A Animal Physiology Saras Publications, Nagercoil.

Bhagavan NV, Medical biochemistry, fourth edition Academic Press.

Guyton AC, Hall JE, Text Book of Medical Physiology, Elsevier

Jain AK Textbook of Physiology. Avichal Publishing Company.

Lehninger AL, Michael Cox, Nelson DL, Biochemistry. Macmillan.

Tyagi BS, Agarwal VK &Verma PS Animal Physiology S. Chand Publishers, New Delhi.

Outcomes	➢ The students will be able to explain how the various organ systems are coordinated and controlled. ➢ The students will be able to list the functions of various organs in relation to physiological process ➢ The students will develop the idea of multilevel controlling and feedback mechanism in relation to various physiological functions.

	➢ The students will be able to understand the basic physiological process related to adaptation, metabolism and major requirements

Semester–V				
Course code: 22BZO5C3	**CORECOURSE-IX**	**T/P**	**C**	**H/W**
	ECOLOGY AND BIO-STATISTICS	**T**	**4**	**4**

Objectives	➢ To develop awareness about the environment and its interaction with living system. ➢ To understand about various habitat ecosystems. ➢ To create an awareness about the biodiversity and need for its conservation. ➢ To develop professional who can have a critical approach to the evaluation of their own and other research work through statistical methods.
Unit-I	Abiotic factors and its ecological role: Light, Temperature and water as limiting factors. Biogeochemical cycles: Carbon, Sulphur, Nitrogen and Phosphorous. Concept of Species, Population dynamics and Growth curves – Population Ecology – Community Ecology. **.**
Unit-II	Animal relationships: - Mutualism, commensalism, parasitism, competition, predation. Habitat Ecology: Characteristic features, types and faunal adaptations in Freshwater (Lotic &lentic), Marine, estuarine, cave, forest and desert ecosystems. Ecotone& edge effect. Significance & Conservation of wetlands. Ecological succession, Ecological effects of dams, hydroelectric projects&aquaculture. Mimicry and colouration
Unit -III	Conservation of Biodiversity : Definition, loss & cause. IUCN, CITES, Species trade and biodiversity loss, Biodiversity hot spots in India. Indian Endangered species & conservation, Community reserves, Sanctuaries, National parks and Tiger reserves in Tamilnadu. Afforestation & Deforestation. Human animal conflicts. Wildlife Protection Act1972 and its schedules and amendment bill 2021. Environment (Protection)Act, 1986 and its amendments rule 2021 and 2022. Brief noteon carbon footprint, carbon trading and carbon offsets.
Unit -IV	Biostatistics: Collection of data, Classification of data, Tabulation of data ,Diagrammatic &Graphical representation of data. Measures of Central Tendency: Mean, Median and Mode.
Unit -V	Measures of Dispersion: Range, Standard Deviation, Standard error& Coefficient of variation. Probability and its types. Chi Square Test.

Text Book:

Arumugam N, Ecology, Saras Publication, Nagerkoil.

Verma&Agarwal–"PrinciplesofEcology"secondedition1985.S.Chand&CompanyLtd., Ramnagar, New Delhi.

Janakiraman.N.,"EnvironmentalBiology",TextBookPublishers,11,SubramaniapuramFirst St., Karaikudi 630 001.

Patchi Rajan, G. & Siva Rama Krishnan.G., "Biostatistics and Computer applications", Seetha Lakshmi Ganesan Publishers, Shri Shanmuga Lakshmi Nilayam, Annamalaiyar Street,Vivekanandhapuram North, Devakottai– 630 303.

Ramakrishnan P, Biostatistics, Saras Publication, Nagerkoil.

Palanichamy, S. Manohar, Statistics for Biologists, Paramount Publications, Palani.

Books for Reference:

Sharma PD, Elements of Ecology, Rastogi Publications, Meerut.

Chapman JL & Reiss MJ, Ecology: Principles and Applications, Cambridge University Press, New Delhi.

Odum EP, Fundamentals of Ecology, W.B Saunders College Publishing, Philadelphia.

Caughley G, Sinclair AR. Wildlife ecology and management. Blackwell Science.

