ARULMIGU PALANIANDAVAR ARTS COLLEGE FOR WOMEN

(AUTONOMOUS)

NATIONALLY RE-ACCREDITED WITH B^{++} GRADE BY NAAC

(Affiliated to Mother Teresa Women's University, Kodaikanal)

Chinnakalyamputtur, Palani

UNDER

CHOICE BASED CREDIT SYSTEM

ACADEMIC YEAR 2022-2023

P.G DEPARTMENT OF ZOOLOGY

M.SC. ZOOLOGY

SYLLABUS

BATCH: 2022-2024

P G ZOOLOGY DEPARTMENT
FACULTY MEMBERS

Dr.R.Muthulakshmi M.Sc.,M.Phil.,Ph.D Associate Professor & Head

Dr.R.UmaMaheswari M.Sc.,M.Phil.,Ph.D Assistant Professor

Mrs.P.Pavatharini M.Sc.,M.Phil., Assistant Professor

Mrs.M.Latha Santhi M.Sc.,M.Phil., Assistant Professor

Dr.S.Subhashini M.Sc.,M.Phil.,Ph.D Assistant Professor

Dr.M.Mohanasundari M.Sc.,M.Phil.,Ph.D Assistant Professor

Mrs.K.P.Sasikala M.Sc.,M.Phil., Assistant Professor

ARULMIGU PALANIANDAVAR ARTS COLLEGE FOR WOMEN
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Nationally Reaccredited with B^{++} Grade by NAAC
Chinnakalayamputhur, Palani - 624 615

PREAMBLE

The Department of Zoology are established as undergraduate Department in the year 1974 and upgraded as postgraduate in 1987. The Department is enriched by altruistic contribution of a galaxy of teachers. The Department is noted for its good academic record and well-established laboratories. The highlight of the Department is the active participation of the faculty members in Research with many International and National papers in reputed Journals, received many awards and Research grants from various funding agencies such as UGC, DST etc., Our Department tirelessly strives to work towards women's education at all level in the State to be a pioneer in the field of Women Empowerment by introducing relevant papers in the Curriculum to fulfill their local needs through the Board of Studies.

COLLEGE VISION

- **Enlightenment and Empowerment of Rural Women.**

COLLEGE MISSION

- **Providing high quality teaching learning environment with practical exposure**
- **Imbibing research culture and collaborate programs with local communities**
- **Imparting strong and supportive education to promote employability**
- **Encouraging questioning spirit and self – reliance**

P.G DEPARTMENT OF ZOOLOGY

VISION

- **To create self confidence among the students through up to date curriculum designing.**
- **To develop and maximize the learning competency.**
- **To inculcate the social and moral values that enables the students to become a good citizen.**
- **To develop true research attitude**

MISSION

- **To provide the students with good quality education.**
- **That integrates science, technologies and society and to perform value based real-time research activities and there by leaping to excellence.**

P.G DEPARTMENT OF ZOOLOGY

M.Sc., Zoology

Program Outcome

Upon completion of M.Sc., Zoology Degree Programme the graduates will be able to

PO1	**Relevant knowledge of core concept, principles, themes, terminology and classified system in the biology and microbiology disciplines covered in Zoology**
PO2	**Scientific explanation for the unity and diversity of life, genetical and heredity concepts of life in the earth and analyze this with developmental stages of animal with copious examples.**
PO3	**Keen awareness about the environment, ecological balance and clean green concepts and develop empathy and love towards the society.**
PO4	**Quantitative, qualitative analysis and interpretation of biological data synthesis of information from the database.**
PO 5	**Skills in designing and carryout the research projects using appropriate biological techniques and approaches**
PO6	**Clear knowledge about the function of physiological system of animals at cell and molecular level and their biological concepts.**
PO7	**Gain knowledge of agro based small scale industries like sericulture, fish farming, poultry farming and vermicompost production to aim at self-reliance.**

P.G DEPARTMENT OF ZOOLOGY
OUTCOME BASED EDUCATION
ACADEMIC STRUCTURE IN AUTONOMY
CHOICE BASED CREDIT SYSTEM (CBCS)
Effect from the academic year 2022-23 onwards

S.NO	Course code	COURSE TITLE	Lecture/ Practical (Hours /week)	Duration of exam (hours)	Max Marks			Credit points
					Internal	External	Total	
SEMESTER I								
1		Core I - Cell & Molecular Biology	6	3	25	75	100	5
2		Core II - Environmental biology	6	3	25	75	100	5
3		Core III –Molecules of life	6	3	25	75	100	5
4		Core Practical I - Cell & Molecular Biology, Environmental biology & Molecules of life.	6	3	40	60	100	4
5		Elective I -Structure and Function of Invertebrates/ Comparative anatomy of chordates	6	3	25	75	100	4
TOTAL			**30**					**23**
SEMESTER II								
1		Core IV –Molecular Genetics	6	3	25	75	100	5
2		Core V – Embryology	6	3	25	75	100	5
3		Core VI –Applied Microbiology	6	3	25	75	100	5
4		Practical II –Molecular Genetics, Embryology and Applied Microbiology	6	3	40	60	100	4
5		Elective II - Biological Techniques/ Economic Zoology	6	3	25	75	100	4
TOTAL			**30**					**23**

S.NO	Course code	COURSE TITLE	Lecture/ Practical (Hours /week)	Duration of exam	Max Marks			Credit points
					Internal	External	Total	
SEMESTER III								
1		Core VII - Human Physiology	6	3	25	75	100	5
2		Core VIII –Applied Sericulture	6	3	25	75	100	5
3		Core IX – Animal Biotechnology	6	3	25	75	100	5
4		Core Practical III - Human Physiology, Applied Sericulture & Animal Biotechnology	6	3	40	60	100	4
5		Elective III - Biostatistics & Bioinformatics/ Ornamental Fish Culture	6	3	25	75	100	4
TOTAL			**30**					**23**
SEMESTER IV								
1		Core X – Immunology	6	3	25	75	100	5
2		Core XI –Organic Evolution	6	3	25	75	100	5
3		Core Practical IV – Immunology & Evolution	6	3	40	60	100	3
4.		Elective IV - Poultry farming/ Nutrition and Dietetics	6	3	25	75	100	4
5		Project	6	---	25	75	100	4
TOTAL			**30**					**21**

Total Credits: 90
Total Marks: 2000

P.G DEPARTMENT OF ZOOLOGY
OUTCOME BASED EDUCATION
ACADEMIC STRUCTURE IN AUTONOMY
CHOICE BASED CREDIT SYSTEM (CBCS)
Effect from the academic year 2022-23 onwards

INTERNAL QUESTION PATTERN

Section	Pattern	Marks	Total
A	1&2 Either or Pattern	2x 5	10
B	3&4 Either or Pattern	2x 10	20
		TOTAL	30

COMPONENTS OF INTERNAL ASSESSMENT

Components	Calculation		Marks
Test I	30/2	15+15	
Test II	30/2	2	15
Assignment			5
Seminar			5
TOTAL INTERNAL MARKS			25

EXTERNAL QUESTION PATTERN

Section	Pattern	Marks	Total
A	1-5 Either or Pattern	5x5	25
B	6-10 Either or Pattern	5x10	50
		TOTAL	75

EQUAL WEIGHTAGE TO BE GIVEN TO ALL THE FIVE UNITS

PROGRAMME CODE	**PGZOOA**	**PROGRAMME**	**M.Sc.,ZOOLOGY**
COURSE CODE		**BATCH**	**2022-2024**
HOURS	**6 Hrs/Week**	**SEMESTER**	**I**
CREDITS	**5**	**COURSE TITLE**	**COREI:CELL AND MOLECULAR BIOLOGY**

COURSEOBJECTIVE

- To understand techniques of Microscopes
- To emphasize Cell as the structural and functional unit
- To understand Heredity and Variations
- To discuss the gene regulation in Prokaryotes and Eukaryotes.
- To analyze cell death, cancer and organisms that cause Cancer.

UNIT	CONTENT	HRS
I	**Microscopy and Prokaryotes** Microscopy: Principles and applications - Electron Microscope (TEM), Phase Contrast Microscope, Confocal and Fluorescent Microscope. Prokaryotic cells- *E.coli*, Cyanobacteria and Mycoplasma. Biomembrane**:** Structure, Celladhesion–Intercellular Junction and function.	**15**
II	**Structure and functions of Cell organelles** Structure and functions of Ribosomes, Mitochondria,Centrioles and Peroxisomes & Glyoxisomes. Nucleus: Structure and function, organization of Nucleosome, Euchromatin and Heterochromatin. Chromosomes - Ultrastructure and functions, Giant Chromosomes- Polytene and Lamp brush.	**15**
III	**Nucleic acids, Cell cycle and Cell division** DNA: Denaturation and Renaturation. Replication - Semi-Conservative method - experimental evidence, Enzymology of Replication, Bi-directional Replication, Rolling Circle Replication. DNA damage and repair mechanisms. Types of RNA-mRNA, rRNA, tRNA and ssRNA-Structure and functions. Cell Division and Cell Cycle: Mitosis, Meiosis, Steps in Cell cycle and Control of Cell Cycle.	**20**
IV	**Protein Synthesis** Protein synthesis – Transcription in Prokaryotes and Eukaryotes, Mechanism of Transcription - Initiation, Elongation, and Termination. Transcription factors - Zinc fingers and Leucine zippers. Translation **–** Initiation of Protein Synthesis - activation of Amino acids, Aminoacylation of tRNA, Elongation and Termination of Polypeptide chain. Enzymes and factors involved in Protein Synthesis, RNA Processing-capping, Polyadenylation, splicing, introns and exons.	**20**
V	**Regulation of Gene expression, Cancer and Apoptosis** Regulation of Gene expression - Lac operon - Components, Repressor mechanism. Ara Operon- Arabinose metabolism in E. coli. Cancer – Types and Properties, Oncogenes and Tumour Suppressor Gene, Genetics of Cancer, Nanotechnology and Cancer. Biology of Aging-Apoptosis-Definition, Mechanism and Significance.	**20**
	TOTAL CONTACT HOURS	**90**

BLOOM'S MAPPING							
PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	S	S	S	S	S	M	M
CO2	S	S	S	M	S	S	M
CO3	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	M

REFERENCE BOOKS

1. De RobertiesE.D.P and E.M.F.DeRoberties 2011.Cell and Molecular Biology. 8th edition. B.I. Publicatons Pvt. Ltd., India
2. Powar,C.B.2010. CellBiology 3rd Edition, Himalayas Publishing House, Bombay.
3. Lewis J Kleinsmith and Valerie MKish.1988. Principles of CellBiology, Harper and Row Publication, New York.
4. PrakashS.Lohar,2009,Cell and Molecular Biology, MJP Publishers. Chennai
5. Lodish, Berk, Zipursky, Matsudara, Baltimoreand Darnell.1999.Molecular Cell Biology, Fourth Edition, W.H.Freeman and Company, Newyork.
6. Gupta M.L andJangir M.L.2009.Cell Biology: Fundamentals and Application, Agrobios Publishers, Jodhpur.
7.Frifelder, D. 2000. Molecular Biology 2nd edition. Narosa Publishing House, New Delhi.
8.KarpG.2013.Cell and Molecular Biology Concepts and Experiments. JohnWiley & Sons,Inc.

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1. https://nptel.ac.in/courses/102/106/102106025/
2. https://nptel.ac.in/courses/102/103/102103012/
3.https://swayam.gov.in/nd2
4.https://nptel.ac.in/courses/102/104/102104059

COURSEOUTCOME(CO)		
K2	**CO1**	Understand techniques of Microscopes.
K2	**CO2**	Learn the structure and functions of Cell organelles.
K3	**CO3**	Understand the role of membranes in Cell communication.
K4	**CO4**	Know about Gene organization, expression& regulation.
K4	**CO5**	Know about Cell cycle, Cancer and its causes.

S-Strong; H-High; M-Medium; L-Low

PROGRAMMECODE	**PGZOOA**	**PROGRAMME**	**M.Sc., ZOOLOGY**
COURSECODE		**BATCH**	**2022-2024**
HOURS	**6 Hrs/Week**	**SEMESTER**	**I**
CREDITS	**5**	**COURSETITLE**	**COREII: ENVIRONMENTAL BIOLOGY**

COURSEOBJECTIVE

- To understand the key aspects of Ecology, Impact of Pollution and Biodiversity conservation for Sustainable Development.
- To comprehend the relationship occurs between the Organisms
- To understand the Population, Community Ecology and function of Ecosystems
- To list biotic and abiotic factors that affect, the distribution, dispersal and behavior of organisms.
- To describe the structure and function of ecological systems and explain how ecological systems work at different spatial and temporal scales.

