

**GOVERNMENT COLLEGE FOR WOMEN(AUTONOMOUS)**

**KUMBAKONAM-612001.**



**PROGRAMME: M.SC., ZOOLOGY**

**PROGRAMME CODE : PSZO**

**SYLLABUS**

**2021 - 2022 ONWARDS**

## PROGRAMME OUTCOMES & PROGRAMME SPECIFIC OUTCOMES

<b>Programme Outcomes (PO) of M.Sc. Zoology</b>	
PO1	The interest in learning, concepts of life science is imparted
PO2	The analytical, communication and professional skills are developed and improved.
PO3	The technical skills for experimental purposes are improved.
PO4	The ability to adopt the scientific methods and hypothesis testing in designing and execution of experiment is obtained

<b>Programme Specific Outcomes (PSO) of M.Sc. Zoology</b>	
PSO1	Developed understanding of key concepts of biology at biochemical, molecular and cellular level
PSO2	Can observe and understand animal-animal, animal-plant, animal-microbe interactions and their consequences to animals, humans and the environment and its impact on complex evolutionary processes.
PSO3	The principles of Genetics in light of advancements in understanding human genome and genomes of other model organism is strengthened. This enables the students to apply their knowledge in Genetics to understand human traits and genetic disorders.
PSO4	The learning of expression of genome revealing multiple levels of regulation and strategies to manipulate it on enable them to apply the same in the benefit of the mankind.
PSO5	Learning, handling DNA sequence data and its analysis equip the students to get employed in R&D in the industry involved in DNA sequencing services, diagnostics, and microbiome analysis.
PSO6	The understanding of zoological science for its application in medical entomology, agriculture based practices like apiculture, aquaculture, and modern medicine provides employment opportunities and entrepreneurial skills.
PSO7	Development of theoretical and practical knowledge in handling the animals and using them as model organism

**GOVERNMENT COLLEGE FOR WOMEN (AUTONOMOUS) KUMBAKONAM**

**(Curriculum – M.Sc., ZOOLOGY – 2021 - 2022)**

**DEPARTMENT: ZOOLOGY PROGRAMME CODE : PSZO**

Course Type	Course Code	Title of the Course	Hrs/ Week	Credits	Exam Hrs	Marks		
						CI A	ES E	Total
<b>SEMESTER – I</b>								
CC I	P21ZC101	Functional Morphology and Phylogeny of Invertebrates and Chordates	6	5	3	25	75	100
CC II	P21ZC102	Cell and Molecular Biology	5	5	3	25	75	100
CC III	P21ZC103	Genetics	6	5	3	25	75	100
CC IV	P21ZC104P	Practical I	6	3	5	40	60	100
MBEC- I	P21Z1MBE1:1	Fisheries and Aquaculture	5	4	3	25	75	100
	P21Z1MBE1:2	Reproductive Endocrinology						
	P21Z1MBE1:3	Bee keeping						
SEC - I	P21Z1SE1	English Grammar for Communication & Scientific writing	2	2	2	25	75	100
<b>Total</b>			<b>30</b>	<b>24</b>				<b>600</b>

<b>SEMESTER - II</b>									
CC V	P21ZC205	Biochemistry		5	5	3	25	75	100
CC VI	P21ZC206	Animal Physiology		5	5	3	25	75	100
CC VII	P21ZC207	Immunology		5	5	3	25	75	100
CC VIII	P21ZC208P	Practical II		6	3	5	40	60	100
MBEC -II	P21Z2MBE2:1	Entomology		5	4	3	25	75	100
	P21Z2MBE2:2	Computer application in biology							
	P21Z2MBE2:3	Fish processing technology							
EDC	P21Z2ED	Diet for healthy Life		2	2	3	25	75	100
SEC - II	P21Z2SE2	Taxonomy of Fishes	Practical	2	1	2	40	60	100
<b>Total</b>				<b>30</b>	<b>25</b>				<b>700</b>
SSC -I	P212SS1	General Studies for Research Fellowships and Lectureship		-	2	2	-	100	100
NCGPA(Internship)	INT	INTERNSHIP			2		-	-	-

<b>SEMESTER – III</b>								
CC – IX	P21ZC309	Developmental Biology and Evolution	6	5	3	25	75	100
CC – X	P21ZC310	Biotechnology and Bioinformatics	6	5	3	25	75	100
CC – XI	P21ZC311	Microbiology	6	5	3	25	75	100
CC – XII	P21ZC312P	Practical III	6	3	5	40	60	100
MBEC– III	P21Z3MBE3:1	Biostatistics and Research Methodology	6	4	3	25	75	100
	P21Z3MBE3:2	Nutrition & Dietics						
	P21Z3MBE3:3	Dairy Science						
<b>Total</b>			<b>30</b>	<b>22</b>				<b>500</b>
SSC- II	P21Z3SS2	Life Sciences for SET/CSIR Examination		2	2	-	100	100
<b>SEMESTER – IV</b>								
CC – XIII	P21ZC413	Ecology and Ethology	6	5	3	25	75	100
CC – XIV	P21ZC414P	Practical - IV	6	4	5	40	60	100
CC – XV (Project )	P21ZPW415	Dissertation with viva voce	12	6	-	-	100	100
MBEC –IV	P21Z4MBE4:1	Biodiversity and Conservation	6	4	3	25	75	100
	P21Z4MBE4:2	Silkworm culture techniques and marketing Management						
	P21Z4MBE4:3	Tools and techniques in Biology						
<b>Total</b>			<b>30</b>	<b>19</b>				<b>400</b>

**COURSE STRUCTURE ABSTRACT FOR  
M.SC., PROGRAMME 2021-2022 ONWARDS**

<b>PART</b>	<b>COURSE</b>	<b>TOTAL NO OF COURSE</b>	<b>HOURS</b>	<b>CREDIT</b>	<b>MARK</b>
III	Core Course	14	80	67	1400
III	Core Project	1	12	6	100
III	Major Based Elective Course	4	22	12	400
III	Extra Disciplinary Course (EDC)	1	2	2	100
III	Skill Enhancement (Theory)	1	2	2	100
III	Skill Enhancement (Practical)	1	2	1	100
<b>Total</b>		<b>22</b>	<b>120</b>	<b>90</b>	<b>2200</b>
<b>Extra Credit Courses</b>					
Self-Study Course		2	-	4	200
NCGPA Course (Internship )		---	-	2	---
Value Added Course		1	-	2	100
<b>Total</b>		<b>3</b>		<b>98</b>	<b>2500</b>

## CORE COURSE I - FUNCTIONAL MORPHOLOGY AND PHYLOGENY OF

### INVERTEBRATES AND CHORDATES

<b>THEORY HOURS</b> <b>6</b>	<b>COURSE CODE</b> : <b>P21ZC101</b>
<b>PRACTICAL HOURS:</b>	<b>CREDITS</b> : <b>5</b>
<b>EXAM HOURS</b> <b>3</b>	<b>MARKS</b> : <b>ESE-75/CIA-25</b>

#### Objectives:

1. To imbibe current knowledge on the structure and functional morphology of invertebrates and chordates.
2. To learn the origin and evolution of invertebrates and chordates.
3. To understand the phylogenetic tree of animal kingdom.
4. To enrich the knowledge of paleontology of evolution.