Saha,T.K.,1992," Biostatistics in theory and Practice" Emkay Publications, PBNo.941 Delhi 110 051

Outcomes	➢ The students will be able to present an overview of diversity of life forms in an ecosystem, will be able to differ between Qualitative & Quantitative study. ➢ The learner can correlate choice of habitat for organisms to Abiotic Factors, aspects of energy transfer and will be able to explain the necessity for and

	adaptations, providing examples. ➢ The learner can understand the reasons and capable of managing pollution and after effects. ➢ The learner will be able to understand the value & need of Biodiversity conservation ➢ Understand human impacts to ecosystem describe and discuss basic statistical concept assess the distribution characteristics of variable. Formulate and test hypothesis

Semester–V				
Course code: 22BZO5C4	**CORECOURSE-X**	**T/P**	**C**	**H/W**
	BIOTECHNOLOGY	**T**	**4**	**4**

Objectives	➢ The objective of this course is to give a firm foundation in the fundamentals of modern Molecular techniques. ➢ The course will give an insight to the mechanism of Gene Expression and Regulation. ➢ The course will give a nut shell idea of various protocols followed in Biotechnology in relation to animal science.
Unit-I	Recombinant DNA technology: Scope of Biotechnology, Restriction endonuclease – , DNA Ligase. Identification & isolation of gene - Cloning vectors and recombination – . Screening of recombinant DNA. Application of recombinant DNA technology. Commercial production of Insulin. Human Genome Project.
Unit-II	Molecular Techniques: Methods to isolate DNA – PCR types, Principle & applications. Electrophoresis – types and Principle. Blotting – types & applications. DNA finger printing and its applications – RAPD – FISH- RFLP. DNA probes & diagnosis.
Unit -III	Animal tissue culture and its applications: Primary culture. Steps involved in mammalian cell culture- He la&WI38 cell lines – Maintenance of cell lines – Techniques and Application of organ culture. Animal cloning – Dolly.
Unit -IV	Biotechnological Applications: Genetically modified Animals - Single cell Protein, Biofuels – Solid waste management – Liquid waste management, Biogas production , Biopesticides and weedicides. Transgenic Animals (Fish, Mice, Sheep & Cow)& its significance – Mushroom Culture.
Unit -V	Enzyme Biotechnology: Microbial production & application of enzymes – Ribozymes- Artificial enzymes - Immobilization of enzymes: methods and its application. Biosensors - Cryobiology - Methods of cryo-preservation.

Text Book:

Smith 2012 Introduction to Biotechnology ELBS publication

Patchirajan, G., "Basics of Genetic Engineering and Fundamentals of Biotechnology" Seetha Lakshmi Ganesan Publishers, Shri Shanmuga Lakshmi Nilayam, AnnamalaiyarStreet,Vivekanandhapuram North, Devakottai 630303.

V.Kumaresan–"Biotechnology",Saras Publication.,Nagercoil.

Lohar.P.S–"Biotechnology", MJPPublishers,Chennai –5.

BrownT.A 2013 Basics of Gene Cloning University press USA

Books for Reference:

Brown TA. Gene cloning. London: Chapman & Hall; 1995.

Primrose SB, Twyman R. Principles of gene manipulation and genomics. John Wiley & Sons; 2013 May 28.

Robertis D. Cell and molecular biology. Lea &Febiger,U.S

Verma PS & Agarwal VK Genetic Engineering, S. Chand Publishers, New Delhi

Outcomes	➢ The course will give an idea about the various techniques used in modern biotechnology. ➢ The course will give an insight to the current applications of biotechnology and advances in the different areas like medical, microbial, environmental, bioremediation, agricultural, animal and forensics. ➢ The learner will be able to understand how microbes is used engineer various genes. ➢ The students will be able to explain the general principles of generating genetically modified organisms and modern artificial methods in biotechnology

SEMESTER – V				
Course code 22BZO5PI	**Core Practical V MICROBIOLOGY, IMMUNOLOGY AND ANIMAL PHYSIOLOGY**	**T/P**	**C**	**H/W**
		P	**4**	**6**

SECTION-A Dissection/experiment/analysis	Agglutination test to show antigen-antibody reaction. Oxygen consumption of fishes under different situations Isolation of Microorganism-Demo
SECTION-B Mountings	Hanging drop experiment for observation of live Bacteria from given sample Using B.P. Apparatus, find out the blood pressure of your classmates Qualitative analysis of excretory products (ammonia, urea and uric acid) Preparation of haem in crystals Prepare thin film of blood and observe blood cells
SECTION-C Museum specimens/ slides/models and charts	Study of permanent histological sections of mammalian pituitary, thyroid, pancreas, adrenal gland, testis and ovary .Air breathing fishes and accessory respiratory organs. Mammalian heart, kidney, brain /ECG/ Haemoglobinometer/ Haemocytometer/ Sphygmomanometer/Kymograph/
SECTION-D	Identify and comment on the slides/specimen of Primary and Secondary Lymphoid organs: Thymus b. Bone marrow c. Spleen d. Lymph node E. Bursa of fabrics.
SECTION-E	▪ Bonafide Record of the work done in laboratory must be submitted while attending the examination. Identify and comment on the