UNIT	CONTENT	HRS
I	**Introduction** Scope importance and need for Public Awareness. Ecosystem-Concept, types- Terrestrial and Aquatic Ecosystems, Pond is an example for typical Aquatic ecosystem: Components Biotic and Abiotic and functional aspects of Ecosystem- flow of Energy, Productivity, Food chain, Food webs, Ecological Pyramid. Matter in ecosystem (biogeochemical cycles)- Types of Nutrient cycles – Gaseous Cycle - Water, Carbon, and Nitrogen.	20
II	**Population and Community Ecology** Population characteristics- Population size, Age structure, Natality, Mortality, Biotic Potential and Dispersion. Fluctuation & Regulation Characteristics of a Community, structure/stratification, Niche - habitat niche, Trophic niche and multifactor Niche Ecotone and Edge Effect, Ecological Indicator. Ecological Succession and Climax stage.	15
III	**Resources and Energy** Renewable resources – Solar energy, Biogas, Wind energy, Ocean energy and Geothermal energy. Petro plants for future fuel and Bio energy from waste. Non-Renewable resources - Fossil fuels, Nuclear fuels, Petroleum and Natural gas	15
IV	**Environmental Pollution and Environmental Disaster** Environmental Pollution: Types of Environmental Pollution and their biological effects. Air Pollution, Stone Leprosy in Tajmahal, Bhopal Gas Disaster. Soil Pollution– RRR Concept and Soil waste Management and protective law, water pollution- causes, effects, and control. Minamata disease. Environmental Disaster and Management: Effect of Climate Change, Global Warming, and its effect on living organisms. Tsunami, Cyclone, Earthquake, Flood: Causes, Consequences, Control and Management.	20

V	**Biodiversity Conservation and Management** Concepts of Biodiversity - Need for conservation-Conservation Strategies. In situ Conservation - Protected areas, National parks, Sanctuaries, Biosphere Reserves, Sacred groves – Ex situ Conservation - Seed Banks, Gene banks- Sthalavrikshas . Germplasm Conservation. Endangered animals, Endemism and Red data Book-Environmental Protection Act (1986)- Forest conservation Act (1980)-Biodiversity Act, 2002. Remote sensing and GIS: Methods and Applications in Environmental Management.	**20**
TOTALCONTACTHOURS		**90**

REFERENCEBOOKS

1. Odum, E.P. and Barrett, G.W.(2005)Fundamental of Ecology.5th Ed.,Cengage Learning India. New Delhi.
2. Primark R.B.,(2000) A Primer of Conservation Biology.2nd Ed., Sinauer Associates.
3. Kormondy, E.J.(1996) Concepts of Ecology. 4th Ed., PHI Cengage Learning India, New Delhi).
4. Peter J.R., Stephan,L.W., Paule.H., Ceche.S.& Beverly.(2008) Ecology. Cengage learning India, New Delhi.
5. Wright, R.T.(2008)Environmental Science, 10th Ed., Pearson Education, New Delhi.
6. Smith T.M.& Smith R.L.(2008)Elements of Ecology. 6thEd.,Pears on Education, New Delhi.
7. Turk A. &Turk J.(1993) Environmental Science. 4thEd., Saunders.
8. Odum, E. P. & Barrett, G.W.(2005)Fundamentals of Ecology. 5th Ed., Cengage Learning India. New Delhi).

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2. https://www.hzu.edu.in/bed/E%20V%20S.pdf
3. http://assets.cambridge.org/97805217/87277/excerpt/9780521787277_excerpt.pdf

COURSE OUTCOME(CO)		
K2	**CO1**	Introduce the basic concepts of Ecology.
K2	**CO2**	Focus on population and Community Ecology.
K3	**CO3**	Illustrate the different types of Resources.
K4	**CO4**	To comprehend Environmental pollution and their impact on the environment.
K4	**CO5**	To know about the Environmental Disaster and Management strategies. Analyze causes of Climatic change and its effect.

BLOOM'S MAPPING							
PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	H	M	L	M	L	M	S
CO2	M	S	L	H	M	L	H
CO3	H	L	M	H	L	S	M
CO4	H	L	M	S	L	M	H
CO5	S	H	L	M	L	M	S

S-Strong; H-High; M-Medium; L-Low

PROGRAMMECODE	**PGZOOA**	**PROGRAMME**	**M.Sc., ZOOLOGY**
COURSECODE		**BATCH**	**2022-2024**
HOURS	**6 Hrs/Week**	**SEMESTER**	**I**
CREDITS	**5**	**COURSETITLE**	**COREIII: MOLECULES OF LIFE**

COURSEOBJECTIVE

- To acquire knowledge about the Macromolecules.
- To analyze and apply Biochemical aspects in day to day life.
- To know Biochemistry as a vital branch of Biology.

UNIT	CONTENT	HRS
I	**Introduction of Atoms** Structure of Atoms, Molecules, Chemical bond. Stabilizing interaction: Vander walls & Electrostatic. Water: Structure - Thermal and Solvent Properties Dissociation of weak acid-Henderson and Hassel Bach equation, Reaction Kinetics and Thermodynamics. pH and Buffer system in Human Biology.	15
II	**Carbohydrates** Carbohydrates: Classification, Structure, Properties and Biological importance of Monosaccharide, Oligosaccharides and Polysaccharide with three example each. Metabolism and its regulation with Energetic (Glycolysis, Krebs's cycle, Gluconeogenesis, Glycogenolysis Oxidative Phosphorylation, Electron Transport system and HMP Shunt).	20
III	**Protein& Amino acids** Covalent properties of Protein: Structure and properties and classification of Amino acids. Protein Primary, Secondary, Tertiary and Quaternary structure, Ramachandra Plot. Hemoglobin subunits, Co-operativity, Hill co-efficient. Catabolic phase of Amino acids: Oxidative Deamination, Transamination, Decarboxylation, and Transmethylation.	15
IV	**Lipid** Fatty acids: Structure, Nomenclature, Acyl glycerides, Phospholipids, Sphingolipids, Glycolipids and Lipoproteins. Terpenoids and Sterols: Structure, Properties and Function. Function of Lipids and Signal Transducing molecules. Oxidation of odd chain and even chain Fatty acids. Biosynthesis of fatty acids and Cholesterol - utilization of Ketone bodies.	20
V	**Nucleic acid and Enzymes** Nucleic acid structure: Duplex Stability Hybridization, RNA structure, Metabolism of Nucleic acids, modified Nucleosides, properties of Polynucleotides, Secondary and Tertiary structure. DNA and RNA Helical geometrics (A-Z) banding, deformation. Enzymes: Classification, Properties, Biological functions, Enzyme mechanism - Coenzymes Cofactors and MM equation. Phenol and Alkaloids- Structure, Biological Properties, and function. Chemistry of Hormones, Mechanism of Protein of Steroid Hormones.	20
TOTAL CONTACT HOURS		**90**

REFERENC EBOOKS

1.Conn, E. E.,P.K. Stump f, G.BrueningandR.H.Doi,1999.OutlineofBiochemistry,JohnWiley& Sons Inc., New York.
2. Deb, A.C. 2011. Fundamentals of Biochemistry, 10th Edition, New Central Book Agency Pvt. Ltd., Kolkata.
3. Jain, J.L., Sunjay Jain and NitinJain.2010.Fundamentals of Biochemistry, Fifth Edition, S. Chand and Company Ltd, New Delhi. 5
4. Morris, J.G. 1974. A Biologist's physical chemistry. II edition. Edward Arnold – A division of Holder and Stoughton, London.
5. Nelson,D.L.,andM.M.Cox,2010,Lehninger Principles of Biochemistry,5thedition,Worth Publishers, New York.
6. Ramarao, A.V.S.S. and Suryalakshmi, A 2009. Textbook of Biochemistry for Medical Students, 11th UVS Publishers Distributors Pvt. Ltd., New Delhi.
7. Stryer,L.,2000.Fourth edition Biochemistry, W.H. Freeman and Company, New York.
8. Emil.Smith Rober.L. Hill, Principles of Biochemistry Mammalian Biochemistry,VIIEd

E.Reference

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2.https://swayam.gov.in/nd1_noc20_cy10/preview
3.https://www.mooc-list.com/course/biochemistry-biomolecules-methods-and-mechanisms-edx

COURSE OUTCOME(CO)		
K2	**CO1**	To understand the structural organization and functions of Biomolecules.
K2	**CO2**	To be able to explain the specificity of Enzymes (biochemical catalysts),and the chemistry involved in Enzyme action.
K3	**CO3**	To understand the principles of Bioenergetics and Enzyme catalysis.
K4	**CO4**	Tobeabletoexplainhowthemetabolismoforganiccompoundsleadsultimatelytothe generation of large quantities of ATP.
K4	**CO5**	To understand the types, structure, biochemical properties and functions of Hormones and Vitamins.

BLOOM'S MAPPING							
PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	S	M	H	H	S	S	S
CO2	H	S	M	M	S	H	H
CO3	S	H	S	M	S	H	L
CO4	S	L	S	M	H	M	M
CO5	H	S	H	L	M	M	S

S-Strong; H-High; M-Medium; L-Low

PROGRAMMECODE	**PGZOOA**	**PROGRAMME**	**M.Sc., ZOOLOGY**
COURSECODE		**BATCH**	**2022-2024**
HOURS	**6 Hrs/Week**	**SEMESTER**	**I**
CREDITS	**4**	**COURSETITLE**	**COREPRACTICALI: CELL & MOLECULAR BIOLOGY, ENVIRONMENTAL BIOLOGY AND MOLECULES OF LIFE**

COURSEOBJECTIVE

- To analysis the cellular components.
- Impart practical knowledge on biochemical analysis.
- To know about the environment.

SUBJECT	CONTENT	HRS
CELL & MOLECULAR BIOLOGY	Microscopy: Optical and Phase Contrast Microscope Micrometry-Measurement of cells using Ocular and Stage micrometers - Length and Width Counting of blood cells in Human blood-R. B. C and W.B.C Identification of mitotic stages in Onion root tip. Identification of meiotic stages in *Tradescantia* Observation of Giant chromosome in *Chironomus* larva.(Visual Aid / Virtual Dissection) Observation of osmosis in Onion epidermal cells(Demonstration only)	**30**
ENVIRONMENTAL BIOLOGY	Estimation of primary productivity by using Aquatic plants –Light and Dark bottle method. Analysis of Water samples- Estimation of dissolved Carbon di oxide, Carbonate and Bicarbonate. Analysis of Soil Samples-Determination of Soil moisture, Soil Texture, Humus and Chloride. Measurement of biodiversity – Alpha and Beta diversity Indices. Pollution bioindicators – Chironomus larva, Mosquito larva, Leech, Pila and Tilapia.	**30**
MOLECULES OF LIFE	Effect of temperature on salivary Amylase activity –Determination of Q_{10}. Effect of pH on salivary Amylase activity. Effect of Enzyme Concentration on Salivary Amylase activity Influence of substrate concentration on Salivary Amylase activity Paper Chromatography – Ascending and Circular chromatography Column Chromatography–Separation of pigments from varied leaves or flowers Gel Electrophoresis–(Demonstration only) Quantitative and qualitative estimation- Estimation of Carbohydrates, Proteins (Lowery *et al.*,) and Lipids from fresh tissues - Standard graphs.	**30**
TOTAL CONTACT HOURS		**90**

COURSE OUTCOME(CO)	
CO1	To apply modern tools in Cell and Molecular Analysis.
CO2	To validate metabolic and Microbial studies
CO3	To keep in mind the Environmental Assessment Strategies and Management systems.
CO4	To remember the Biochemical activity at Cellular level.
CO5	To comprehend the methodologies of Biochemistry.

BLOOM'S MAPPING							
PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	S	S	H	H	S	L	H
CO2	S	H	M	M	H	L	M
CO3	S	H	M	M	L	M	L
CO4	S	H	M	M	M	M	L
CO5	H	L	S	L	H	L	M

S-Strong; H-High; M-Medium; L-Low

PROGRAMMECODE	**PGZOOA**	**PROGRAMME**	**M.Sc., ZOOLOGY**
COURSECODE		**BATCH**	**2022-2024**
HOURS	**6 Hrs/Week**	**SEMESTER**	**I**
CREDITS	**4**	**COURSETITLE**	**ELECTIVEI: STRUCTURE & FUNCTION OF INVERTEBRATES**

COURSEOBJECTIVE

- To understand the principles of animal classification and the salient features of Invertebrates.
- To know the economic importance of Invertebrates.
- To enable the students to understand the classification of animals.
- To acquire the knowledge about Invertebrates and their diversity.