#### A. INVERTEBRATES

##### UNIT - I Organization

Symmetry in animal organization: Asymmetry, radial, biradial and bilateral symmetry – Significance and advantages.

Coelom: Evolution of coelom. Acoelomate, pseudocoelomate, eucoelomate groups (Schizocoel and Enterocoel) - Significance.

Metamerism: Pseudometamerism, cyclometamerism, corm theory, embryological theory - Significance.

Locomotion: Movement in Protozoan and Annelids.

Nutrition: Filter feeding in Polychaetes and Prochordates. Respiration: Gills and trachea in Arthropods.

Circulation: Circulation in Arthropods and Molluscs.

##### UNIT - II

Excretion: Different types of excretory organs in invertebrates.

Nervous System: Primitive types - Coelenterates, Advanced types - Nervous system in Molluscs.

Chemical Co-ordination: Endocrine glands in Crustaceans and Insects - Pheromones and allelochemicals.

##### UNIT - III

Reproduction: Pattern of sexual and asexual reproduction - Echinoderm larval forms and their phylogenetic significance.

Invertebrate Fossils: Evolutionary trends and phylogenetic importance of Trilobites, Ammonoids, Belemnoids and Nautiloids.

Minor Phyla: Organisation and affinities of Chaetognatha, Rotifera and Phoronida.

## **B. CHORDATES** - Comparative study functional Morphology of vertebrates.

### **UNIT - IV**

Integumentary System: Exoskeletal structures and their modifications. Digestive System: Alimentary canal and associated glands

Respiratory System: Gill respiration in cyclostomes and fishes - Pulmonary respiration in tetrapods.

Circulatory System: Types and evolution of heart and aortic arches. Excretory System: Types and evolution of kidneys.

### **UNIT - V**

Nervous System: Brain and spinal cord - cranial nerves, spinal nerves and visceral nerves.

Reproductive System – Comparative anatomy.

Vertebrate Fossils- Evolutionary significance of Ostracoderms, Placoderms, Crossopterygians, Labyrinthodonts, Archaeopteryx and Mesozoic Reptiles.

### **Recommended Text**

#### **Books INVERTEBRATES**

1. Barnes R.D (1982). Invertebrate Zoology. IV Ed., Holt Saunders International Edition.
2. Barrington E.J.W (1979). Invertebrate Structure and Functions. II Ed., ELBS and Nelson.
3. Moore R.C., Lolicke and Fischer, A.G (1952). Invertebrate Paleontology. McGraw Hill Book Co., Inc., N.Y.

#### **CHORDATES**

1. Waterman A.J (1971). Chordate Structure and Function. The Macmillan Company.

### **References Books:**

#### **INVERTEBRATES**

1. Highnam K.C and L. Hill (1979). The Comparative Endocrinology of Invertebrates, ELBS and Edward Arnold (Publishers) Ltd., London.
2. Hyman G.H. The Invertebrates, Vol. I to VII, McGraw Hill Book Co., Inc., N.Y. (Add year)
3. Vasantika Kashyap (1997). Life of Invertebrates, Vikas Publishing House Pvt. Ltd., New Delhi.
4. Kotpal R.L. Minor Phyla. Rastogi Publication, Meerut. (Add year)
5. Nigam. Comparative anatomy of Invertebrates. (Add publisher & year)

#### **CHORDATES**

1. Colbert H. Edwin (1989). Evolution of the Vertebrates. II Ed., Wiley Eastern Limited, New Delhi.



2. HarreyPough, John B. Heisher and William N. Mcfarland (1990).Vertebrate Life.Macmillan Publishing Co., New York..
3. Jollie M (1962). Chordate Morphology.Reinholt Publishing Corporation, New York.
4. Kent G.C (1976). Comparative anatomy of the Vertebrates. McGraw Hill BookCo.,Inc., New York.
5. RomerA.S (1974). The Vertebrate Body. W.B. Saunders, London.
6. RomerA.S (1979). HYMAN's Comparitive Vertebrate Anatomy. III Ed.TheUniversity of Chicogo Press, London.
7. Weichert C.K (1965). Anatomy of the Chordates. McGraw Hill Book Co., NewYork..
8. Newman N.H (1961). Phylum Chordate. The University of Chicago Press,Chicago.

### **COURSE OUTCOMES:**

Upon completion of the course, the students are able to

CO1: Understand the significance of symmetry and coelom in animal organization and general characteristics of invertebrates and chordates.

CO2: Understand the relation between structure and functions of organs of invertebrates and chordates.

CO3: Acquire knowledge on phylogenic importance of invertebrate fossils and larval forms in Echinodermata

CO4: Know invertebrates that gave rise to the modern day vertebrates and interpret the gradual emergence of chordates.

<b>QUESTION PAPER PATTERN</b>	
<b>Exam Hours : 3</b>	<b>Max.marks: 75</b>
<b>PART-I (Answer ALL)</b>	
<b>20X1=20</b>	
<b>Q.No:1 to 20 –Objective type question: MCQ – 5; Fill up the blanks -5; Match the following-5</b>	<b>True or false – 5;</b>
<b>PART-II (Either OR)</b>	
<b>Q.No:21 to25 - One question from each Unit</b>	
<b>PART-III (Answer any THREE out of FIVE)</b>	
<b>Q.No:26 to 30 - One question from each Unit</b>	<b>3X10=30</b>

## CORE COURSE II – CELL AND MOLECULAR BIOLOGY

<b>THEORY HOURS</b>	<b>5</b>	<b>COURSE CODE</b>	<b>: P21ZC102</b>
<b>PRACTICAL HOURS: -</b>		<b>CREDITS</b>	<b>: 5</b>
<b>EXAM HOURS</b>	<b>3</b>	<b>MARKS</b>	<b>: ESE-75/CIA-25</b>

### Objectives:

To make the students understand

1. Concepts of cell theory and principles of cell biology
2. Cellular grade of organisation and assess the role of various cells in physiological functions.
3. Specify cell types that pass on information to generations.
4. The structure and molecular basis of cellular components, ultra structure, chemical composition and regulation of gene expression
5. Mechanism of cell cycle, cell division, ageing and formation of cancer cells.