SCHEME OF EVALUATION	
Estimation of oxygen consumption by a fish [or] Estimation of Salt loss / salt gain in Tilapia fish	**15 Marks**
Mounting of Blood cells / Haemin crystals	**5 Marks**
Identify, sketch and comment on the five spooters given	**15 Marks**
Identify and comment on any one of the immunological organs given	**5 Marks**
Prepare thin film of blood and observe blood cells	**5 Marks**
Bonafide Record of the work done in laboratory must be submitted while attending the examination	**15 Marks**
Total	**60 Marks**

SEMESTER –IV				
Course code: 22BZO5P2	**Core Practical VI**	**T/P**	**C**	**H/W**
	ECOLOGY, BIO-STATISTICS & BIOTECHNOLOGY	**P**	**4**	**6**

SECTION-A Dissection/experiment/analysis	1. Estimation of dissolved Oxygen of river, pond and sewage water 2. Estimation of Salinity 3. Estimation of Calcium. 4. Collection and identification of plankton in a pond 5. Calculation of Mean, Medium, Mode, Standard deviation and Standard Error. 6. Chi-square test and testing hypothesis using coin method 7. Techniques of sterilization using autoclave/pressure cooker 8. Blotting techniques – observation of photograph 9. Extraction of DNA from samples – Demonstration Only
SECTION-B Mountings	▪ Analysis of fresh water and marine plankton and mounting of plankton.
SECTION-C Museum specimens/ slides/models and charts	Laboratory specimens related to animal associations: symbiosis, mutualism, commensalism, parasitism and predatioc. Mimicry and colouration: Leaf insect, stick insect, Chameleon. 5 freshwater Zoo planktons and 5 marine zoo planktons. Statistics: Pie chart, Histogram, Bar diagram, Multiple bar diagram, Component bar diagram, Percentage bar diagram, Cartogram, Pictogram. Biotechnology: Spirulina, Mushroom seed, Penicillin, Yeast, Autoclave, Pressure cooker, Culture Media.
.SECTION-D	• Comment on S e c c h i d i s c / Pond Ecosystem/ Ecological Succession • Construct a food web/ energy pyramid/ pyramid of biomass/ and inverted pyramid from the sample pictures given.
SECTION-E	• Internal: Visit a nearby biotechnology laboratory and submit report of what are the instruments/ techniques they use in their lab. • External: Field visit to expose the students to o b s e r v e various ecological habitats and its animal adaptations: Forest/Mountain/Seashore/Lake /River/etc.and to pollution affected areas to study the impact on environment and ecosystem(**Compulsory)**
SECTION-F	• Bonafide Record of the work done in laboratory must be submitted while attending the examination.

SCHEME OF EVALUATION

Estimation of dissolved Oxygen of in different types of water/ Calculation of Mean, Standard deviation and Standard Error	**15 Marks**
Mount any one of the plankton from the given sample, sketch and lable the parts	**5 Marks**
Identify, sketch and comment on the 5 spotters given in section C	**15 Marks**
Construct a food chain/ food web/ energy pyramid/ pyramid of biomass/ and inverted pyramid from the sample pictures given. Or Comment on S e c c h i d i s c / Pond Ecosystem/ Ecological Succession.	**5 Marks**
Field visit report	**10 Marks**
Bonafide Record of the work done in laboratory must be submitted while attending the examination.	**10 Marks**
Total	**60 Marks**

Semester–VI				
Course code: 22BZO6E1	DSE	**T/P**	**C**	**H/W**
	FISHERIES BIOLOGY	**T**	**6**	**6**

Objectives	➢ To provide the students about necessary basic information regarding fishery and aquaculture. ➢ To improve the technical and general knowledge necessary for competent fisheries management ➢ To discuss important factors for performing a sustainable fishery and sustainable aquaculture.
Unit-I	Importance of Fisheries Classification of fisheries –Marine fisheries (Coastal, Offshore and deep sea fisheries),inland fisheries, Crustacean fisheries (Prawn, shrimp, lobster and crab fisheries); Molluscan fisheries (Edible Oyster,pearl oyster,Cephalopod and lime fisheries).
Unit-II	South Indian fisheries and its management Fishing craft and gear in India, Fisheries Management. Parasites and diseases of fishes –Fishinrelation to public health.
Unit -III	Physiology and Ecology of fishes Food and feeding habits –locomotion by fins and Body form – Respiration – Accessory respiratory organs – Airbladder – reproduction – Ecological factors influencing spawning incarps, parental care, Migration.
Unit -IV	Fish Culture Types–Hybridization–InducedspawningofIndiancarps– Paddycumfishculture,Monoculture, Composite fish culture, sewage – fed fisheries, cage fish culture – culture of Prawn, pearl – Oysterand Catla – Catla(Common carp). Fresh water ornamental fish culture
Unit -V	Fish processing and preservation Drying, Salting Smoking, Canning, Froglegs and Prawns–Fishery by products .