UNIT	CONTENT	HRS
I	**Principle of Animal taxonomy** Species concept; International Code of Zoological Nomenclature - Taxonomic Procedures. New trends in Taxonomy - Animal collection, Handling and Preservation. Organization of Coelom – Acoelomates – Pseudocoelomates- Coelomates: Protostomia and Deuterostomia.	**20**
II	**Locomotion** Pseudopodia - Flagella and ciliary movement in protozoa - Hydrostatic movement in Coelenterata, Annelida and Echinodermata. Nutrition and Digestion Patterns of Feeding and Digestion in lower Metazoan - Filter feeding in Polychaeta, Mollusca and Echinodermata.	**15**
III	**Respiration and Excretion** Organs of Respiration: Gills, Lungs, and Trachea-Respiratory pigments - Mechanism of Respiration. Excretion – Organs of Excretion- Coelom, Coelomoducts, Nephridia and Malphighian tubules - Mechanisms of excretion.	**15**
IV	**Nervous System** Primitive nervous system: Coelenterata and Echinodermata - Advanced nervous system: Annelida, Arthropoda (crustacean and insecta) and Mollusca (cephalopoda) Trends in neural evolution.	**20**
V	**Invertebrata Larvae** Larval forms of free-living Invertebrates-Larval forms of Parasites-Strategies and Evolutionary significance of Larval forms. Minor Phyla (Structural features and affinity) – Concept and significance- Organization and general characters.	**20**
	TOTAL CONTACT HOURS	**90**

REFERENC E BOOKS

1.Hyman,L.H. The in vertebrates. Vol.l Protozoa through Ctenophora, McGraw Hill Co., New York.

2.Barrington, E.J.W. Invertebrate structure, and function. Thomas Nelson and Sons Ltd., London3.Jagerstein,G.Evolution of Metazo an life cycle, Academic Press, NewYork &London.

4. Hyman, L.H. The Invertebrates. Vol.2. McGraw Hill Co., New York.

5. Hyman,L.H.The Invertebrates.Vol.8.McGrawHillCo.,NewYork,Barnes,

6. R.D. Invertebrate Zoology, III edition. W.B. Saunders Co.,

7. Russel-Hunter, W.D. A biology of higher Invertebrates, the Macmillan Co. Ltd., London

8.Hyman,L.H.The Invertebrate smaller coelomate groups, Vol.V.Mc Graw Hill Co., New York.

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11.Parker,T,J.,Haswell, W.A.Text Book of Zoology, Macmillan Co., London.

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1. https://nptel.ac.in/courses/102/106/102106035/
2. https://biologydictionary.net/invertebrate
3. http://rcastilho.pt/DA/ewExternalFiles/Invertebrates_Cap_33_Cambell.pdf
4. file:///C:/Users/ACER/Downloads/invertebrates_3-4_unit_guide%20(1).pdf

COURSE OUTCOME(CO)		
K3	**CO1**	Under stood the Classification and General characteristics Phylogeny of Invertebrates.
K3	**CO2**	Describe important Biological processes in Invertebrates.
K3	**CO3**	Describe common and distinctive features of Invertebrate organisms.
K4	**CO4**	Gain knowledge about Locomotion, Digestion, Respiration and. Excretion
K5	**CO5**	Explain Phylogenetic relationships between the Phyla covered.

BLOOM'SMAPPING

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	H	M	L	L	H	S
CO2	S	H	M	L	L	M	S
CO3	S	H	M	L	L	S	H
CO4	S	H	M	L	L	M	H
CO5	H	M	L	S	S	L	M

S-Strong; H-High; M-Medium; L-Low

PROGRAMMECODE	**PGZOOA**	**PROGRAMME**	**M.Sc., ZOOLOGY**
COURSE CODE		**BATCH**	**2022-2024**
HOURS	**6 Hrs/Week**	**SEMESTER**	**I**
CREDITS	**4**	**COURSE TITLE**	**ELECTIVEI: COMPARATIVE ANATOMY OF CHORDATES**

COURSE OBJECTIVE

❖

UNIT	CONTENT	HRS
I	**Origin of Chordata** Concept of Protochordate - The nature of Vertebrate Morphology–Definition, scope, and relation to other disciplines – Importance of the study of Vertebrate Morphology.	**20**
II	**Origin and Classification of Vertebrates** Vertebrate integument and its derivatives - Development, general Structure and Functions of Skin and its derivatives - Glands, Scales, Horns, Claws, Nail, Hoofs, Feathers and Hairs.	**15**
III	**General plan of Circulation in Various groups** Blood - Evolution of Heart - Evolution of Aortic arches and Portal systems – Respiratory system –Characters of respiratory tissue - Internal and external respiration - Comparative account of Respiratory Organs.	**15**
IV	**Skeletal system** Form, function, body size and Skeletal elements of the body - Comparative account Of Jaw Suspensorium, Vertebral column - Limbs and Girdles - Evolution of Urinogenital system in Vertebrate series.	**20**
V	**Sense organs** Simple receptors - Organs of Olfaction, Taste, and Hearing - Lateral line system – Electroreception-Nervous system-Comparative anatomy of the Brain in relation to its functions .Comparative anatomy of Spinal cord–Nerves-Cranial, Peripheral and Autonomous nervous system.	**20**
TOTAL CONTACT HOURS		**90**

REFERENCE BOOKS

1.Alexander, R.M. The Chordata. Cambridge University Press, London.
2. Barrigton,E.J.W.The Biology of Hemichordata and Protochordata. Oliver and Boyd, Edinbourgh.
3. Bournr,G.H. The structure and function of nervous tissue. Acadamic Press, NewYork
4. Carter,G.S. Structure and habit in vertebrate evolution–Sedgwick and Jackson, London.
5. Eecles,J.C. The understanding of the brain. Mc Gram Hill Co., New York and London.

E.Reference

1.https://nptel.ac.in/courses/102/106/102106035/
2.http://assets.vmou.ac.in/MZO06.pd

COURSEOUTCOME(CO)		
K3	**CO1**	Under stood the Classification and General characteristics Phylogeny of Chordates.
K3	**CO2**	Describe important biological processes in Vertebrates.
K3	**CO3**	Describe common and distinctive features of Vertebrate organisms.
K4	**CO4**	Gain knowledge about Locomotion, Digestion, Excretion and Osmoregulation, Respiration.
K5	**CO5**	Explain Phylogenetic relationships between the phyla covered.

BLOOM'S MAPPING							
PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	S	S	M	H	M	S	M
CO2	S	S	H	M	M	S	M
CO3	S	S	H	M	M	S	L
CO4	S	M	S	M	M	S	M
CO5	S	M	M	M	L	M	S

S-Strong; H-High; M-Medium; L-Low

PROGRAMMECODE	**PGZOOA**	**PROGRAMME**	**M.Sc., ZOOLOGY**
COURSECODE		**BATCH**	**2022-2024**
HOURS	**6 Hrs/Week**	**SEMESTER**	**II**
CREDITS	**5**	**COURSETITLE**	**COREIV: MOLECULAR GENETICS**

COURSEOBJECTIVE

- To understand the inheritance of Genetic characters.
- To acquire knowledge on Sex determination, Hardy-Weinberg Law and Mutation.
- To understand the basic concepts of hereditary and Environmental variations.
- To appreciate the mechanism of Allelic and Non-allelic interaction.

UNIT	CONTENT	HRS
I	**Basics of Genetics** Fine structure of genes-Interaction of Genes- Epistasis, Genes and Environment, Lethality, Meiotic drive, Pleiotropism, Polygenic Inheritance, Extra Chromosomal Inheritance.	15
II	**Linkage and Molecular markers** Linkage - Types, Factor affecting linkage, Molecular mechanism- Crossing over – Molecular mechanism - Chromosome Mapping: Two factor crosses, three factor crosses, Interference, QTL mapping. Transposable genetic elements in Prokaryotes: IS elements, Eukaryotes: Yeast TY element.	15
III	**Chromosome and Genetic disorder** Evolution of Sex chromosomes, Dosage compensation - X inactivation. Genomic imprinting Human Genetics: Normal Human Karyotype - Variations in Karyotypes (autosomal and sex chromosomal, structural, and numerical) with special reference toclassicalSyndromesinman(Klinefelter's,syndromeTurnersyndromeandDown syndrome) -Inherited disorders – Sickle cell anemia, Thalassemia. Mechanism of chromosomal breakage -Genetic changes in Neoplasia in man.	20
IV	**Gene expression and Applied genetics** Regulation of Gene expression-Attenuation and Anti-termination. Applied Genetics – Pedigree chart. Application of genetics in Crime and Law - DNA fingerprinting, Genetic basis of intelligence. Genetic Counselling - Objectives, ethics and principles. Methods of Counseling for Point Mutation, Structural and Chromosomal disorders.	20
V	**Population Genetics** Genetic structure of Population- Gene pool, Genotype frequency, Allelic frequency, Kinds of selection, Fisher' theorem, Genetic variability, Canalization, Genetic load, Genetic death. Hardy-Weinberg law, Conservation of Gene Frequency, Co-Dominance and Dominance in natural population. Changes in Gene frequency, Mutation, Fitness, Genetic drift, Migration, Selection, Inbreeding depression.	20
TOTAL CONTACT HOURS		**90**

REFERENCE BOOKS

1. Eldon John Gardner et al., (1991) Principles of Principles of Genetics, VIII Edition Johnwiley and sons. Inc, New york.
2. W.Strickberger,(1976),Genetics,IIIEdition,MacmillanPublishingCo.,Newyork.
3. Williumd.Stansfield,(1969),TheoryandProblemsofGenetics,McCraw-HillBookCompany, (1968) Newyork.
4. Mckusick,V.A.,Human Genetics, Prentice-Hall of India Private Limited, Newyork.
5. Lewin.,(1999)Genes, VIEdition., Oxford University Press, Oxford.
6. D.PeterSnustad,MichaelJ. Simmons,PrinciplesofGenetics,7thEdition,JohnWiley&Sons, Inc. 2015.
7. D. Peter Snustad, Michael J. Simmons Principles of Genetics 7th Edition. John Wiley & Sons Ltd. New York. 2015.
8. BenjaminLewin,GenesIX,OxfordUniversityPress,NewYork.2008.

E.REFERENCES

1. https://swayam.gov.in/nd2_cec20_bt17/preview
2. https://nptel.ac.in/courses/102/104/102104052/

COURSE OUTCOME(CO)		
K1	**CO1**	Mendelian Genetics, their principles and Gene interaction will be taught.
K2	**CO2**	To learn about Chromosomes in Linkage and Crossing over.
K3	**CO3**	To know the Genetic Disorders and Diseases.
K4	**CO4**	Know about the basics of Population genetics.
K5	**CO5**	To explore the Applications of Genetics.

BLOOM'S MAPPING							
PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	S	M	M	H	S	L	M
CO2	H	H	M	H	H	L	H
CO3	S	S	H	M	L	M	H
CO4	S	M	S	M	M	M	S
CO5	S	L	M	H	H	L	M

S-Strong; H-High; M-Medium; L-Low

PROGRAMMECODE	**PGZOOA**	**PROGRAMME**	**M.Sc., ZOOLOGY**
COURSECODE		**BATCH**	**2022-2024**
HOURS	**6 Hrs/Week**	**SEMESTER**	**II**
CREDITS	**5**	**COURSE TITLE**	**COREV: EMBRYOLOGY**

COURSE OBJECTIVE

- Embryological processes of different organisms are described, and developmental patterns are well explained.
- To understand the basic principles of genetic growth and development tin animals.
- Toacquireknowledgeontheroleofgenesinthegonadandembryonicdevelopmentin animal
- To imparting knowledge on various aspects and concepts in Ontogenetic development in animals.
- To know about the process of human development.