### UNIT - I

**Cell theory:** Extended, modern version and exception.

**Plasma membrane:** Fluid mosaic model, intercellular space, specialized structures, membrane permeability, membrane transport (passive diffusion, active transport and ion pumps, translocation, vesicular transport) Cell communication - General principles and cell adhesion molecules.

**Endoplasmic reticulum:** Occurrence, Types, Morphology and Functions.

**Golgi apparatus:** Occurrence, Morphology and Functions.

**Cytoskeleton:** Microtubules and Microfilaments.

### UNIT- II

**Mitochondria:** Historical background, Distribution, Morphology, Ultra structure, Functions, Mitochondrial DNA and ribosomes. ATP synthesis - Chemiosmotic coupling hypothesis.

**Nucleus:** Occurrence, Ultra structure - Nuclear membrane, nuclear pores, nucleolus, nucleoplasm, chromatin fibers.

**Chromosomes:** Historical background, Chromosomal number, Morphology, Structure, Hetero chromatin, Euchromatin, L and M Chromosomes.

### UNIT- III

**Lysosome:** Occurrence, Morphology, Polymorphism and Functions.

**Ribosomes:** Occurrence, distribution, Types and Ultra Structure.

**Cell division:** Mitosis, Meiosis and their regulation, Cell cycle, regulation of cell cycle

**Ageing:** Sub cellular changes due to ageing, Theories for causes of ageing.

**Apoptosis:** Purpose, mechanism, regulation and significance.

**Cancer:** Types, Characteristics of Cancer cells - Gene involved in transformation of cells.

#### UNIT- IV

**DNA:** Chemical composition, Chargaff rule, Watson and Crick's model, Forms of DNA, Denaturation, Renaturation, Hybridization, Replication and functions of DNA.

**RNA:** Kinds of genetic and non genetic RNA, mRNA, rRNA and tRNA – structure and functions.

#### UNIT- V

Genetic Code-Characteristics, Central dogma - Transcription, Post transcriptional modifications, Translation and Post translational modification. **Regulation of gene Expression (Action) in Prokaryotes:** Constitutive genes and inducible genes, Transcriptional control mechanism, Operon model - Lac operon and Trp operon models.

#### Text books:

1. Verma P.S and Agarwal V.K. (2016) Cell Biology. S. Chand and Company Pvt. Ltd. I edition.
2. Verma P.S and Agarwal V.K. (2008) Cytology. S. Chand and Company Pvt. Ltd.

#### References Book:

1. De Robertis E.D.P and De Robertis E.M.F (1987). Cell and Molecular Biology. VIII Ed., Lea and Febiger, Philadelphia.
2. David Freifelder (1998). Molecular Biology. II Ed., Narosa Publishing House, New Delhi.
3. Lewis, Keleinsmith and Valeris M. Kish (1988). Principles of Cell Biology. Harper and Row Publications, New York.
4. Powar C.B (1983). Cell Biology. Himalaya Publishing House, Bombay.
5. Watson *et al.*, (Add authors) (1987). Molecular Biology of the Gene. The Benjamin Cummings Publishing Co., Inc., California.

#### COURSE OUTCOMES:

Upon completion of the course, the students are able to

CO1: Acquire knowledge about the structure and functions of cells. CO2: Understand the activity of the organism at cellular level.

CO3: Acquire gene expression concepts in prokaryotes and eukaryotes. CO4: Know the role of cell cycle in cell division.

CO5: Explain the molecular events in central dogma of life translation and transcription.

#### QUESTION PAPER PATTERN

Exam Hours : 3

Max.marks: 75

#### PART-I (Answer ALL)

Q.No:1 to 20 –Objective type question: MCQ – 5; Fill up the blanks -5;  
Match the following-5

20X1=20

#### PART-II (Either OR)

#### PART-III (Answer any THREE out of FIVE)

Q.No:26 to 30 - One question from each Unit 3X10=30

## CORE COURSE III – GENETICS

<b>THEORY HOURS</b> <b>6</b>	<b>COURSE CODE</b> : <b>P21ZC103</b>
<b>PRACTICAL HOURS:</b>	<b>CREDITS</b> : <b>5</b>
<b>EXAM HOURS</b> <b>3</b>	<b>MARKS</b> : <b>ESE-75/CIA-25</b>

### Objectives:

To make the students

1. Understand the gene concept and principles of Genetics
2. Comprehend gene interaction and their impact on genetic and phenotypic characters
3. Apprehend the microbial genetics, mutation and human genetics.
4. Gain knowledge on genetic disorders.
5. Enrich knowledge in genetic counseling.

### UNIT - I

**Classical genetics:** Mendel's law - Gene interaction: Codominance, Supplementary, Complementary, Epistasis - Dominant, Pleiotrophism, Penetrance, Expressivity - Sex linked Inheritance in man, Sex influenced genes, Sex limited genes- Genomic imprinting, X inactivation in mammals.

### UNIT – II

**Allele- Multiple Alleles:** ABO Blood grouping - Pseudo allele Linkage and Crossingover in Drosophila - Mechanism and Chromosomal mapping.  
Homologous recombination- Holiday model, Non - Homologous Recombination. Fine structure of gene - cistron, muton, recon, exon and split genes. House keeping genes, luxury genes.

### UNIT – III

**Sex determination:** Grasshopper, Bonellia, Free-martin (Cattle), Pigeon, Sacculina. Extra nuclear inheritance by cellular organelles - Mitochondria and Chloroplast. Microbial Genetics: Methods of gene transfer: Transformation, conjugation, sex-duction and transduction.

### UNIT –IV

**Mutation:** Types chromosomal mutation: Numerical and Structural changes in chromosomes - Edward's syndrome, Cri du chat syndrome, Klinefelter's syndrome and Turner syndrome. Molecular basis of gene mutation, Spontaneous and Induced Mutation  
- DNA repair mechanism.