Text Book:

Chandy N, “Fishes”, National Book Trust.

Jhingran V.G, ‘Fish and Fisheries of India’, Hindustan Publishing Corp. Delhi.

Norman J.R, ‘A History of Fishes’ Earnest Benn Limited, London.

Marshall N.B, ‘The life of Fishes’ Weidnefeld & Nicholson, London.

Reference Books:

Lakshmi Prasad. An Introduction To Fish Culture. Vandana Publications.

Francis Day.Fish Culture. Forgotten Books (2018).

Board Eiri. Hand Book of Fish Farming and Fishery Products . Engineers India Research Institute.

Outcomes	➢ Students will learn about the role of fisheries management. ➢ Students will learn about fresh water and marine water fish species ➢ Students able to understand about prawn culture and molluscan culture.

Semester VI				
Course code: 22BZO6E2	DSE	**T/P**	**C**	**H/W**
	VERMICULTURE	**T**	**6**	**6**

Objectives	➢ To study about the earthworms ➢ To learn the skills of vermiculture and vermicomposting methods ➢ To teach about the eco-friendly technology ➢ To generate employment after completion of the Degree
Unit-I	Classification – different species of earth worms. Morphology, anatomy and Physiology of earth worms.
Unit-II	TypesofVermicomposing–Rollofearthwormsinsoilfertility–vermiculture–vermi-cast –vermi-technologyandapplications–Physical,chemicalandbiologicalpropertiesofvermi-compost.
Unit -III	Raw materials for composting–requirements of vermicomposting. Maintenance of composting–Collection of vermicompost–Efficiency of vermicomposting–General problems in production of vermi-composting.
Unit -IV	Advantage of vermicomposting – Applications of vermicomposting – Vermicomposting of Agricultural and Urban SolidWastes–Recycling of wastes through vermicomposting.
Unit -V	Small Scale or Indoor vermicomposting –Large scale or outdoor vermicomposting. Effects of vermicompost on soil properties. Vermicompost Quality& Economics. Vermicompost for self-empowerment.

TEXT BOOKS:

SEETHALEKSHMY **M** (Author), R SANTHI .Vermitechnology. Saras Publication; 1st edition (1 January 2012).

Dr Keshav Singh . A Textbook of Vermicompost: Vermiwash and Biopesticides. Biotech Books (1 January 2014)

Bhatnagar R.K. & Palta R.K, "Earthworm Vermiculture and Vermicomposting", Kalyani Publishers, No. 1, Mahalakshmi Street, T. Nagar, Chennai -600 017.

Reference Books:

Gupta P.K, "Vermi Composting for Sustainable Agriculture", AGROBIOS (India), Agro House, Behind Nasrani Cinema, Chopasani Road, Jodhpur – 342 002.

Himadri Panda. The Complete Technology Book on Vermiculture and Vermicompost (Earthworm) with Manufacturing Process, Machinery Equipment Details & Plant Layout_2nd Edition. Asia Pacific Business Press Inc.2022.

Outcomes	➢ Creation of knowledge about conservation of soil health through development of vermiculture and vermicomposting. ➢ Morphology and taxonomy of earthworms will be helpful to save our native earthworm species. Student can generate minimum income through install a small scale vermiunit ➢ If they develop in commercial scale level they can provide employment opportunity to the rural peoples.

Semester–VI				
Course code: 22BZO6E3	DSE	**T/P**	**C**	**H/W**
	MUSHROOM CULTURE	**T**	**6**	**6**

Objectives	➢ To teach the students knowledge and skills which allow them to establish a mushroom cultivation enterprises. ➢ Appropriate knowledge belongs principally to a new applied science and practice of mushroom cultivation. ➢ The develop skill work will autoclaves preparing sterile microbiological media and work with pure culture.
Unit-I	Introductiontomushroom–Importanceofmushroomandnutritivevalue–Lifecycleofmushroom
Unit-II	Identification of mushroom and types of mushroom–Edibleandpoisonousmushrooms–MushroomgrowthandEnvironment.
Unit- III	Mushroom cultivation techniques: Culture media preparation – Selection of mushrooms to be cultivated – Production of the culture or starter – Preparation of spawn – preparation of the compost– Spawning, harvesting, post harvesting technology.
Unit -IV	Major pests:Insect Pests, Mite Pests, Viral, Bacterial, fungal. Mushroom insects diseases–Prevention and Control measures.
Unit -V	Preservation: Short term storage &Longterm storage. Marketing. Mushroom products and its economic importance.