UNIT	CONTENT	HRS
I	**Gametogenesis** Origin of Primordial germ cells–Spermatogenesis– Formation of Spermatid S permiogenesis – Oogenesis – Proliferative phase – Growthphase – Previtellogenesis – Vitellogenesis – Maturation phase. Types of Egg–Hormonal regulation– Gene expression and control.	15
II	**Fertilization and Cleavage** Process and mechanism – Activation of Egg and Sperm – Essence of Activation program - Ionic fluxes and Inhibition of Polyspermy – changes in Egg organization after Fertilization–Theories of fertilization– signification of fertilization. Cleavage: Types–Pattern and Molecular changes during Cleavage – maternal cleavage– Maternal gene action and morphogenetic movements– Cells adhesion molecules and pattern formation. Cleavage in Amphioxus, Frog, Chick, and Mammal.	15
III	**Gastrulation and Organogenesis** The Fatmap, Morphogenetic Movement–Metabolism during Gastrulation -Activity of gene during gastrulation.- Gastrulation in Amphioxus, Frog, Chick, and Mammal. Formation of Primary organ Rudiments – Methods of Organ formation – Tubulation. Development of Eye, Brain, Ear and heart in frog.	20
IV	**Induction and Differentiation** Spemann's Primary Organizer – Analysis of nature of Induction – Emission of inducing substances by Natural Inductions – chemical analysis of inducing substances –Mechanism of action of inducing substances -Theories of Organizer. Differentiation:Types–factorscausingDifferentiation–dedifferentiation– transdifferentiation. Post embryonic events: Metamorphosis in Amphibians and Insects. Regeneration in Planarian and Amphibian.	15
V	**Experimental Embryology** Nucleo cytoplasmic interaction – nuclear transplantation – Birth control measures –infertility - Artificial insemination – Intra cervical, Intra vaginal, and Intra uterine insemination. *In- vitro* fertilization techniques.	25

	Applied Embryology Human development – Hormonal regulation of Reproductive Cycle – Ovulation – organizationofSpermandEgg–Fertilization–Blastocystformation–Implantation– Pregnancy changes and Foetal growth – multiple and abnormal Pregnancies – Paturition – Birth defects – Teratogenesis.	
TOTAL CONTACT HOURS		**90**

REFERENCE BOOKS

1. B.IBalinsky(1981),AnIntroductiontoEmbryology,VEd.,SaundersCollegePublishing, Newyork.
2. Dr.R.C.Delela and R.Verma., (1986 – 87), A Text book of Chordate Embryology, V Ed., Jai Prakashnathan & co, Meerut city, India.
3. P.S.VermaandV.K.Agarwal (1975) Chordate Embryology XEd., S.Chand & Co Pvt Ltd, Ramnager, New Delhi.
4. BradleyM.Pattern.,(1957),EarlyEmbryologyoftheChickIVEd.,McGraw–Hill Book company, Network.
5. Bradley M. Pattern., (1948), Embryology of the pig III Ed., McGraw – Hill Book Company Network

E. REFERENCES

1.https://nptel.ac.in/courses/102/106/102106084/]

COURSE OUTCOME(CO)		
K1	**CO1**	Explain specialized cells of gonads and the process of Gametogenesis
K2	**CO2**	Compare fertilization process, events during and affect Fertilization and Cleavage patterns in selected animals.
K3	**CO3**	Comprehend the process of Gastrulation and Organogenesis.
K4	**CO4**	AnalyzetheprocessofinductionanddifferentiationinEmbryonicDevelopment.
K5	**CO5**	Acquire better understanding of scientific reasoning exhibited in experimental Life science.

BLOOM'S MAPPING							
PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	S	S	H	H	H	H	M
CO2	S	H	M	M	M	M	S
CO3	S	H	M	M	L	H	L
CO4	S	H	M	M	L	H	L
CO5	S	H	M	L	M	S	H

S-Strong; H-High; M-Medium; L-Low

PROGRAMMECODE	**PGZOOA**	**PROGRAMME**	**M.Sc., ZOOLOGY**
COURSECODE		**BATCH**	**2022-2024**
HOURS	**6 Hrs/Week**	**SEMESTER**	**II**
CREDITS	**5**	**COURSETITLE**	**COREVI:APPLIED MICROBIOLOGY**

COURSE OBJECTIVE

- To study the basic of Microbiology and it uses
- To acquire the knowledge on Microbes and Fermentation.
- To know about microbes in Food Production.
- To understand the significance of the Microbes in medical field.

UNIT	CONTENT	HRS
I	**History and Microbial Growth** History and application of Microbiology Methods in Microbiology-Microbial Cultures, Methods of Culturing Anaerobes, Methods of Isolation and maintenance of Pure Culture, Culture characteristics, Microbial growth. Measurement of Bacterial growth- measurement of cell mass, measurement of cell number factors affecting bacterial growth. Staining Techniques- Simple, differential and Gram Staining.	**25**
II	**Fermentors and Fermentative microbes** HistoryandDesignofFermenters,BasicfunctionsofFermenters,typesofFermenters, Construction of Fermenters, Design and Operation, Use of computer in fermenter, Achievement and maintenance of Aseptic conditions, Aseptic operation and Contaminant, Batch Fermentation, Fed Batch Fermentation, Continuous Fermentation, Scale up of Fermentations. Industrial Microbiological processes, Culture Preservation, Criteria for Selection of Microorganisms for Fermentation and Strain improvement.	**20**
III	**Industrial Microbiology** Alcohol production– Ethanol Production of Acids - Lactic acid and Vinegar, Production of Antibiotics–Penicillin and Streptomycin Production of Amino acid - L-lysine, L- glutamic acid. ProductionandApplicationofMicrobialEnzymesandImmobilizationofenzymes.	**20**
IV	**Food Microbiology** Dairy Industry :Dairy Products-Yoghurt, Butter Milk, Butter and Cheese. Microbial Spoilage of Food- Food infection and intoxification. Microbial Contamination and Spoilage of Poultry, Fish and Sea Foods. Preservation of Food: Preservative Methods-Physical and Chemical Methods.	**10**
V	**Microbial Analysis of Drinking water and Sewage treatment** Microbial analysis of Drinking water- Test for Coliforms (presumptive, confirmed and completed test). Purification of Water: Sedimentation, Filtration (slow and rapids and filters) and Disinfection. Sewage system and Types: Single Dwelling Knit, Municipal Sewage Treatment- Primary, Secondary and Tertiary treatment.	

(Trickling filters, activated sludge process, oxidation lagoons and Imhoff tank. Nature of Sewage and its Composition-Physical, Chemical and biological properties of Sewage (BOD, COD) etc., **Medical Microbiology** Causative organism, Transmission and Preventive measures of Cholera, Typhoid, Tuberculosis, Leprosy, Syphilis, Chicken pox, Hepatitis - B, Polio, Rabies, Swine flu, Dengue, Chikungunya and Covid-19 and its Variant, Zoonotic diseases and Hospital acquired infection.	**15**
TOTAL CONTACT HOURS	**90**

REFERENC E BOOKS

1. Dr.R.C.Dubey. Dr.D.K.Maheswari, (2010), A Textbook of Microbiology, S.Chand & CO Ramnager, New Delhi.
2. Ronald,M.Atlas,(1988),MicrobiologyMacmillanpublishingcompanyNewyork.
3. J.Pelczar,D,Reid.(1984),TATAMcGrawHillpublishingcompanyLtd.Newyork.
4. Samuel Baron, Medical Microbiology, IIEd., Wesley publishing company, California
5. Presscott - Microbiology.
6. Sathyanarayana-Biotechnology.

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1. https://www.classcentral.com/course/immunologyfundamentalsimmunityb cells-12724
2. https://swayam.gov.in/nd2_cec20_bt05/preview
3. https://www.classcentral.com/course/swayam-immunology

COURSE OUTCOME(CO)		
K2	**CO1**	Gain knowledge in isolation and identification of Microbes.
K3	**CO2**	Exploit Microorganism in Food production.
K3	**CO3**	An overview of the Microbes in medical field.
K4	**CO4**	An understanding of Microbes in sewage treatment.
K5	**CO5**	Illustration of Microbial fermentation.

BLOOM'S MAPPING

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	M	S	S	S	S	M
CO2	M	S	S	S	S	S	S
CO3	S	S	M	S	S	M	S
CO4	S	S	S	S	S	S	S
CO5	S	S	S	M	S	S	M

S-Strong; H-High; M-Medium; L-Low

PROGRAMME CODE	**PGZOOA**	**PROGRAMME**	**M.Sc., ZOOLOGY**
COURSE CODE		**BATCH**	**2022-2024**
HOURS	**6 Hrs/Week**	**SEMESTER**	**II**
CREDITS	**4**	**COURSE TITLE**	**CORE PRACTICAL II: MOLECULAR GENETICS, EMBRYOLOGY AND APPLIED MICROBIOLOGY.**

COURSE OBJECTIVE

- To impart practical knowledge on inheritance of genetic characters.
- To introduce practical knowledge about animal development.
- To study the basic of microbiology and it uses
- To acquire the knowledge on microbes and fermentation.

SUBJECT	CONTENT	HRS
GENETICS	**EXPERIMENT** Mendel's Law of Segregation with Beads of Two different Colours. Mendel's Law of Independent Assortment with Beads of Four different Colours Probability-Tossing of Coins. Correlation of Length and Width of leaves. Observation of Simple Mendelian Traits. **SPOTTER** Chromosomal Disorders in Man – Down's Syndrome, Turner's Syndrome, Klinefelter's Syndrome, Sex Linked Inheritance in Man - Colour Blindness and Haemophilia, Extra Nuclear Inheritance - Kappa Particles in Paramecium - Shell coiling in snail Limnaea, Multiple Alleles - ABO, Rh bloodgroup, Barr body, Twins – Mono and Dizygotic Twins, Pedigree Chart.	30
DEVELOPMENTAL BIOLOGY	**EXPERIMENTS** Early Embryonic development of Frog – Observation of 2 cell, 4 cell, 8 cell, 16 cell, Blastula, Gastrula and Yolk plug stages. Temporary Mounting of Chick Blastoderm Early Hours of Chick development–Observation of various stages 24,48,72 and 96 hrs of chick blastoderm. Induced Ovulation in Frog.(Demonstration only) Effect of Thyroxine Hormone on Amphibian Metamorphosis (Demonstration only) **Spotters:** Types of eggs & sperms. Development of Brain, eye, heart and ear in Frog.	30
APPLIED MICROBIOLOGY	**EXPERIMENT** Sterilization of glassware and media Preparation of Culture media Serial dilution Technique Aseptic transfer of Bacteria Pure culture of Bacteria	30

	EXPERIMENT Preservation and maintenance of Bacterial culture Cultural characteristics of bacteria Wet mount preparation and Hanging Drop technique Microscopic measurement of microbes using Hemocytometer **Spotters:** Hot airoven, Autoclave, Agar Plate, Inoculation needle, Structure of Bacteria, Structure of Virus.	
TOTALCONTACTHOURS		**90**

COURSEOUTCOME(CO)		
K3	**CO1**	To study the Mendelian Experiments.
K3	**CO2**	Basic applications of embryonic development.
K3	**CO3**	To keep in mind the development strategies.
K4	**CO4**	To comprehend embryonic formation stages with suitable example.
K5	**CO5**	Gain knowledge in isolation and identification of microbes.

BLOOM'S MAPPING							
PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	L	M	M	H	S	S	H
CO2	M	M	H	H	S	H	M
CO3	M	M	H	S	S	M	S
CO4	M	H	H	S	S	M	L
CO5	H	S	L	M	H	S	L

S-Strong; H-High; M-Medium; L-Low

PROGRAMME CODE	PGZOOA	PROGRAMME	M.Sc.,ZOOLOGY
COURSE CODE		BATCH	2022-2024
HOURS	6 Hrs/Week	SEMESTER	II
CREDITS	4	COURSE TITLE	ELECTIVEII: BIOLOGICAL TECHNIQUES

COURSEOBJECTIVE

- To understand the principle and applications of the instrument used in biological sciences.
- To adopt and understand the various biological methods used in recent
- Analytical techniques also import knowledge on handling instruments.
- To know the principles of Research design and Thesis writing.

UNIT	CONTENT	HRS
I	**Principle and Applications** Centrifugation - Principle and Applications, types, pH meter. Spectrophotometry - visible and UV spectrophotometry. Atomic absorption Spectrophotometer. Chromatographic techniques – principle and applications of chromatography , types of chromatography and HPLC.	15
II	**Molecular biological methods** Isolation and purification of Nucleicacids and Proteins – Electrophoresis-one-and two-dimensional, PAGE and Isoelectric focusing – MALDI-TOF. Screening of recombination-Detection of Post–TranslationalmodificationsinProteins–RAPID–RFLP–AFLP–Microarray.	15
III	**Histochemical techniques and Immuno techniques** Cryostat and Importance of Enzyme Histochemistry -Detection of molecules in living cells – *insitu* localization–FISHandGISH.Antibodygeneration–detectionofmoleculesusingELISA, RIA, Immunoblot, Immuno fluorescence microscopy, Cytometry – Flow Cytometry.	15
IV	**Biophysical and Radio labeling techniques** Detection and measurement of different types of Radioisotopes – GMcounter, Scintillation Counter, Autoradiography – incorporation of Radioisotopes in Biological tissues and cells – Molecular imaging of Radioactive material-Safety guidelines.	20
V	**Research methods** Objectives –types- significance –Components of Research – Research process – Selection and defining of a Research problem – Sources and Retrieval of information: Journals, Monographs, Books and Computer aided searches – Search Engines-formulatingaResearchHypothesis–Researchdesign:need–featuresofaGooddesign–concepts–Principlesofexperimental design. **Thesis writing** Format of Thesis –preparation of Manuscript and Editing –forms of Presentation of results –Components of discussion – Citing the References –Research papers for Publication – writing a Research proposal – Impact factor – Citation index – Manuscript preparation – IPR and Patenting.	25
TOTAL CONTAC THOURS		**90**

REFERENCE BOOKS

1. Brown, TA(2017) Genecloning and DNA analysis: an introduction, Seventh edn, John Wiley & Sons, USA.
2. KumarP(2016)Fundamentals and techniques of biophysics and molecular biology, pathfinder publications New Delhi.
3. Jayaraman, J – (1972) Laboratory manual in biochemistry New age International Pvt., Ltd.,Publisher, New Delhi.
4. Swargiary,A(2017) Biological Tools and techniques Kalyani Publications New Delhi.
5. Kothari,C.R. Research Metholodology:MethodsandTechniques2nd Ed.,NewageInternational Publishers, New Delhi, 2004.
6. Ramadas.P. and Wilson Aruni, A Research and writing across the disciplines MJP Publishers, Chennai 2009.