### UNIT - V

**Human Genetics:** Pedigree analysis - Karyotypes, Chromosomal banding, Inborn error in metabolism, Genetic disorders of Human beings - Sickle cell anemia, Thalassemia, Diabetes mellitus, Brachydactyly and Huntingtons chorea.

**Population genetics:** Hardy Weinberg law, Eugenics, Euthenics, Euphenics, Inbreeding - homozygosity.

**Text Book:**

1. Verma P.S and V.K. Agarwal (2008). Genetics. S. Chand and Company Private.Ltd. New Delhi.

**Reference Books:**

1. Watson J.D., Hopkins N.H., Roberts J.W., Steitz J and A.M. Weinter (1987). Molecular Biology of Genes (4th edition).The Benjamin/Cummings publishing Company inc, Joky.
2. Lewin B (1997). Genes VI.Oxford University Press, Oxford, New York, Tokyo.
3. KavithaBhutianiAhluwalia (1985)Genetics, Wiley Eastern Limited, New Delhi.
4. Alice Maravs (2009) Genetics, MJP Publishers, Chennai.
5. Eldon J. Garder (1968)Principles of genetics, Wiley Eastern private Limited, NewDelhi.

**COURSE OUTCOMES:**

Upon completion of the course, the students are able to

CO1: Understand the Theories of classical genetics, sex linked inheritanceand genomic imprinting

CO2: Able to describe the genetic variations through linkage andcrossing over, recombination

CO3:Obtain the knowledge about sex determination, Extra nuclear inheritance andmicrobial genetics.

CO4:Gain knowledge on mutations chromosomal aberration and DNA repair mechanismCO5:Understand the genetic defects and inborn error in metabolism,

Genetic counseling and effect of inbreeding

**QUESTION PAPER PATTERN**

**Exam Hours : 3**

**Max.marks: 75**

**PART-I (Answer ALL) 20X1=20**

**Q.No:1 to 20 –Objective type question: MCQ – 5; Fill up the blanks -5; True or false –5;Match the following-5**

**PART-II (Either OR)**

**Q.No:21 to25 - One question from each Unit**

**PART-III (Answer any THREE out of FIVE)**

**Q.No:26 to 30- One question from each Unit 3X10=30**

**CORE COURSE IV - PRACTICAL – I**  
**COMPARATIVE FUNCTIONAL MORPHOLOGY AND PALEONTOLOGY OF**  
**INVERTEBRATES AND CHORDATES, GENETICS, CELL AND MOLECULAR**  
**BIOLOGY AND AQUACULTURE**

<b>THEORY HOURS</b>	<b>: -</b>	<b>COURSE CODE</b>	<b>: P21ZC104P</b>
<b>PRACTICAL HOURS</b>	<b>: 6</b>	<b>CREDITS</b>	<b>: 3</b>
<b>EXAM HOURS</b>	<b>: 5</b>	<b>MARKS</b>	<b>: ESE-60/CIA-40</b>

**Objectives:**

To impart practical skills for the theoretical knowledge gained through core courses I, II and III

**A. INVERTEBRATES and CHORDATES**

**1. Taxonomy**

A list of at least two representative animals belonging to major classes of each invertebrate phyla and major orders of 5 classes of Chordata can be prepared by the faculty and the animals shown to the students. A student has to identify and describe the salient features and assign them to the order, class and phylum to which they belong.

**2. Mounting**

Mounting of different insect mouthparts (Mosquitoes, Housefly, Cockroach, Honeybee).

**3. Dissections**

1. Pila, Earthworm- Nervous and Reproductive systems.
2. Virtual dissections of chordate systems.

**3. Spotters**

Echinoderm larval forms - Microscopic slides.  
Invertebrate fossils - Ammonoids, Belemnoids and Nautiloids. Minor Phyla - Chaetognatha, Rotifera and Phoronida.

**B. GENETICS**

1. Drosophila culture.
2. Identifications of sex.
3. Identifications of mutants.
4. Identification of Blood groups ABO and Rh factors.
5. Pedigree analysis.
6. Human karyotyping.
7. Chromosomal abnormalities.
8. Hardy Weinberg law and Calculation of gene frequencies for dominant, recessive and codominant traits and Multiple alleles.

**C. CELL AND MOLECULAR BIOLOGY**

1. Micrometry – Measurement of cells.
2. Camera Lucida.
3. Localization of Barrbodies in buccal epithelium.
3. Cell division (Mitosis and Meiosis).
4. Cytochemical detection of Carbohydrates, Proteins, Lipids.

## **COURSE OUTCOMES:**

Upon completion of the course, the students are

able to CO1: Obtain soft skills through dissection

and mounting

CO2: Obtain knowledge on observation and analysis of fossils and other evolutionary important animals

CO3: Acquire skill to identify blood groups.

CO4: Skill for pedigree chart preparation and identification of chromosomal abnormalities. CO5: Gain the skill to execute microtechniques

### **QUESTION PAPER PATTERN**

**Exam Hours : 5**

**Max.marks:60**

<b>QUESTION NO.I – Major Practical from allotted lot of 4 experiments</b>	<b>15 Marks</b>
<b>QUESTION NO.II – Minor Practical</b>	<b>10 Marks</b>
<b>QUESTION NO.III- Minor Practical</b>	<b>10 Marks</b>
<b>QUESTION NO.IV – 4 Spotters</b>	<b>4 X 3 =12 Marks</b>

## MAJOR BASED ELECTIVE COURSE- I

### 1.FISHERIES AND AQUACULTURE

<b>THEORY HOURS</b> : 5	<b>COURSE CODE</b> : P21Z1MBE1:1
<b>PRACTICAL HOURS:</b>	<b>CREDITS</b> : 4
<b>EXAM HOURS</b> 3	<b>MARKS</b> : ESE-75/CIA-25

#### Objectives:

1. To gain the current perspectives on the aquaculture principles and practices,
2. To give knowledge on water quality management and fish harvest technology.
3. To understand the capture fisheries and culture fisheries.

#### UNIT-I

**Inland Fisheries:** Present status and scope of Inland fisheries - commercially important fishes - Food and feeding habits of Indian major carps - Age and growth - Scale method and length - weight relationship.

#### UNIT-II

**Culture Fisheries:** Present status and scope of culture fisheries – criteria for selection of cultivable species - Biology of important cultivable fishes - *Catla catla*, *Labeo rohita*, *Cirrhinus mrigala*, *Channa striata*, and *Latescalcarifer*. Marketing of cultured fishes- Major diseases (Viral, Bacterial, Fungal and Parasites)causes, symptoms and treatments.