Text Prescribed:

V.N.Pathak, Nagendra Yadav & Maneesha Gaur, "*Mushroom Production and Processing Technology*", Published by Agrobios (India), Chopasani Road, Jodhpur – 342 002.

Marimuthu,T. Krishnamoorthy, A.S., and Jeyarajan.R, (1991), "*Oyster Mushroom Production*", Glimpses of Mushroom Research in Tamilnadu Agricultural University, TNAU Publishers, Coimbatore.

Kumaresan V,. *Mushroom Cultivation.* Saras Publication. Nagercoil

Reference Books:

Bahl N., (1984), "*Handbook of Mushroom*", Oxford IBH, New Delhi 123p.

Garcha H.S. (1984), "*A manual of Mushroom Growing*", PAU Publications, Ludhiana, 54p.

Kapoor, J.N. (1989), "*Mushroom Cultivation*", ICAR Publication, New Delhi

Outcomes	➢ Determine the most important species of cultivates mushroom and known the basic ways of the cultivation of each of them. ➢ Can work with autoclaves ➢ Can prepare microbiological media Can work with pure culture of microorganisms.

Semester–VI				
Course code: 22BZO6E4	**DSE**	**T/P**	**C**	**H/W**
	BIOINFORMATICS AND COMPUTER APPLICATION	**T**	**6**	**6**

Objectives	➢ To introduce the basics of bioinformatics- biological databases, retrieval tools and applications. ➢ To introduce MS Office applications, internet and its application ➢ To effective utilization of computer and applications in biological sciences ➢ To aware the students about the usages of E. mail and sending document through E.mail. To teach about usage of internet for collection of reading materials. To explain about the short cut keys and create a new word document. To teach to draw various diagrams using MS Excel. To motivate the students to prepare power point slides for effective presentation.
Unit-I	Introduction to bioinformatics and data generation .Bioinformatics and its relation with molecular biology. Nomenclature of DNA sequence, protein sequence, Proteomics – Protein structure, PIR, entry of a SWISSPROT account, Genomics – Divisions, entry of Gene Bank account.
Unit-II	General Introduction of Biological Databases; Nucleic acid databases (NCBI, DDBJ, and EMBL). Protein databases (Primary, Composite, and Secondary). Specialized Genome databases: (SGD, TIGR, and ACeDB). Structure databases (CATH, SCOP, and PDBsum).
Unit -III	Data retrieval tools- Entrez, BLAST, Bioinformatics in drug design, Phylogeny analysis in bioinformatics, Human genome project.
Unit -IV	Basic Components of computer ((CPU, input, output and storage devices).Internet : ISP, Search engines (Google, Yahoo etc.), types of browsers, email ID creation, file sharing (file attachments and downloads) cloud storage (Google drive) and its management. File conversion MS word, PPT, Excel, JPG to PDF vice versa ,password encryption on files. File compressing , merge, split and compress PDF
Unit -V	Office automation software: Basics of MS Word, Excel, Power point. Basic online communication tools: Zoom, google meet. Creation Google form, Google Doc, Google sheet.

Text Book:

Kumaresan V, Sundaralingam R, Bioinformatics. Saras Publication, Nagerkoil.

Arumugam N, Gopi A, Meena A, Computer for Digital Era. Saras Publication, Nagerkoil.

Sundaralingam R, Arumugam N, V. Biostatistics, Computer Application and Bioinformatics

Saras Publication, Nagerkoil.

Books for reference: Use latest edition.

Ignachimuthu S. Basic Bioinformatics –. NarosaPublising House, New Delhi.

Mani, S. Bioinformatics Vol I, II, III. Centre for Cultural Studies Pub, Coimbatore.

Rastogi S.C., Mendiratta, N .Bioinformatics – Methods and Applications., Rastogi Prentice New Delhi,

Outcomes	➢ Basics of bioinformatics- biological databases, retrieval tools and applications. ➢ Students will familiar with Collection, Handling, Analysis of Biological Data. ➢ Student will familiar about the usage of E. mail and attaching documents. Students will learn about the collection of search engines and reading materials for their assignments and university examinations. ➢ Students will know creation of documents with MS office, MS Excel, MS Power point. ➢ The presentation will become easy and effective while attending interviews. ➢ Students will easily attend online classes, interviews discussion and store their data in the cloud

Semester–VI				
Course code 22BZO6E5	DSE (A)	**T/P**	**C**	**H/W**
	POULTRY SCIENCE	**T**	**6**	**6**