E. REFERENCES

https://www.mooc-list.com/course/understanding-research-methods-coursera
https://swayam.gov.in/nd2_ugc19_ge04/preview

COURSE OUTCOME(CO)		
K2	**CO1**	To learn the Procedures, Principles and Applications of various techniques.
K2, K4	**CO2**	Explain the Principles and applications of various Recombinant DNA methods.
K3, K4	**CO3**	Analyze immune techniques of ELISA, RIA, Immuno blotting, Immuno fluorescence Microscopy and Flow Cytometry.
K2	**CO4**	Outline the Biophysical and Radio labeling techniques.
K2, K3	**CO5**	To know the Principles of Research Design and Thesis writing.

BLOOM'S MAPPING							
PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	S	S	H	H	S	L	H
CO2	S	H	M	M	H	L	M
CO3	S	H	M	M	L	M	L
CO4	S	H	M	M	M	M	L
CO5	H	L	S	L	H	L	M

PROGRAMMECODE	**PGZOOA**	**PROGRAMME**	**M.Sc., ZOOLOGY**
COURSECODE		**BATCH**	**2022-2024**
HOURS	**6 Hrs/Week**	**SEMESTER**	**II**
CREDITS	**4**	**COURSE TITLE**	**ELECTIVEII: ECONOMIC ZOOLOGY**

- **COURSEOBJECTIVE**
- To understand the Importance and scope of Aquaculture.
- To gain a knowledge in the Culture of Fishes and its economic importance.
- To understand the preparation of Pond and methods of Fish culture.

UNIT	CONTENT	HRS
I	**Apiculture** Scope of Apiculture. Honeybee – Classification, types of honeybees – *Apis dorsata, Apis cerana, Apis florea, Apis indica* and *Apis mellifera*. Biology of honeybee-External structure, lifecycle. *Apis indica* – Social life of Indian Honeybee. Foraging behavior of Bees, Queen rearing methods. Principals of Bee keeping –Methods of bee keeping in India – Primitives hives – Wall type, Movable type, Bamboo hive. Modern hives – Langstroth hive, Newton hive. Appliances used in Bee keeping. Choice of Bee in Apiculture – Desirable traits for Bee keeping, Poor choice, Good Choice, Best Choice. Economic importance of Bee products –Chemical composition, Nutritive value and Medicinal uses of Honey, Bees Wax and Bee Venom.	**20**
II	**Beneficial and harmful insects** Insect vectors of human diseases. Pests of sugarcane, (*Pyrilla perpusilla*), oil seed (*Achaea janata*) and rice (*Sitophilus oryzae*). **Aquaculture** Scope of Aquaculture- Aquaculture in India –Freshwater Aquaculture –Coastal Aquaculture–Marine Aquaculture– Metahaline Aquaculture –Culture practices in India – World Fisheries – Types of Fisheries – Culture Practices in the World. Industrial fish, Prawn, and Molluscs of India. Apiculture, Sericulture, Lac culture, Carp culture, Pearl culture, Prawn culture.	**15**
III	**Pathology** Fish diseases–Parasitic disease – Protozoan, Viral and Bacterial diseases. Government participation in aquaculture–Entrepreneurship Development in Aquaculture.	**15**
IV	**Applied zoology** Introduction to Poultry farming – construction of poultry house – Rearing of Layers and Broilers. Preparation and methods of Vermicomposting – advantages of Vermicompost.	**20**
V	**Major infectious and Communicable diseases** (Smallpox, Plague, Malaria, Tuberculosis, Cholera and AIDS) their vectors, Pathogens and prevention. Cattle and livestock diseases, their Pathogens (Helminths) and vectors (Ticks, Mites, Tabanus, Stomoxys).	**20**
TOTAL CONTACT HOURS		**90**

REFERENCE BOOKS

1.Ayyar,E.K.andT.N.Ananthakrishnan,2000.ManualofZoologyVol.I&II(Non–
2.ChordataandChordata),S.Viswanathan(PrintersandPublishers)PvtLtd.,Madras.
3.Economic Zoology by Upadhyay and Shukla, Rastogi Publication (2008 ed.).
4.ModernTextbookofZoology,R.L.Kotpal,RastogiPublications(2000),Meeru

COURSE OUTCOME(CO)		
K2	**CO1**	To study the Introductory of aspects of Beneficial insects.
K3	**CO2**	Demonstrate the technical aspects of Aquaculture.
K3	**CO3**	To know the Poultry farming.
K2, K3	**CO4**	To know about the Commercial importance of Zoology.
K2, K3	**CO5**	To elaborate the Diseases of animals.

E. REFERENCES

1. https://swayam.gov.in/nd2_cec20_ge23/preview
2. https://www.classcentral.com/course/swayam-indian-agriculturaldevelopment-14119

BLOOM'S MAPPING							
PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	S	H	M	L	M	M	L
CO2	H	S	L	M	S	L	H
CO3	S	L	M	L	M	M	L
CO4	M	L	S	M	M	H	L
CO5	S	H	M	L	M	M	L

S-Strong; H-High; M-Medium; L-Low

PROGRAMME CODE	**PGZOOA**	**PROGRAMME**	**M.Sc., ZOOLOGY**
COURSE CODE		**BATCH**	**2022-2024**
HOURS	**6 Hrs/Week**	**SEMESTER**	**III**
CREDITS	**5**	**COURSE TITLE**	**COREVII: HUMAN PHYSIOLOGY**

COURSEOBJECTIVE

- To understand the structural organization and functions of different organ systems within the body.
- To impart knowledge of the various metabolic and Physiological mechanisms of the Human body.
- To get thorough knowledge on metabolic pathways of Human Physiology and to apply the knowledge for Biotechnological and Biochemical research.

UNIT	CONTENT	HRS
I	**Nutrition, Digestive system and Absorption** **Nutrition:** Origin of Nutritive type, Nutritional requirement and Feeding pattern. **Digestion and Absorption**: Structure and function of Digestive system- Buccal glands, Gastric, Intestinal glands, Liver and their function. Mechanical and Chemical Digestion of food, Buccal, Gastric and Intestinal Digestion-Important Digestive enzyme for Carbohydrate, Protein, Lipids. Hormonal control of secretion and enzymes in Gastrointestinal tract, Symptoms andcauses of peptic ulcer.	15
II	**Respiratory System and Circulatory System** **Respiratory system:** Respiratory Organs, Transport of gases, Exchange of gases, Neural and chemical regulation of Respiration. Rate and control of Respiration- BMR, RQ, Anoxia and Hypoxia. Respiratory disorder - Asthma. Oxygen as a limiting factor in the environment. **Circulation system**: Structure and functions of Human Heart- Hemodynamic principle-Cardiac cycle. Symptoms and causes of stroke- coronary heart disease- Hypertension-Myocardial infarction (Heart attack).	15
III	**Excretion, Osmoregulation and Thermoregulation** **Excretion :** Organs of Excretion, structure of Nephron- Renal function-mechanism of Urine Formation- Hormonal control- urinary bladder- Regulation of Water Balance- Regulation of Acid-Base Balance**.** **Osmoregulation:** Maintaining Water and Electrolyte Balance – Living in Isosmotic, Hypoosmotic, Hyperosmotic and Terrestrial Environments. Hormonal regulation of Water and Electrolytes. **Thermoregulation:** Temperature and rate of biological activities, Temperature Compensation in Poikilotherms and Homeotherms.	20
IV	**Muscular System and Nervous System** Structure of Skeletal, Non-striated and Cardiac Muscles -Physical, Chemical properties of Muscles-Physiology of Skeletal Muscle Contraction, Energetics of Muscular Contraction-Electro Kinetic theory and Sliding Filament theory.	20

	Nervous System Structure and function of Neuron- Reflex action - Reflex arc - Chemical co-ordination - Structure of Synapse – Synaptic transmission – Neuromuscular Junction, Neurotransmitters - Symptoms and causes of Alzheimer's Disease.	
V	**Sense Organs and Hormones** **Sense organs** Photoreceptor: Eye-Anatomy and Physiology of Vision, Symptoms and causes of Myopic Retinopathy and Glaucoma Phonoreceptor: Ear-Structure and functions, Symptoms and causes of– Cholesteatoma and Otitis media. **Hormones:** Endocrine glands and their secretion: Structure and functions of Pituitary, Thyroid, Parathyroid, Pancreas, Islets of Langerhans-Type II Diabetes, Adrenal glands, and Reproductive Hormones – Male and Female hormones.	**20**
TOTAL CONTACT HOURS		**90**

REFERENCE BOOKS

1. William S. Hoar, General and Comparative Physiology Prentice - Hall of India (private) Ltd, New Delhi.
2. C.Ladd. Prosser, Frank A. Brown, Comparative Animal Physiology, II Ed., W.B. Saunders company, London.
3. Kunt sachmidt- Nielsen, (2013), Animal physiology: Adaptation and Environment- III Ed., Press syndicate of the University of Cambridge, London.
4. Elaine,N. Marieb,(2006),HumanAnatomy & physiology, VIEd., Dorling Kindersley (India) Pvt.Ltd.,
5. Christopher D. Moyes & Patricia M.Schulte., (2007), Principles of Animal Physiology,

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1. https://www.classcentral.com/course/swayam-animal-physiology-12894
2. https://swayam.gov.in/nd1_noc20_bt42/preview
3.https://www.classcentral.com/course/edx-respiration-in-the-human-body3050.
4. https;//swayam.gov.in/nd1_noc20_hs33/preview

COURSEOUTCOME(CO)		
K1	**CO1**	To gain knowledge of the feeding mechanism and Digestion.
K2	**CO2**	To know about the regulation of Heartbeat and Blood Pressure, Neural and Chemical Regulation of Respiration and transfer of air.
K3	**CO3**	To perceive the knowledge about Kidney function and pattern of Excretion.
K4	**CO4**	To under stand the concept of about Muscular system and theories related to it.
K5	**CO5**	To understand about the Nervous system and its working mechanism, Sense organ and Hormones.

PROGRAMMECODE	**PGZOOA**	**PROGRAMME**	**M.Sc., ZOOLOGY**
COURSECODE		**BATCH**	**2022-2024**
HOURS	**6 Hrs/Week**	**SEMESTER**	**III**
CREDITS	**5**	**COURSETITLE**	**COREVIII : APPLIED SERICULTURE**

COURSEOBJECTIVE

- To know about Importance of soils with reference to Mulberry cultivation.
- To enable the students to learn the basics of Silkworm rearing techniques.
- To understand the economic importance of Sericulture.
- To obtain knowledge on the basic facts about Grainages.
- To know about the Silk reeling and Cocoon marketing.