#### UNIT-III

**Aquaculture Principles and Practices:** Aquaculture-types of culture - fish farm - types of ponds – preparation of ponds, maintenance and management – types of feed - live feed(rotifers, artemia) - predators -induced breeding - hypophysation - factors of induced spawning-transport of fish seed.

#### UNIT-IV

**Water Quality Management:** Physical Factors– Transparency, temperature- Chemical Factors - dissolved oxygen, Carbondioxide, Salinity and pH, Biological oxygen Demand  
- Biological Factor - Plankton - Nutrients - Assessment of water Quality - Discolouration of water –Bloom crash, Mass mortality of fishes.

#### UNIT-V

**Fish Harvest Technology:** Inland Fishing gears and crafts, handling,Processing and preservation of fish - fishery by-products - marketing and economics.

#### TEXT BOOKS:

1. Ramasamy Santhanam, N.Sugumaran and P. Natarajan (1987). A Manual of Freshwater Aquaculture. Oxford& IBH Publishing Company Ltd., New Delhi.
2. C.B.L.Srivastava, Sushmasrivastava,(2006),A text book of Fishery Science&Indian Fisheries, KitabMahat Publishers.



3. ICAR(2006),Handbook of Fisheries and Aquaculture Indian Council of AgriculturalResearch, New Delhi.

**REFERENCES:**

1. Pillay T.V.R (2005).Aquaculture principles and practices. Fishing new Books,Blackwell Science Ltd.,Oxford.
2. Jhingran, V.G.,(1991). Fish and Fisheries of India. Hindustan Publishing Corporation,NewDelh

**COURSE OUTCOMES:**

Upon completion of the course, the students are able to

CO1: Gain knowledge of current perspectives on the fisheries and aquaculture.

CO2: Know the biology of important cultivable fishes and gain Knowledge of fishdisease management.

CO3: Understanding of fish farm management and artificial breeding

techniquesCO4: Know about the water quality management

CO5: Learning the fish harvest technology and marketing ethics.

<b>QUESTION PAPER PATTERN</b>		
<b>Exam Hours</b> : 3		<b>Max.marks: 75</b>
<b>PART-I (Answer ALL)</b>		<b>20X1=20</b>
<b>Q.No:1 to 20 –Objective type question: MCQ – 5;</b>	<b>Fill up the blanks -5;</b>	<b>True or false – 5;</b>
<b>Match the following-5</b>		
<b>PART-II (Either OR)</b>		
<b>Q.No:21 to25 - One question from each Unit</b>		
<b>PART-III (Answer any THREE out of FIVE)</b>		
<b>Q.No:26 to 30 - One question from each Unit</b>		<b>3X10=30</b>

## MAJOR BASED ELECTIVE COURSE-I

### 2.REPRODUCTIVE ENDOCRINOLOGY

<b>THEORY HOURS</b> : 5	<b>COURSE CODE</b> : P21Z1MBE1:2
<b>PRACTICAL HOURS:</b>	<b>CREDITS</b> : 4
<b>EXAM HOURS</b> 3	<b>MARKS</b> : ESE-75/CIA-25

#### Objectives:

To gain the knowledge on structure and functions of male and female reproductive endocrine glands and their hormonal regulation.

#### UNIT – I

**General endocrinology:** Structure of endocrine glands - secretion of pituitary, thyroid, pancreas, adrenal, ovary and testis – factors influencing secretion – endocrine disorders.

#### UNIT- II

**Male reproductive system:** Testis – structure, spermatogenesis, spermiogenesis, steroidogenesis, endocrine, paracrine and autocrine regulation.

**Epididymis:** structure and function and regulation.

**Accessory sex organs** – prostate, seminal vesicles, bulbo urethral gland - structure, function and regulation.

#### UNIT- III

**Ovary:** Structure, folliculogenesis, ovulation – Sources of ovarian hormones, ovarian androgen, inhibit – endocrine regulation of ovarian – functions.

**Uterus and fallopian tube** – Structure, function and hormonal regulation, reproductive cycles.

**Mammary gland** - Structure, function and regulation.

#### UNIT –IV

**Conception:** Fertilization, conception, parturition, maternal-foetal placental hormones.

#### UNIT – V

**Sterility:** Male and female sterility – regulation of male and female fertility – surgical method – hormonal and non-hormonal methods.

### Text books

1. Turner C.D. (1966). General endocrinology. 4<sup>th</sup> Ed., W.B.Saunders Co., London.
2. Barrington E.J.W. (1968). An introduction to general and comparative endocrinology. Academic press, London.
3. Bentley P.J. (1985). Comparative vertebrate endocrinology. S.Chand and Co., Newyork.

### Reference books

1. Barrington (1979). Hormones and evolution, Vol.I&II, Academic press, Newyork.
2. Wiliaimas R.H. (1974).Text book of endocrinology V.Ed. Saunders Press, London.
3. E.K. Nobil and JU. D. Neil (1988). The physiology of reproduction V. I& II E.K.Nobil and JU. D. Neil, Raven press, Newyork.

### COURSE OUTCOMES

Upon completion of the course, the students will be able to

- CO1:** Explain the structure and functions of reproductive glands.
- CO2:** Understand the regulation of testis, epidydimis and accessory glands by hormone.
- CO3:** Correlate the structure, function and regulation of ovary, uterus, fallopian tube and mammary gland.
- CO4:** Know the biological process of fertilization, conception and parturition.
- CO5:** Analyze and understand the reasons for male and female sterility and fertility.

QUESTION PAPER PATTERN		
Exam Hours	: 3	Max.marks: 75
PART-I (Answer ALL)		20X1=20
Q.No:1 to 20 –Objective type question: MCQ – 5;	Fill up the blanks -5;	True or false – 5;
Match the following-5		
PART-II (Either OR)		
Q.No:21 to25 - One question from each Unit		
PART-III (Answer any THREE out of FIVE)		
Q.No:26 to 30 - One question from each Unit		3X10=30

## MAJOR BASED ELECTIVE COURSE-I

### 3.BEE KEEPING

<b>THEORY HOURS</b>	<b>5</b>	<b>COURSE CODE</b>	<b>: P21Z1MBE1:3</b>
<b>PRACTICAL HOURS:</b>		<b>CREDITS</b>	<b>: 4</b>
<b>EXAM HOURS</b>	<b>3</b>	<b>MARKS</b>	<b>: ESE-75/CIA-25</b>

#### Objectives

1. To learn the identification keys for honey bees
2. To understand the structure and colony formation of honey bees
3. To acquire the knowledge on handling and maintenance of bee colony
4. To comprehend the importance of disease management and its control
5. To obtain the perspectives on marketing of honey and to motivate for the preparation of projects for funding

#### UNIT - I

Honey Bee: Systematic position-species of honey bees- embryology and life history of honey bee- behaviour- swarming- pheromone.