Objectives	➢ This course will cover all aspects of modern poultry production including breeding, nutrition, health, behavior, and well fare as well as quality of meat and eggs. ➢ The course is relevant for all students working in the field of poultry science and will provide the understanding of poultry production.
Unit-I	**General:** Poultry Industry in India, a survey– progress through I toVII five year plans. Poultry breeds. Choosing commercial layings tock: Purelines, commercial chicks, sexing in day old chicks. Poultry housing– General principles of building poultry house. Economic Importance of Poultry.
Unit-II	**Management:** Practical aspects of chick rearing: Brooding equipment, Brooder temperature, feeder and water space allowance, vaccination. Management of growers, layers andbroilers(CageHouseanddeeplittersystem).SummerandWintermanagement.Lightingfo rchicks, growers and layers. Debeaking.
Unit -III	**Poultry Nutrition**: Energy: Gross energy, digestible energy, metabolizable energy and net energy, Energy requirements for chicks, growers, layers andbroilers.Proteins,aminoacids,VitaminsandInorganicelements:Requirementsforchicks, growers and layers – fat soluble and water soluble vitamins– supplementation of vitamins and minerals in poultry feeds.
Unit -IV	**Non-nutritive food additive:** Names and their allowance s in the poultry feed, merits and demerits in the usage of feed additives. Feed formulation for chicks, growers, layers and Broilers. Makenote on the overcoming ofenvironmental temperature by changing feed formulate.
Unit -V	Poultry Diseases: Short account of Cause, symptoms, prevention, control and treatment of the following diseases: Virus diseases: New Castle disease, fowlplague, infectiousbronchitis, Laryngotracheitis, fowlpox and Avian Leucosis complex & Gumboro disease. Bacterial Diseases: Pullorum, salmonellosis, fowl cholera, coryza, botulism, mycoplasmosis and spirochaetosis. Fungal Diseases: Aspergillosis& Aflatoxicosis. Parasitic Disease: Coccidiosis, Nematodeinfection,Tape worm in fections, ticks, mites and Lice.

Text Prescribed:

M.R.Gnanamani, Modern Aspects of Poultry Keeping, Deepam Publication, Madurai.

David J.Lobo, (Editor) "*Deejay Technical Bulletin*", Deejay Hactheries, Banglore – 77

Senevirrantna P,"*Diseases of Poultry*", Published by Bristol, john wright & Sons Ltd.,

Reference Books:

Das D , Das B C and nayak N .Text Book on *Poultry Management*. Narendra Publishing House. (2019).

Colin G. Scanes , George Brant , M. E. Ensminger Deceased. *Poultry Science*. Pearson; 4th edition (2003) .

Ralph Owens .*Handbook of Poultry Science*. Syrawood Publishing House (2019).

Outcomes	➢ To understand breeding, nutrition half welfare and product quality ➢ Understand the power of genetic selected formulate diets for poultry ➢ Formulate diets for poultry Evaluate the quality of poultry meat and eggs.

Semester–VI				
Course code: 22ZOE6E6	DSE (B)	**T/P**	**C**	**H/W**
	SERICULTURE	**T**	**6**	**6**

Objectives	➢ To Imparting training in Mulberry cultivation, silk worm rearing and silk realing. ➢ To know various new technologies of mulberry production ➢ To know about significance of biological chemistry of silk worm. ➢ To know about the importance of cocoons. ➢ To understand the occurrence, distribution and croploss due to mulberry pests and diseases.
Unit-I	General: History in India, promoting organizations (CSB, NSSP, SSTC, CSTRI, NSP) future scope. Mulberry silkworm (Bombyxmori): Taxonomy, Morphological sex differences in larva andadult, silk gland. Non –Mulberry silk worm: Tasar, Muga & Eri– brief accountsonly.
Unit-II	Moriculture: Cultivation: varieties, land preparation, planting system, propagation, irrigation, manuring, pruning, harvesting and storing. Diseases: Fungal, Bacterial and Viral.Pests: Leaf eating pests.
Unit -III	Methods of industrial egg production. Rearing: House appliances, Operation-disinfection, feeding,cleaning, moulting, maintenance of temperature and humidity.
Unit -IV	Diseases: Protozoan, bacterial, fungal &viral.Pests: Uzifly, beetles, mites, ants, nematodes, lizards, birds, squirrels & rats.
Unit -V	Physical characters of marketable cocoons, defective cocoons, the markets, transport. Stifling, cooking, reeling – operations & appliances.