UNIT	CONTENT	HRS
I	**General aspects of Silkworms** Introduction to Sericulture-Origin and history of Sericulture-Silk Road, spread of Sericulture to Europe, South Korea, Japan, India and other countries. Taxonomy-Systemic position of Mulberry Silkworm. Types of Silk worms - Mulberry and Non- Mulberry Silkworms. General aspects of Non-Mulberry Silkworms –Eri, Muga, Tasar. Races of mulberry silkworms.	15
II	**Moriculture** Importance of soils with reference to mulberry cultivation, Propagation of Mulberry, Planting systems, Manures and Fertilizers, Micronutrients; Composting and Vermicomposting. Irrigation, Leaf harvesting, Classification of Mulberry, Popular varieties in India, Draught Resistant varieties, Pests and diseases of Mulberry – Fungal, Bacterial and Viral diseases and their control. Pests of Mulberry.	15
III	**Silkworm Biology** Life cycle of *Bombyx mori*; Morphology of Egg, Larva, Pupa and Adult. Sexual Dimorphism in Larva, Pupa and Adult. Morphology and Anatomy of Digestive system and Silk gland of Silkworm larva**.** Morphology and Anatomy of Reproductive systems of Silk moth. Diseases of Silkworm : Viral, Bacterial, Fungal and Protozoan diseases and Pests of Silkworm larva.	15
IV	**Grainage Technology** General account on Grainages, Breeding stations(P4,P3,P2andP1). **Grainages:** Procedures in Grainages – Rearing of Parental Seed cocoon, Seed Cocoon Preservation, Separation of Sexes, Moth Emergence, Pairing and Ovipositions, Methods of Industrial Egg Production, Mother Moth Examination. Voltinism, Diapausing and Non – diapausing egg, Artificial hatching of Diapause eggs – Hot Acid treatment and Cold Acid treatment and Acid treatment after Chilling and Incubation.	20

V	**Silkworm Rearing and Reeling** Rearing House and Rearing Appliances. Rearing operations, Rearing methods. Identification, and separation of defective and diseased Cocoons. Harvest, Storage and Transport of cocoons and Cocoon Marketing. Steps to be followed before Reeling-Stifling, Drying and Storing, Cooking and Boiling, Deflossing and Ridding. Process of Reeling- Reeling appliances, Methods of reeling - Charka, Cottage basin and Filatures, Re-reeling, Lacing Skeining, Booking, Raw Silk testing and uses of Silk.	**25**
TOTAL CONTACT HOURS		**90**

REFERENCE BOOKS

1.Ganga G. and J. Sulochana Chetiy, 2005. An Introduction to Sericulture 2nd Edition, Oxford and IBH Publishers & Co. New Delhi.
2. S.Krishnaswamy *et al.*, (1972), Sericulture manual -1 (Mulberry cultivation), Manual-2 (Silkworm rearing) and Manual-3 (Silk reeling), Food and Agriculture Organization of the United Nations, Rome.
3. Hiroo, Sibuya Ku., (1975) Textbook of Tropical Sericulture, Japan Overseas Corporation, Volunteers 4-2, 24, Tokyo, Japan.
4. Venkata Narasaiah (2003),Sericulture in India, Ashish Publishing House, New Delhi.
5. Silk Production, (2004), Dr.N.G.Ojha, Dr.P.N.Panday APH Publishing Corporation, New Delhi.

E REFERENCE

1. https://swayam.gov.in/nd2_cec20_ge23/preview
2. https://www.classcentral.com/course/swayam-indian-agriculturaldevelopment-14119

COURSE OUTCOME (CO)		
K3	**CO1**	Students learn the basics of Silkworm rearing techniques.
K3	**CO2**	Understand the economic importance of Sericulture.
K3	**CO3**	Obtain knowledge on the basic facts about Grainages.
K4	**CO4**	Know about the Silk reeling and Cocoon marketing.
K5	**CO5**	Know about Importance of Soils with reference to Mulberry cultivation.

BLOOM'S MAPPING

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	H	M	L	L	H	S
CO2	S	H	M	L	L	M	S
CO3	S	H	M	L	L	S	H
CO4	S	H	M	L	L	M	H
CO5	H	M	L	S	S	L	M

S-Strong; H-High; M-Medium; L-Low

PROGRAMMECODE	**PGZOOA**	**PROGRAMME**	**M.Sc., ZOOLOGY**
COURSECODE		**BATCH**	**2022-2024**
HOURS	**6 Hrs/Week**	**SEMESTER**	**III**
CREDITS	**5**	**COURSETITLE**	**COREIX: ANIMAL BIOTECHNOLOGY**

COURSEOBJECTIVE

- Facilitate young women at all levels to develop as outstanding scholars/ teachers/ Career women/ Entrepreneurs and responsible leaders by applying their knowledge in life sciences for betterment of society**.**
- To know the recent trends in Biotechnology and make the students to understand the integral application of biotechnology in various fields.

UNIT	CONTENT	HRS
I	**Introduction and Recombinant DNA technology** Brief history and scope of biotechnology-Restriction Endonucleus – DNA ligase – linkers and adaptors. Vectors: Plasmids, Phagemids, Cosmids, Bacterio phages, Artificial chromosomes (BACs, PACs, YACs, MACs and HACs) – Shuttle vectors-Animal viral vectors.	15
II	**Techniques of Genetic Engineering** Gene transfer methods: Transfection, Liposome mediated, Particle bombardment, Virus vector method and microinjection. Gene cloning strategies: Construction and screening of Genomic library and c DNA library. Blotting techniques- Southern, Northern and Western blotting. Human Genome Project.	15
III	**Animal Biotechnology** Animal Cell Culture: Culture media, Culture techniques, Primary and Secondary culture. Stem Cell biology : Embryonic and Adult stem cells. Organ culture: tissue engineering-artificial skin and cartilages. Transgenic animals: Cattle and Gene knockout Mice and its applications. Cloning mechanism - Dolly. Hybridoma technology – Monoclonal Antibody production.	15
IV	**Plant Biotechnology** Basic concept in Plant Tissue Culture – Micro propagation – Protoplast culture and Somatic hybridization – Haploid plant production – Gene transfer in plants – Vector mediated (Ti plasmid) and Virus mediated. Transgenic plants - Resistance to Biotic Stress (insect and microbes) and Abiotic stress (phosphinothicin and glyphosate)- Improvement of Crop yield, Quality and Nutrition.	15
V	**Pharmaceutical and Industrial Biotechnology** Gene therapy – *Ex-vio* and *In-vivo*.DNA Finger Printing in Forensics. Pharmaceutical products: Insulin, Interferon, Blood products. Vaccine: Malarial vaccine, Recombinant hepatitis B vaccine, FMD and DNA Vaccine. Bio process and Enzyme technology – Biosensors. Biomass production – Citric acid, Alcohol and Bio- fuel (hydrogen and methane). **Environmental Biotechnology and Society** Environmental Pollution – Biotechnological methods for monitoring and management. Biodegradation and Bioremediation – Xenobiotics – genetically	30

	Engineered microorganisms in bioremediation. Intellectual property right sand patent. Bio safety and Bioethics.	
TOTAL CONTACT HOURS		**90**

REFERENCE BOOKS

1. R.C. Dubey, (1993), A Textbook of Biotechnology. IIIEd.,S.Chand& Company Ltd.
2. H.K.Das, (2004), Textbook of biotechnology IIIEd., WileyIndia(P) Ltd.
3. U.Satyanarayana,(2005), Biotechnology, Arun abhasen(P) Ltd.
4. MohanP.Arora,(2003), Biotechnology, IEd., Himalaya Publishing house.
5. V.Kumaresan,(1994), Biotechnology VIEd., -Himalaya Publishing house.

E REFERENCE

1. https://swayam.gov.in/nd1_noc20_bt31/preview
2. https://swayam.gov.in/nd1_noc19_bt33/preview
3. https://swayam.gov.in/nd1_noc19_bt15/preview

COURSE OUTCOME(CO)		
K1, K2	**CO1**	To know about the importance of enzymes, gene transfer methods and techniques in Biotechnology.
K2, K3	**CO2**	Explain the procedures in Animal Cell culture and Applications.
K3, K6	**CO3**	Identify the overall process in Plant tissue culture and Applications.
K3, K4	**CO4**	Analyze the principles in formulating Pharmaceutical industrial products and their applications.
K2, K3	**CO5**	To know the recent trends in Biotechnology and applying their knowledge in life sciences for betterment of Society.

BLOOM'S MAPPING

PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	M	H	L	M	S	H	S
CO2	S	M	S	M	H	M	M
CO3	S	H	H	H	S	L	H
CO4	H	S	M	S	M	M	H
CO5	L	M	S	M	M	S	M

S-Strong; H-High; M-Medium; L-Low

PROGRAMMECODE	**PGZOOA**	**PROGRAMME**	**M.Sc., ZOOLOGY**
COURSECODE		**BATCH**	**2022-2024**
HOURS	**6 Hrs/Week**	**SEMESTER**	**III**
CREDITS	**4**	**COURSETITLE**	**CORE PRACTICAL III: HUMAN PHYSIOLOGY, APPLIED SERICULTURE AND ANIMAL BIOTECHNOLOGY**

COURSEOBJECTIVE

- To study the basis for various systems in the Animal kingdom.
- To gain knowledge on silkworm rearing
- To keep in mind about the basic technologies applied in Biotechnology.

SUBJECT	CONTENT	HRS
HUMAN PHYSIOLOGY	**EXPERIMENTS** Effect of Temperature on Oxygen consumption of Fish & calculation of Q10. Effect of Temperature on Opercular movements of Fish & calculation of Q10. Effect of salinity on Oxygen Consumption of fish. Effect of salinity on Opercular movement of fish. Mounting of Haemin crystals. Blood pressure recording. Estimation of Blood sugar.	**30**
APPLIED SERICULTURE	**DISSECTION AND DISPLAY** Silk gland of Silkworm. **Spotter:** Morphology of Egg, larva. Pupa and adult moth, Mouthparts of Silkworm, Digestive system of Silkworm. Life cycle of Silkworm, Rearing House, Rearing appliances, Egg card, Mountages, Identification of Diseased worms. Identification of Non-Mulberry Silkworm, Reeling appliances: three pan system, Jetteb out, Croissure. Field visit Report	**30**
ANIMAL BIOTECHNOLOGY	**EXPERIMENTS** Extraction of DNA and quantification. Extraction of RNA Agarose gel Electrophoresis. PAGE PCR (Demonstration only). Transgenic techniques-Micro injection and Electroporation (Demonstration only). **Spotters:** pBR322, Animal cloning, Southern blotting, Northern blotting, Colony Hybridization.	**30**
TOTAL CONTACT HOURS		**90**

COURSE OUTCOME(CO)		
K5	**CO1**	To apply functional knowledge on various organs and its status.
K4	**CO2**	To comprehend Physiological activity of organ systems.
K6	**CO3**	To understand the Economic importance of Sericulture.
K5	**CO4**	To gain knowledge on Silkworm rearing techniques.
K5	**CO5**	To analyze the Biotechnological areas.

BLOOM'S MAPPING							
PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	S	M	M	M	L	S	H
CO2	S	M	M	S	M	H	S
CO3	S	M	S	M	M	S	H
CO4	S	M	M	M	M	M	H
CO5	M	S	S	H	M	H	S

S-Strong; H-High; M-Medium; L-Low

PROGRAMME CODE	**PGZOOA**	**PROGRAMME**	**M.Sc.,ZOOLOGY**
COURSE CODE		**BATCH**	**2022-2024**
HOURS	**6 Hrs/Week**	**SEMESTER**	**III**
CREDITS	**4**	**COURSE TITLE**	**ELECTIVEIII: BIOSTATISTICS & BIOINFORMATICS**

COURSEOBJECTIVE

- To understand the role of Biostatistics is tremendous in all branches of lifescience.
- It serves as the base to analyses and understand the Sample outcomes with Comparative and Probability-based studies.
- To study the application of Biostatistics for testing Hypothesis.
- Computational analysis of Genes and Proteins.

UNIT	CONTENT	HRS
I	**Measures of Central Tendency** Introduction to Biostatistics: Collection of data - methods of data collection, Measures of central tendency- Mean Median, Mode- for individual observations, discrete series and continuous series.	15
II	**Measures of Dispersion** Measures of Dispersion : Range, Standard deviation, Standard error, Variance& Coefficient of Variation and Mean Deviation. **Statistical Methods** Probability: Basic concepts, types, Addition & Multiplication Theorems of Probability (only), Probability distribution–Normal, Binomial & Poisson distribution.	20
III	**Testing of Hypothesis** Testing of Hypothesis, Student"t"test, Chi–square test & their properties and uses. Correlation – Definition, Types & Methods of studying Correlation, Regression Analysis –Methods, Estimation of unknown value from known value – One way ANOVA.	15
IV	**Genomics and Proteomics** Importance of Databases, Nucleic acid Sequence Databases EMBL, GenBank, Protein Sequence Databases SWISSPROT, TrEMBL and PIR, Structure of Databases, Uses of Databases. Objectives of Biological Databases Protein structures – Primary, Secondary& Tertiary – Protein Structure Predictions: a). Ab – intio modeling and Identification of Conserved and Variable regions. b) Comparative modeling–Homology modeling and Protein threading.	20
V	**Sequence Alignment** Algorithm, goals and types of Alignment, Study of seminaries, Scoring mutation, Depletion and Substitutions, Sequence Alignment methods. Pairwise sequence alignment – Dot matrix, Dynamic Programming & word or K tuple, FASTA, BLAST. Multiple Sequence Alignment- Dynamic programming, progressive and Iterative method CLASTAL W.	20

	Pharmacogenomics Molecular Docking: Protein – Protein Docking, Drug designing – Objectives, Rational Drug design – examples of Designed drugs – Drug development – Pharmacogenomics – uses of Pharmacogenomics.	
TOTAL CONTAC THOURS		**90**

REFERENCEBOOKS

1. S.P.Gupta - Statistical Methods
2. NormanT.J.Bailey – Statistical Methods in Biology
3. S.S.Palanisamy & M.Manoharan – Statistical Methods for Biologists
4. Biostatistics–P.Ramakrishnan (2010) SarasPublication.
5. Daniel, W.W, (1978 – Biostastics. A foundation for Analysis in the Health Sciences.(Wiley Seriesin Probability and Statistics) 9th Ed., New York.
6. Developing Bioinformatics & Computer Skills – Cynthia Gibas & Per Jamback

E REFERENCE

1. https://swayam.gov.in/nd2_ugc19_ma03/preview
2. http://rijuebookbiostatistics.blogspot.com/2008/06/biostatisticsebooks-free-download.html

COURSEOUTCOME(CO)		
K1	**CO1**	Understand the basic concept and application of Biostatistics and Bioinformatics.
K2	**CO2**	Know about the methods of Data collection techniques.
K3	**CO3**	Know about measures of Central tendency and Dispersion.
K4	**CO4**	To communicate the results of Statistical analysis accurately and effectively
K5	**CO5**	Caters the immediate needs in Pharmaceutical industries.