#### UNIT - II

Bee colony, castes, Natural colonies and their yield. Types of beehives-structure location care and Management-Genetic studies –breeding of stocks- winter broods.

#### UNIT - III

Apiary-care and Management-Artificial beehives-different types-construction of space frames-selection of sites-catching and transforming a Colony-Handling and maintenance of the Colony-Instruments employed in Apiary.

#### UNIT - IV

Bee foraging: pollen and nectar yielding plants. Natural enemies and diseases of honey bees and their control methods.

#### UNIT - V

Honey: Extraction and equipment's used-chemical composition - nutritive and medicinal values-honey yield in national and international market. Present status of apiculture in India. prospects of apiculture as self employment venture. Preparing proposals (Layout and budget) for financial assistance and funding agencies.

## Reference Books

1. Morse, R.A., (1990).The ABC and XYZ of Bee culture 40<sup>th</sup>edn. A.I.Root& co.,Ophio.
2. Rare, S., (1998), Introduction to bee keeping. vikas publishing House.
3. Sharma, P.andsingh, L.(1987). Hand book of bee keeping. controller printing andstationery, Chandigarh.
4. Dewey M. Caron, (2013). Honey Bee Biology and Beekeeping, Revised Edition.Wicwas Press, Kalamazoo.
5. Alison Benjamin, By (author) Brian McCallum, 2008. Keeping Bees and MakingHoney. David & Charles, Newton Abbot.KimPezza, 2013.
6. Backyard Farming: Keeping Honey Bees: From Hive Management to HoneyHarvesting and More. Hatherleigh Press, U.S.

## COURSE OUTCOME

At the end of the course, the students will be able to

- CO1. Start a small business enterprise by liaising with different stake holders.CO2. Effectively manage small business enterprise.  
CO3. Establish Bee Keeping unit and run it profitably.  
CO4. Select suitable species and races of bees for Bee keeping.CO5. Maintain the Bee hives in a scientific way.  
CO6. Work out the economics of BeeKeeping.  
CO7. Understand the methodologies of extracting, preservation and marketing of honeyand other products of honeybee.  
CO 8. Appreciate the importance of embarking on self-employment and has developedthe confidence and personal skills for the same.

QUESTION PAPER PATTERN		
Exam Hours	: 3	Max.marks: 75
PART-I (Answer ALL)		20X1=20
Q.No:1 to 20 –Objective type question: MCQ – 5;	Fill up the blanks -5;	True or false – 5;
Match the following-5		
PART-II (Either OR)		
Q.No:21 to25 - One question from each Unit	PART-III (Answer any THREE out of FIVE)	
Q.No:26 to 30 - One question from each Unit	3X10=30	

## SKILL ENHANCEMENT THEORY

### ENGLISH GRAMMAR FOR COMMUNICATION AND SCIENTIFIC WRITING

<b>COURSE CODE: P21Z1SE 1</b>	<b>Hours/working</b>	<b>Credit</b>	<b>Exam hours</b>		<b>Marks</b>		
<b>Theory</b>	<b>1</b>	<b>2</b>	<b>-</b>	<b>CIA</b>	<b>ESE</b>	<b>TOTAL</b>	
<b>Practical</b>	<b>1</b>		<b>2</b>	<b>2</b>	<b>20</b>	<b>-</b>	<b>10</b>
					<b>20</b>	<b>60</b>	<b>0</b>

**Objectives:** To understand and acquire knowledge of subject, verb and object, parts of speech, tense and its applications, voices and writing skill of letter, report and research paper.

#### UNIT-I

Sentence: Types (Assertive, Interrogative, Imperative and Exclamatory), Subject, verb and object & predicate.

#### UNIT-II

Parts of speech: Noun, pronoun, verb, adverb, adjectives, preposition, conjunction, and interjection

#### UNIT-III

Tense – Present, past and future application of present and past participle

#### UNIT-IV

Active voice and passive voice, degrees of comparison.

Synthesis of sentences – simple, compound and complex. Punctuation.

#### UNIT-V

Letter writing, Scientific report writing, Research article writing.

#### REFERENCES

1. Ref: Wren & Martin, 2017, High school, English Grammar & Composition, (Revised by N.D.V. Prasad Rao) S. Chand Publication
2. Madras Rajan, 2014. Basic English Grammar, Leo Book publisher

#### COURSE OUTCOMES

- CO1: Acquire knowledge of Types of sentence making
- CO2: Understand the parts of speech
- CO3: Gain the knowledge of Tenses
- CO4: Learn the Active and passive voices, degrees of comparison
- CO5: Learn the ability of writing skill of letter, Scientific report and article etc.,

#### QUESTION PATTERN

**THEORY → 5 QUESTIONS X 15 MARKS (EITHER OR PATTERN) = 75 MARKS**

## CORE COURSE V - BIOCHEMISTRY

<b>THEORY HOURS</b> <b>5</b>	<b>COURSE CODE</b> : <b>P21ZC205</b>
<b>PRACTICAL HOURS:</b>	<b>CREDITS</b> : <b>5</b>
<b>EXAM HOURS</b> <b>3</b>	<b>MARKS</b> : <b>ESE-75/CIA-25</b>

### Objectives:

1. To make the students to learn about the chemical constituents of living organisms
2. To understand the basic principles and chemical nature of biomolecules with reference to various metabolic activity and hormonal control of biochemical reactions.
3. To make them understand life is made up of lifeless molecules.

### UNIT- I

Atoms- atomic number and atomic weight, molecules, molecular weight. Bonds- ionic, covalent, metallic, hydrogen bonds and vander Waal's force.

Water as universal solvent - physical properties, structure, weak interaction in aqueoussolutions, pH and buffer system.

### UNIT- II

Carbohydrates- Structure, Classification and functions of mono saccharides, disaccharides polysaccharides and carbohydrate derivatives.