Texts Prescribed

Ullal, SR., & Narasimhanna, Dr,M.N. "*Handbook of practical Sericulture*", published by the central silk board, 39, M.G. Road, Bangalore-560 001.

Ganga, G., & Sulochana chetty, J. "An Introduction to Sericulture", Oxford & IBH Publishing Co. Pvt., Ltd., 66, Janpath, New Delhi-110 001.

Reference Books:

Shankar J. P. A, Reddy R**.** *Sericulture.* Commonwealth Publishers; 2008th edition (2009).

Amardev Singh & Dr Ravinder Kumar. Sericulture Handbook Vol 1. Biotech Books (1 January 2013).

Tribhuwan Singh. *Silkworm Rearing Technology: Principles and Management.* Discovery Publishing House Pvt Ltd (2015).

Outcomes	➢ Sericulture offers career opportunity in Govt. research centers, silk boards, academic fields, sericulture units, agriculture sector banks etc. ➢ One can get jobs in Central Government agencies like Central Silk Board/Silk Export Promotion Council/Fao/Nabard, Krishi Vigyan Kendra etc. ➢ Candidates with M.Sc sericulture can apply for the post of lecturer, professor and lab assistant. Sericulturists can find employment as officers, managers in the agricultural loan sector of nationalized as well as private banks. ➢ Consultants with in-depth and updated knowledge of the field are also in demand, especially to provide guidance for the setting up of sericulture farms.

Semester–VI				
Course code: 22BZO6E7	**DSE (A)**	**T/P**	**C**	**H/W**
	RECOMBINANT DNA TECHNOLOGY	**T**	**6**	**6**

Objectives	List out tools used for gene exploration Utilize the knowledge on creation of a genomic library Recall about transgenic plants and animals
Unit-I	Restriction and Modification systems of Bacteria. Restriction enzyme: DNA Polymerases, DNA Ligase, methylase, Taqpolymerase, polynucleotidekinase, alkaline phosphatase, reverse transcriptase, DNase, S1nuclease, RNaseH, terminal deoxynucleotidyl transferase, RNA polymerase.
Unit-II	Types and methods in probe construction, methods of labeling gene probes, identification of recombinant DNA. Construction of DNA libraries and genomiclibraries, proteinengineering.
Unit -III	Introduction of cloned genes into the host cells: Transformation, transduction, Particle gun, electroporation, liposomemediated and agro packed co-cultivation.
Unit -IV	Recombinant DNA techniques: Antisense technology, terminatorgene technology, sitedirected mutagenesis, hybridization techniques–southern, Western and Northern blotting.
Unit -V	Humangenome project. Chromosome walking. PCR, DNA finger printing, Microarray and sequencing, genetherapy, DNA sequencing.

Texts Prescribed

Ernst.Winnacker L, (2003) from genes to clones, 2nd edition, Panima publishing corporation, New Delhi.

Reference Books:

James.D.Watson (2001) Recombinant DNA technology, 2nd edition, WH Freeman and company, New York.

Glick and Pasternak, (1996), Molecular biotechnology, Panima publishing corporation, New Delhi.

Brown T.A., (1998) Introduction to gene cloning, 3rd edition, Stanley Thomas Publishing Ltd, London.

Primrose S.B., (2003) Principles of gene manipulation,6th edition, Blackwell Science Ltd, Germany.

Cartagena Protocol on Biosafety, January 2000.

Biological Warfare in the 21st century, by M.R. Dano, Brassies London, 1994.

Safety Considerations for Biotechnology, Paris, OECD, 1992 and latest publications

Outcomes	➢ Isolate and purify nuclic acids for routine laboratory procedures ➢ Explain the underlying mechanisms of gene cloning ➢ Discuss the practical aspect of applying recombinant DNA technology ➢ Explain the significance of model organisms in recombinant DNA technology ➢ Describe recombinant gene expression systems.

Semester–VI				
Course code:	**DSE (B)**	**T/P**	**C**	**H/W**
22BZO6E8	**BIOLOGY OF CLONING VECTORS**	**T**	**6**	**6**

Objectives	To provide students with basic knowledge of the concepts and themes of gene cloning. To present the students with an overview of the various biological tools used in• gene cloning. To outline the process of science in studying biological problems based on gene• cloning techniques.
Unit-I	Introductiontocloningvectors:PlasmidBiology.*E.coli*vector;propertiesofplasmid(plasmids in gene transfer) plasmid compatibility, copy number control, PBR322, BAC and expression vectors in prokaryotes.
Unit-II	Molecular biology of lambda, Lambda vectors; cosmid, phagemid. *in-vitro* packaging, M13 and other viral vectors of prokaryotes. Laboratory and industrial applications of prokaryotes.
Unit -III	Cloning in Yeast: genetics of S.cerevisiae, identification of Yeast genes, Yeast vectors, YAC. Cloning in Bacillus. Plasmids and vectors, inducible promoters. Cloning in Streptomyces.
Unit -IV	Animal vectors; Selectable markers, SV40 Vectors, papilloma virus, Retro virus, Vacciniavirus. Bacculovirus Tiplasmidasgenevector,Caulimoviruses,Geminiviruses,Transposableelements, RNAviruses, viroids
Unit -V	m RNA isolation, cDNA synthesis. Genomic and cDNA liobraries. Site–directed mutagenesis