PROGRAMMECODE	**PGZOOA**	**PROGRAMME**	**M.Sc., ZOOLOGY**
COURSE CODE		**BATCH**	**2022-2024**
HOURS	**6 Hrs/Week**	**SEMESTER**	**III**
CREDITS	**4**	**COURSE TITLE**	**ELECTIVEIII: ORNAMENTAL FISH CULTURE**

COURSEOBJECTIVE

- To learn the art of Fish keeping and setting up a Fishtank.
- Learn the technique of Aquarium management.
- To gain knowledge about Taxonomy and Biology of fishes.
- To understand the collection and preparation of live and prepared feed.
- To gain knowledge about the common diseases of Ornamental fishes and their control.

UNIT	CONTENT	HRS
I	**Aquarium Tank** Construction of Home Aquarium: Design and Construction of Aquarium tank, Accessories used in Aquarium, (aerators, filters, types of filters and hand nets), Setting up of Aquarium tank (gravels / pepples, plants, ornamental objects and fishes, selection of species). Aquarium plants and its importance.	20
II	**Aquarium Management** Cleaningtheaquarium-MaintenanceofWaterquality–Temperature,Waterchange, Ammonia,O_2/C_{O2},Waterhardness.ControlofSnailandControlofalgalgrowthin Aquariumtank.	15
III	**Taxonomy and Biology** Taxonomy and Biology of popular Ornamental fishes: Live-bearers (Ovo-viviparous)-Red Swordtail (*Labeo bicolor*), Platy (*Xiphophorus maculatus*), Guppy (*Poecilia reticulata*) and Molly (*Black molly*). Egg layers (Oviparous) - Gold fish (*Carassius auratus*),Siamese fighting fish(*Beta splendens*), Gourami(*Tricho gaster leeri*), Angel fish (*Pterophyllum scalare)*, Oscar(*Austronotus ocellatus*)and Koi carp (*Cyprinus carpio carpio*). Breeding and Spawning of Live bearers and Egg layers. Induced breeding and Production of Monosex fish.	15
IV	**Nutrition** Nutritional requirements of Ornamental fishes – Different kinds of feeds - Artificial and Live food. Culture of live food organisms - Infusorians, Rotifers, Cladocerans, Brineshrimp, Chironomus and Tubifex. Artificial feed- feed formulation. Balanced diets for Aquarium fishes	20
V	**Diseases of Ornamental Fishes** Common diseases of aquarium fishes- Protozoan, Fungal, Bacterial and Nutritional diseases. Their diagnosis and treatment, Problems of over feeding. Commercially important Marine Ornamental fishes. Purchase and Transport of Ornamental fishes. Use of Sedatives. Entrepreneurship development in Ornamental fish culture.	20
TOTAL CONTACT HOURS		**90**

REFERENCEBOOKS

1. J.D. Jameson and R.Santhanam (1996) - Manual of Ornamental fishes and Farming Technologies - Fisheries College and Research Institute TANVASU, Tuticorin
2. Meenakshi Jindal, N.K.Yadava and R.K.Gupta (2000) - Freshwater Ornamental Fishes, Mangalam Publications, Delhi.
3. V.K.Venkatataramanietal.,(2004).BiodiversityandStockAssessmentofMarineOrnamental fishes. Department of Fisheries Biology and Capture Fisheries, Fisheries College and Research Institute, TANVASU, Tuticorin.
4. A.D.Dholakia,(2009)-OrnamentalFishCultureandAquariumManagement,DayaPublishing House, Delhi
5. H.S.JagtapandS.N.MukherjeeandS.S.Nanware,(2009)-P.racticalManualofPisciculture and Aquarium Keeping, Daya Publishing House, New Delhi.

E REFERENCE

1. https://swayam.gov.in/nd2_cec20_ge23/preview
2. https://www.classcentral.com/course/swayam-indian-agriculturaldevelopment-14119

COURSEOUTCOME(CO)		
K2	**CO1**	To study the various Ornamental fishes and its culture
K3	**CO2**	To recollect the general Ornamental fishes
K3	**CO3**	To understand the scope of Fish culture
K4	**CO4**	To apply the ornamental Fish culture methods for Aquarium maintenance
K5	**CO5**	To review the different types of Cultural methods

BLOOM'S MAPPING

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	L	S	H	S	S	H
CO2	L	M	H	H	H	S	M
CO3	H	M	M	M	H	S	H
CO4	H	H	M	L	H	S	H
CO5	S	S	M	S	M	H	L

S-Strong; H-High; M-Medium; L-Low

PROGRAMME CODE	**PGZOOA**	**PROGRAMME**	**M.Sc., ZOOLOGY**
COURSE CODE		**BATCH**	**2022-2024**
HOURS	**6 Hrs/Week**	**SEMESTER**	**IV**
CREDITS	**5**	**COURSE TITLE**	**COREX: IMMUNOLOGY**

COURSE OBJECTIVE

- To acquire knowledge on Immunity and Immune system.
- To understand the significance of the organs and cells and their functions during the Immune reactions.

UNIT	CONTENT	HRS
I	**Cells and Organs of Immune system** Immunity-Innate immunity, acquired immunity, Cell mediated immunity and Antibody mediated immunity. Lymphoid Organ-Primary and secondary. Proliferation and Maturation of Lymphocytes -B cell receptor-BCR Complex, MechanismofBcellactivation,Tcell-typesTcellreceptorTCRcomplex,Activation of T cell, Mechanism of T cell activation, Costimulation of T cell, Cytokine, and Cytokine receptors.	**15**
II	**Antigen and Antibody** Antigen- Characteristics, Types, Cross reactivity, Heptane, Adjuvant, Immunogenicity and Antigenicity. Antibody - distribution and production of antibodies. molecular structure of antibodies, Ig isotypes, biological properties, Ig super family, Metagene organization of Ig genes, Gene rearrangement, Mechanism of Variable region rearrangement, Allelic exclusion, Generation of Antibody diversity, Strength of AntigenAntibodyinteraction,Affinity,Avidity,Crossreactivity,Precipitation,and Agglutination reaction.	**15**
III	**Immune Response Complex and MHC** Antibody mediated–Neutralization, Aponisation, Complement fixation and Antibody dependent Cell Mediated Cytotoxicity- Cell Mediated Cytotoxic T cell response and Natural Killer cell activity. Regulation of Immune response-Age, Nutrition and other factors. Immune tolerance. Complement system-Classical and Alternate pathways. Complement fixation. MHC-General organization, Inheritance molecules, Immune responsiveness and MHC disease susceptibility.	**20**
IV	**Hypersensitivity, Autoimmunity and Immune Deficiency Disorders** Gell and Coombs Classification-Hypersensitive reaction-IgE mediated (Type I) Antibody mediated (Type II), Immune Complex mediated (Type III) Cell mediated (TypeIV),Organ specific and Systemic Auto Immune diseases – Mechanism and treatment of Auto Immune Disease. Primary and Secondary Immunodeficiency diseases.	**20**
V	**Transplantation, Tumour and Reproductive Immunology** Immunological basis of Graft rejection, Clinical manifestation of Graft rejection-General and Specific Immune Suppressive Therapy- Clinical Transplantation, Tumours of Immune system, Tumour antigen, Immune respone to Tumour-Tumour evasion of the Immune system-cancer Immunotherapy.	

	Reproductive Immunology - Cytokines TH1/TH2, MHC, NK cells, Macrophages, Regulatory Tr cell. Role of IDO, Spontaneous abortion and immune disorders, other infections, age and chronic diseases	**20**
TOTAL CONTACT HOURS		**90**

REFERENCEBOOKS

Kuby.,(1992),Immunology, IVEd.,- W.H.Freemanandcompany.
Evan M.Roitt., (1988), Essentials Immunology- VIEd., ELBS imprint. Shailendra Kumar Sinha., (2009) Serial dilution Technique.
Immunology and Medical Zoology-IEd., -Oxford Book Company.
Davidmale.,(2008),Immunology VIIEd., Elsevier Health sciences.
I.Kannan., (2007), Immunology I Ed., - MJP Publisher.
Punt. J,Stranford.S,Jones.P andOwen.J2018-Kubyimmunology,8th Ediition, W.H.Freeman and Co.,Newyork.

E REFERENCE

1. https://www.classcentral.com/course/immunologyfundamentalsimmunitybcells-12724
2. https://swayam.gov.in/nd2_cec20_bt05/preview
3. https://www.classcentral.com/course/swayam-immunology

COURSEOUTCOME(CO)		
K1	**CO1**	An overview of the Immune system, Principles of Innate and Adaptive Immunity.
K2	**CO2**	An Understanding of Antigen recognition by Immune cells.
K2	**CO3**	Illustration of Antigen processing and presentation to T Lymphocytes by Antigen presenting cells and understanding the role of MHC Complex.
K5	**CO4**	Description of consequence of Immunodeficiency leading to diseases such as Inherited Acquired Immunodeficiency disease, Hypersensitivity diseases, Autoimmunity and Transplant rejection.
K5	**CO5**	An understanding of manipulation of Immune responses for the benefit of mankind - Vaccines

BLOOM'S MAPPING

PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	S	S	H	S	M	S	L
CO2	S	H	M	S	H	H	M
CO3	S	S	S	M	S	H	L
CO4	S	M	S	M	S	H	M
CO5	H	M	L	H	L	M	H

S-Strong; H-High; M-Medium; L-Low

PROGRAMME CODE	**PGZOOA**	**PROGRAMME**	**M.Sc., ZOOLOGY**
COURSECODE		**BATCH**	**2022-2024**
HOURS	**6 Hrs/Week**	**SEMESTER**	**IV**
CREDITS	**5**	**COURSE TITLE**	**COREXI: ORGANIC EVOLUTION**

COURSEOBJECTIVE

- To understand the unity of life with the rich diversity of organisms and their ecological and evolutionary significance.
- To know about the basic concepts of Evolution.

UNIT	CONTENT	HRS
I	**Evidences and Theories** Origin of Life - Introduction, Abiogenesis, Biogenesis, Cosmozoic theory, Theory of eternity of present conditions, Theory of Catastrophism and origin of life and organic Evolution. Evidences for Evolution from Comparative Anatomy, Physiology and Biochemistry. Geological Time Scale. Theories of Evolution-Darwinism, Lamarckism and Modern Synthetic Theory.	**20**
II	**MutationandIsolating Mechanism** Genetic basis of Variation – Elemental forces of Evolution: Mutation – Neutralist Hypothesis - Hybridization and Evolution. Role of Isolating mechanism -Premating, Postmating and Multiple Isolating Barriers and evolution of Reproductive Barrier.	**15**
III	**Speciation & Adaptive Radiation** Speciation-Structure of Species - Genetics and ecology of Speciation - MAYR's Founder principle - Modes of speciation – Allopatric, Sympatric, Quantum and Parapatic Speciation.	**15**
IV	**Molecular Evolution** EvolutionofHemoglobinandCytochrome,HistoryofHumanEvolution-Biological Evolution of Human – the earnest hominins - Bipedal and Brain size of the early Human Evolution.	**15**
V	**Fossils, Rates of Evolution and Evolution of Human** Origin of Higher categories- Simpson's definition. Evidence from Fossil Record-Polyploidy-Modesoforiginofhighertaxa-MosaicMode-Connectinglink-Quantum evolution- Simpson's adaptive grid. Cultural Evolution: Osteo - donto - Keratic culture -Pebble tool culture-Paleolithic culture-Neolithic Culture-Language, Self-Awareness and Death Awareness. Sociobiology-Selfish gene-Altruism-Kin selection.	**25**
TOTAL CONTACT HOURS		**90**

REFERENCEBOOKS

1. G.LStebbins,1979, Process of Organic Evolution, Prentice Hall India, NewDelhi.
2. Paul AmosMoody,1978, Introduction to Evolution, Kalyani Publishers,NewDelhi.
3. The odosius Dobzhansky, FranciscoJ.Ayala, G.LedyardStebbins, JamesW.Valentine,1973,
4. Evolution,Surject Publications, NewDelhi.E.PeterVolpe,1989.
5. Understanding Evolution, Universal Book Stall, New Delhi.
6. Mohan,P.Arrora,2000, Organic Evolution, Himalayan Publishing House, NewDelhi.
7.Monroe.W.Strickberger,2000 Evolution, Jones & Barlett publishers, Boston.