Lipids and fatty acids - classification, properties and biological significance. Proteins - classification, Structure and biological significance.

Amino acids - structure, classification and properties.

### UNIT - III

Carbohydrate metabolism -Glycolysis, Krebs cycle, Energetics of Krebs cycle- Glycogenesis, glycogenolysis, Gluconeogenesis, HMP Shunt pathway and Cori's Cycle.

### UNIT - IV

Protein and amino acid metabolism - Oxidative deamination, transamination, decarboxylation and transmethylation reactions, Lipid metabolism - Metabolism of fatty acids - Glycerol and Cholesterol - Theories of Oxidation of fatty acids.

### UNIT - V

Enzymes -Nomenclature and classification, chemical nature and properties of enzyme, factors affecting enzyme activity, Active site, Enzyme inhibition, Enzyme specificity, Mechanism of enzyme action-Michaelis Menten Hypothesis. Regulation of enzyme activity, Non protein enzymes -coenzymes and Iso enzyme. Hormones: Biochemical classification.

**Text books:**

1. Lehninger, Albert. David. L Nelson and Michael M. Cox (1993). Principles of Biochemistry. CBS Publishers and Distributors, Delhi.
2. Stryer, L (1988). Biochemistry W.H. Freeman and Co.
3. Cooper, T.G (1977). The tools of Biochemistry. Wiley Inter science Publication, JohnWiley and Sons; NY.
4. Prof.DubyFathima,Dr.L.M.Narayanasamy,Dr.R.P.Meyyanpillai,Prof.K.Nallas ingam and Dr.S.Prasannakumar (2017)Biochemistry,Saras publications
5. Dr.N.Arumugam(2016)Cell and Molecular biology,Saraspublicati

**Reference Books**

1. Robert K.Muray, Daryl K.Granner, Peter A.Wayes and Victor W.Rodwell (1993).Harper's Biochemistry (24th Edition) Prentice Hall International Inc., London.
2. Voet. D andVoet. J (1995). Biochemistry. John Wiley and Sons, New York.
3. Agarwal R. A., Srivasta, A. K, Kaushed Kumar(2008), Animal physiology andbiochemistry, S. Chand & Company PVT. Ltd, New York.
4. Jain, J. L. Sanjay jain, NitinJain(2008).Fundamentals of Biochemistry.S.Chand andCompany Ltd.
5. Organic chemistry by soloman

**COURSE OUTCOMES:**

Upon completion of the course, the students are able to

CO1: Understand the various chemical Constituents of living organisms.CO2: Acquire knowledge on the micro and macro biomolecules.

CO3: Understand that energy flow in cells through the breakdown of carbohydrate.

CO4: Know the significance of protein and aminoacid metabolism and their role inhuman health.

CO5: Understand the mechanism of enzyme action.

QUESTION PAPER PATTERN		
Exam Hours	: 3	Max.marks: 75
PART-I (Answer ALL)		
Q.No:1 to 20	-Objective type question: MCQ – 5; Fill up the blanks -5; Match the following-5	20X1=20
Q.No:21 to25	- One question from each Unit	
PART-III (Answer any THREE out of FIVE)		



## CORE COURSE VI - ANIMAL PHYSIOLOGY

<b>THEORY HOURS</b> 5	<b>COURSE CODE</b> : P21ZC206
<b>PRACTICAL HOURS:</b>	<b>CREDITS</b> : 5
<b>EXAM HOURS</b> 3	<b>MARKS</b> : ESE-75/CIA-25

### Objectives:

1. To impart knowledge on the functions of different organs and systems of animals.
2. To understand animal behaviours and reproductive methods.
3. To give awareness on human diseases related to organ dysfunctions.

### UNIT - I

Organization of gastro intestinal tract - Digestion and absorption of proteins, carbohydrates and lipids. Assimilation. Role of gastrointestinal hormones in digestion.

Vitamins and minerals: Sources, functions and deficiency diseases.

### UNIT - II

Respiration: Structure of lungs, Lung air volumes, Respiratory pigments and their functions - Exchange of gases (Transport of O<sub>2</sub> and CO<sub>2</sub>) - Regulatory mechanisms.

Circulation: Components of blood and their functions - cardiac cycle - Blood pressure- ECG - Cardiovascular diseases: Myocardial infarction.

### UNIT - III

Excretion: Patterns of excretion in relation to different habitats, ultrastructure of mammalian kidney and urine formation, Micturition. Detoxification pathways of ammonia, Renal control mechanism.

Homeostatic mechanisms - Ionic and osmoregulation in crustaceans and fishes.

### UNIT - IV

Muscles: chemical composition of muscles. Mechanism of muscle contraction: Sliding filament theory, Chemistry of muscle contraction.

Nervous co-ordination: Propagation and transmission of nerve impulse-synaptic transmission. Neurotransmitters, Reflex action - Autonomous nervous system.

Bioluminescence and its significances. Biological rhythms.

Receptors - Types of receptors - Photoreceptors: Structure of retina, Physiology of Vision- Phonoreceptor- mechanism of hearing.

### UNIT-V

Hormones from Pituitary, thyroid, parathyroid, adrenal, pancreas, gonads and their functions - molecular mechanism of hormonal action.

Mammalian reproductive cycles and its hormonal control.

**Reference Books:**

1. Agarwal R.A, Anil K.Srivastava Kaushal Kumar (1998). Animal physiology and Biochemistry –S. Chand and Company Ltd. New Delhi.
2. Rastogi S. C. Essentials of Animal Physiology - Wiley Eastern Limited New Delhi.
3. Guyton, Arthur C and J.E. Hall, 1996. Textbook of Medical Physiology. W.B.Saunders Company.
4. Nielson, K.S. 1995. Animal Physiology- IV Edition Cambridge University Press.

**COURSE OUTCOMES:**

Upon completion of the course, the students are able to

CO1: Understand the functioning of digestive system and the importance of vitamins and minerals in human pathology

CO2: Gain the knowledge on functioning of circulatory system, components of blood, significance in cardiac diseases. Improve the knowledge on gaseous exchange through respiration process.

CO3: Acquire knowledge on the functioning of excretory system in relation to different habitats and homeostasis mechanism in crustaceans and fishes.

CO4: Understand the physiological functions of muscle, nervous system and Endocrine glands and reproductive cycle

CO5: Obtain the knowledge on human health related issues.