Texts Prescribed

Ernst.Winnacker L, (2003) from genes to clones, 2nd edition, Panima publishing corporation, New Delhi.

Benjamin Lewin (2004) Genes VIII, Pearson Education corporation, New Jersy.

Primbrose S.B (2003) Principles of gene manipulation 6th Ed Black well Sci ltd, Germany.

Reference Books:

Alberts B, (1994) molecula biology of the cell, Garland publishing Inc New York

Friedfielder.D, (2002), Molecular biology II Ed., Narosa publishing house, New Delhi.

Watson J.D, (2001) Recombinant DNA technology, 2nd Ed WH Freeman and Company, NY.

Brown T.A (1998) Introduction to gene cloning 3rd ED Stanley Thomas Pub ltd, Germany

Outcomes

- At the end of this module, students will be able to gain knowledge about: - The various fundamental biological concepts and tools used in gene cloning. - The various steps of gene cloning. - The importance of gene cloning in the various fields of biotechnology. Cognitive skills (thinking and analysis).
- At the end of this module, students will be able to develop their intellectual skills through understanding the concepts of gene cloning and formulating questions and thinking of the appropriate answers to their questions.
- Communication skills (personal and academic). At the end of this module, students will be able to develop personal communication skills through participating in open-discussions with their colleagues and instructors.
- Practical and subject specific skills (Transferable Skills).
- At the end of this module, students will be able to: - Improve their ability to search for information using various communication settings. –
- Improve their ability to analyze data based on their understanding to the basic biological concepts of gene cloning. - Benefit from all supplementary material provided with the textbook.

Semester–VI				
Course code: 22BZO6E9	**DSE**	**T/P**	**C**	**H/W**
	FERMENTATION TECHNOLOGY	**T**	**6**	**6**

Objectives	➢ To make students acquainted with principles of using of microorganisms in fermentation process. ➢ Attain knowledge of production equipment in fermentation industry, application of microorganisms and enzymes in technological operation, substrate preparation and control of fermentative process and isolation of products. ➢ Substantial time is devoted to particular fermented products -- spirits industry, yeast industry, brewing industry, production of microbial biomass and selected organic acids.
Unit-I	Industrially important strains – Screening methods – Strain development for Improved yield –Mutation, Recombination and protoplasmicfusion.
Unit-II	Fermentation–submerged and solidstate–component parts of a CSTR–types of Fermentors (Tower,cylindroconical & airlift)–batch fermentation–continuous Fermentation.
Unit -III	Production of beverages – beer and wine – vitamin B12 and Riboflavin – Antibiotics –penicillin and streptomycin – production of enzymes – Amylases andProteases – methods of immobilization.
Unit -IV	Single cell protein – Bakers yeast, spirulina – Details of mushroom development – Oyster(Pleurotus) and Button (Agaricus) mushroom.
Unit -V	Downstream process – Intercellular and extracellular – Centrifugation, filtration, Floatation –solvent extraction, precipitation–Breakageof cells – physical and chemical methods.

Texts Prescribed

Stanbury P T and Whitaker 1984, Principles of Fermentation Technology, Pergamon Press. NY

Casida, L E JR 1968 Industrial Microbiology. New Age International Publishers.

Prescott and Rehm 1979. Industrial Microbiology. Wiley and Sons.

Reference Books:

S.M. Reddy Basic Fermentation Technology .New Age International Pvt Ltd; 2017.

Aydin BerenjianEssentials in Fermentation Technology.Springer; 1st ed. 2019 edition .

Peter F Stanbury (Author), Allan Whitaker (Author), Stephen J Hall Principles of Fermentation Technology. Butterworth-Heinemann; 3rd edition (2016)

Outcomes	**Generic competences**: - ability to apply knowledge - capacity to learn - general knowledge - professional knowledge **Specific competences:** - Knowledge of industry cultivation of microorganisms. - Knowledge of principles of fermentation technology. - Knowledge of production alcoholic beverages, beers, yeasts and food acids. - Knowledge of production equipment in fermentation technology.