E REFERENCE

1. https://www.classcentral.com/course/early-vertebrate-evolution-5417
2. https://www.classcentral.com/course/molecularevolution-3555

COURSEOUTCOME(CO)		
K1	**CO1**	To understand the concepts of origin of life and their evolution in different Past Eras and to understand different theories of Evolutionary concepts.
K2	**CO2**	To know well about the Adaptations, Adaptive Radiations with appropriate examples.
K3	**CO3**	To Understand the genetic basis of Evolution, Human Karyo typing and Speciation.
K4	**CO4**	To have an knowledge about Molecular Evolution.
K5	**CO5**	To have a knowledge about the origin and evolution of Human and milestones of Cultural evolution.

BLOOM'S MAPPING							
PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	S	S	H	H	H	H	S
CO2	S	S	H	H	H	M	M
CO3	S	S	H	M	M	L	H
CO4	S	H	H	M	M	M	H
CO5	M	H	L	M	H	L	M

S-Strong; H-High; M-Medium; L-Low

PROGRAMME CODE	**PGZOOA**	**PROGRAMME**	**M.Sc.,ZOOLOGY**
COURSE CODE		**BATCH**	**2022-2024**
HOURS	**6 Hrs/Week**	**SEMESTER**	**IV**
CREDITS	**3**	**COURSE TITLE**	**CORE PRACTICAL IV: IMMUNOLOGY & ORGANIC EVOLUTION**

COURSEOBJECTIVE

- ❖ An Understanding of antigen recognition by Immune cells.
- ❖ An overview of the Immune system, principles of Innate and Adaptive immunity.
- ❖ To understand the concepts of Evolution through experiments.

SUBJECT	CONTENT	HRS
IMMUNOLOGY	Dissection and Display of Lymphoid organs. Ouchterlony technique (Demonstration only). ABO Blood Grouping and Rh typing. Serum separation. VDRL Structure of Immunoglobulins, Types of Bleeding, Cells of Immune system. Visit to Immunology Lab.	**45**
ORGANIC EVOLUTION	**Experiments** Variation–Fingerprints. Use of Models to study selection in large and small population and principles of genetic drift. **Spotters** Homologous & Analogous organs, Vestigial organs, Fossils, Embryos of various Vertebrates. Examples of Evolutionary importance – *Peripatus* and *Limulus*. Animals with adaptive coloration - Leaf insect, Stick insect, Chameleon.	
TOTALCONTACTHOURS		**90**

COURSEOUTCOME(CO)		
K3	**CO1**	Understanding the role of MHC Complex.
K3	**CO2**	To understand T Lymphocytes by antigen presenting cells.
K3	**CO3**	Illustration of Antigen processing and presentation.
K4	**CO4**	To understand the Evolution through experiments
K5	**CO5**	Able to perform, analyses and report on experiments and observations in Evolution.

PROGRAMME CODE	**PGZOOA**	**PROGRAMME**	**M.Sc.,ZOOLOGY**
COURSE CODE		**BATCH**	**2022-2024**
HOURS	**6 Hrs/Week**	**SEMESTER**	**IV**
CREDITS	**4**	**COURSE TITLE**	**ELECTIVEIV: POULTRY FARMING**

COURSE OBJECTIVE

- ❖ To develop human resource in Poultry farming.
- ❖ Gain knowledge about various rearing management systems study of Poultry birds
- ❖ It will impart knowledge in Poultry industry, Farming, Breeding, Housing, Nutrition, disease and Management.

UNIT	CONTENT	HRS
I	**Poultry Industry and Biology** History of Poultry industry in India – 5-year plans – NECC – Entrepreneurship – funding agencies – Role of Egg and Meat in Human nutrition. Poultry manure and byproducts. External features – Digestive and Reproductive system – Egg formation Feather sexing – Feather tracts.	15
II	**Breeds of Layers and Common Broilers** Common Poultry birds – choosing commercial laying stock–Egg laying breeders– Leghrons and Anconas; Table breeds or Broilers –Sussex and Darking; Production of commercial laying stock – Pure line strain and Strain crosses, Breed crosses and Inbred crosses; Sexing in one day old chicks – Colour sexing, Vent sexing and Feather sexing.	20
III	**Poultry Housing** Location of the Farm–Construction of Poultrysheds–Poultryhousing–1+3system and its advantages; Deep litter system – Litter Management, Advantages, and disadvantages– Dropping pit, Nest Boxes, Feeder and Waters Cage Rearing for Layers – Californian cages, Feeder, Waterers. Management of Cage birds – Advantages and Disadvantages of Cage rearing.	15
IV	**Poultry Nutrition** Energy – Carbohydrates – Fats – Proteins – Vitamins – Minerals – Feed stuff, Feed formulation – non-nutritive feed additives – feed grinder – homemade mineral mixture of feed for chick – grower – layer – broiler and finisher – Nutrition deficiency Diseases – Vitamin deficiency diseases A, E and D. Essential inorganic elements – Calcium, Phosphorus, Sodium, Potassium, Magnesium, Manganese, and Iodine. Non-nutritive Feed additives.	20
V	**Rearing and Management** Practical aspects of Chick rearing: Brooding Lighting Programme, Debeaking and forced Moulting. Management of Growers, Layers, and Broilers; Seasonal and Intergrated Management of Poultry bird – Summer Management and Winter Management.	20

	Diseases and Control Measures Bacterial (Infectious coryza), Viral (Newcastle, birdflu), Fungal (Mycotoxicosis) and Parasitic (Coccidiosis) – Transmission, Symptoms & Treatment. Vaccination –Antibodies – Nutritional deficiencies.	
TOTAL CONTACT HOURS		**90**

REFERENCEBOOKS

1. Singh,R.A.,2011.Poultry Production.3rd Edition, Kalyani Publishers, New Delhi.
2. Jull,A.,Morely,2007.Succesful Poultry Management.2Edition, Biotech Books, New Delhi.
3. Hurd M. Louis, 2003. Modern Poultry Farming. 1st Edition. International Book Distributing Company, Lucknow.
4.Ensmiger, M.E.,2015.PoultryScience.3rdEdition,International Book Distribution Co., Lucknow, India.
5.Bell,D.Donald and WeaverD WilliamJr.2007.Commercial chicken meat and egg production. 5th Edition. Springer India Pvt. Ltd., Noida.

E REFERENCE

1. https://dahd.nic.in
2. https://ubblab.weebly.com

COURSEOUTCOME(CO)		
K1	**CO1**	Discuss the aspects of Poultry industry and Nutrition
K5	**CO2**	Identify the Indian Exotic breeds, Importance of Layers and Broilers and to evaluate their efficiency.
K3	**CO3**	Use the Poultry equipment for day-to-day activities to be involved in the Farm and explain the Rearing system and use them efficiency.
K1, K3	**CO4**	Compile the source of ingredients for the Poultry feed stuff and formulate homemade feed for Broilers and Layers and Feed additives.
K3	**CO5**	Demonstrate the practical aspects of Chick rearing.

BLOOM'S MAPPING							
PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	S	S	M	L	S	M	H
CO2	H	S	S	M	H	S	M
CO3	S	H	M	M	H	M	H
CO4	M	L	S	M	S	H	L
CO5	S	M	H	S	M	L	M

S-Strong; H-High; M-Medium; L-Low

PROGRAMME CODE	**PGZOOA**	**PROGRAMME**	**M.Sc.,ZOOLOGY**
COURSE CODE		**BATCH**	**2022-2024**
HOURS	**6 Hrs/Week**	**SEMESTER**	**IV**
CREDITS	**4**	**COURSE TITLE**	**ELECTIVE IV: NUTRITION AND DIETETICS**

COURSEOBJECTIVE

- To understand the Nutritive values of various Foods.
- To recollect the concept of Nutritive foods.

UNIT	CONTENT	HRS
I	**Introduction** The scope of Food and Nutrition. Composition of food (Protein–Carbohydrate–Fat-Vitamins and Minerals).	20
II	**Balanced Diet** Measurement of energy and energy values of various food. Nutritional requirements –Children, Adolescence and Oldage. Balanced diet – Foods to Eat and Avoid.	15
III	**Milk and Egg products, Fats and Oils** Milk - Composition, Nutritive value, kinds of Milk, Pasteurization and Homogenization of milk, changes in milk during Heat Processing, Preparation of Cheese and Milk powder. Egg - Structure, Composition, Selection, Nutritive value, uses of Egg in Cookery, methods of Cooking, Foam formation and factors affecting foam formation. Fats and Oils-Types of oils, function of Fats and oils, Shortening effects of oil, Smoking point of oil, Effect of heat on oil absorption and factors affecting absorption of oil.	15
IV	**Vegetables, Fruits and Beverages** Vegetables – Types - importance in the Diet. Fruits – Types - importance in the Diet. Vegetables-Classification, Composition, Nutritive value, Selection and preparation for Cooking, methods and principals involved in Cooking. Fruits -Composition, Nutritive value, changes during ripening, methods and effects of cooking, enzymatic browning. Beverages- Classification, nutritive value and Milk based Beverages.	20
V	**Food Spoilage** Food Poisoning- Food borne diseases & Food adulteration Methods of purification of Potable Water. Food Laws and Regulations in India. FSSAI (Food Safety and Standard Authority of India) – An account	20
	TOTAL CONTACT HOURS	90

REFERENCEBOOKS

1.Anita Tull, (1987) 1st edition. Food and nutrition – Oxford University Press. Cambridge.

2.Srilakshmi,B. (2012)5thedition. Food Science, New age International Publishers, New Delhi. Swaran

3.Pasran Pasricvha, (2000) 1st edition. Count what you eat – NIN – Hyderabad.

4.Tripathy,S.N.(2004)1stedition. Food Biotechnology. Dominant Publishes and distributors, New Delhi. 110002.

E REFERENCE

1.https://guides.emich.edu.

2.libguides.csuchico.edu

COURSEOUTCOME(CO)		
K2	**CO1**	To understand the Energy values of various Foods.
K3	**CO2**	To apply the importance of Food chart.
K5	**CO3**	To analyze the Food deficiency diseases.
K4	**CO4**	To know about the Food borne diseases.
K2	**CO5**	To avoid Malnutrition and FSSAI

BLOOM'S MAPPING							
PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	S	S	M	L	S	M	H
CO2	H	S	S	M	H	S	M
CO3	S	H	M	M	H	M	H
CO4	M	L	S	M	S	H	L
CO5	S	M	H	S	M	L	M

S-Strong; H-High; M-Medium; L-Low

PROGRAMMECODE	**PGZOOA**	**PROGRAMME**	**ZOOLOGY**
COURSECODE		**BATCH**	**2022-2024**
HOURS	**6 Hrs/Week**	**SEMESTER**	**IV**
CREDITS	**4**	**COURSETITLE**	**CORE PROJECT : PROJECT**

COURSEOBJECTIVE

- To investigate the development of student's ability in Research field.
- To develop true research attitude for Rural students.

COURSEOUTCOME(CO)		
K5	**CO1**	To prepare the students for further Research.
K4	**CO2**	Inculcate innovative ideas for modern Science and Technology Development.
K6	**CO3**	Learn to write Research proposals for funding.
K5	**CO4**	To become Technically knowledge students.

BLOOM'S MAPPING							
PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	S	S	H	H	H	H	S
CO2	S	S	H	H	H	M	M
CO3	S	S	H	M	M	L	H
CO4	S	H	H	M	M	M	H
CO5	M	H	L	M	H	L	M

S-Strong; H-High; M-Medium; L-Low