<b>QUESTION PAPER PATTERN</b>		
<b>Exam Hours : 3</b>		<b>Max.marks: 75</b>
<b>PART-I (Answer ALL) 20X1=20</b>		
<b>Q.No:1 to 20 –Objective type question: MCQ – 5; Fill up the blanks -5; the following-5</b>		<b>True or false 5; Match</b>
<b>PART-II (Either OR)</b>		
<b>Q.No:21 to 25 - One question from each Unit</b>		
<b>PART-III (Answer any THREE out of FIVE) Q.No:26 to</b>		

## CORE COURSE VII - IMMUNOLOGY

<b>THEORY HOURS</b> 5	<b>COURSE CODE</b> : P21ZC207
<b>PRACTICAL HOURS:</b>	<b>CREDITS</b> : 5
<b>EXAM HOURS</b> 3	<b>MARKS</b> : ESE-75/CIA-25

### Objectives:

1. To inculcate basic and current knowledge on the immune system.
2. To learn the structure and functions of immune system.
3. To educate tumour immunology and the applications of immuno techniques.

### UNIT I:

**Organs of immune system:** Primary - Thymus, Bone marrow, Secondary - Spleen, Lymphnodes, Tonsils, GALT and MALT.

**Cells of immune system:** Haematopoetic stem cells, cells of lymphoid lineage - Lymphocytes, NK cells, K cells, myeloid lineage - granulocytes, Neutrophils, Eosinophils, Accessory cells.

**T cells:** Differentiation and maturation of T cells - Positive and Negative selection, Surface markers and Receptors of mature T cells, Types of T cells (T cell subsets) and their functions.

**B Lymphocytes:** Surface markers, Development and maturation of B cells.

### UNIT II:

**Antigens:** Factors determining immunogenicity, Types of Antigens, Epitopes - B cell and T cell epitopes.

**Humoral Immune response:** Antigen processing and presentation - class I and class II MHC pathways T cell activation, B cell activation - T dependent and independent, T cell

- B cell conjugate (Immunological synapse), B cell maturation (Affinity mechanism and class switching, Plasma cells and memory cells, Immunological memory, Immune response - Primary and Secondary).

**Immunoglobulins:** Structure, General function, Classes of Ig (properties and biological functions).

### UNIT III:

**Antigen - Antibody reaction:** Immune complex, Binding forces, Types of Antigen- antibody reactions - precipitations, Agglutinations, cytolysis, complement fixation, opsonization.

Complements (Classical and Alternate pathways) Cytokines

Cell mediated Immune response

### UNIT IV:

**Hyper sensitivity:** Types and Mechanism of anaphylaxis.

Auto immunity - Causes, Auto immune disease - pernicious anemia, Rheumatoid arthritis, Graves disease.

Transplantation Immunology - Types of graft, Mechanism of Allograft rejection, Graft versus Host reaction, Prevention of graft rejection.

### UNIT V:

Tumour Immunology - Tumour antigens, Immune response to tumours-immune surveillance - Escape mechanism from immune response, Immunotherapy for tumours.

**Immune prophylaxis:**Types of vaccines.

**Immunotechniques:** Double Immune diffusion-Radioimmuno electrophoresis  
- Rocketelectrophoresis, ELISA, Agglutination (ABO, Rh, Widal, Coombs Test).

**Text Books:**

1. Gupta S.K (1999). Immunology. Narosa Publishing House, New Delhi.
2. Annadurai B (2013). A Text book of Immunotechnology, S.Chand publication. (Addplace)

**References Books:**

1. Ivan Roitt (1994). Essential Immunology (8th Edition). Blackwell ScientificPublication. Immunology W.H. Freeman and Company.
2. Weir D.M and Stewart J (1997). Immunology. 8th Edn., Churchill Livingston, NewYork.
3. Kuby J (1994). Immunology. W.H. Freeman and Co., New York.
4. AshimK and Chakravarthy. Immunology and Immunotechnology. OxfordPublications. (Add year & place)
5. Abbas A.K., Lichtman A.K., Jordan S and J.S Pober(1997). Cellular and Molecular Immunology. Harcourt Brace and Co., Asia Pvt. Ltd., Singapore.
6. Coleman, Lombard and Sicard(1992). Fundamentals Immunology. W.M.C. BrownPublishers.
7. Srivastava R., Ram B.P and P. Tyle (1991). Molecular Mechanisms of Immune Regulation. VCH Publishers Inc., New York.
8. Sells S (1987). Basic Immunology. Elsevier Science Publishing Co., New York.
9. Tizard I.R (1995). Immunology – An Introduction. IV Ed., Saunders CollegePublications, Philadelphia.

**COURSE OUTCOMES:**

Upon completion of the course, the students are able to CO1: Understand the types and functions of immune system.

CO2: Induct basic concepts of antigenecity and immunogenicity.

CO3: Understand the molecular basis of humoral (Cytokines and complement)andcellular process.

CO4: Understand the principles of hypersensitivity and develop theoretical knowledge On tissue and organ transplantation

CO5: Integrate knowledge of immune prophylaxis(Vaccine),Auto immunityAnd tumour immunology.

<b>Exam Hours</b> : 3	<b>Max.marks: 75</b>
<b>PART-I (Answer ALL)</b>	
<b>Q.No:1 to 20 –Objective type question: MCQ – 5; Fill up the blanks -5; Match the following-5</b>	<b>20X1=20</b>
<b>PART-II (Either OR)</b>	
<b>PART-III (Answer any THREE out of FIVE)</b>	

**CORE COURSE VIII - PRACTICAL II - BIOCHEMISTRY, ANIMAL  
PHYSIOLOGY, IMMUNOLOGY, AND ENTOMOLOGY**

<b>THEORY HOURS</b> :		<b>COURSE CODE</b> :	<b>P21ZC208P</b>
<b>PRACTICAL HOURS:</b> 6		<b>CREDITS</b> :	<b>3</b>
<b>EXAM HOURS</b> :	<b>5</b>	<b>MARK</b> :	<b>ESE-60/CIA-40</b>

**Objectives:**

To impart practical skills for the theoretical knowledge gained through core courses V, VI and VII

**A. BIOCHEMISTRY**

1. Quantitative estimation of carbohydrate, protein, lipids and amino acids in tissuesamples.
2. Preparation of solutions - Molarity, Normality and Percentage.
3. Calculation of moles, millimoles, micromoles and nanomoles.
4. Buffer preparation - determination of pH using pH meter.
5. Beer lamberts law verification
6. Separation of amino acids by paper and thin layer chromatography - Unidirectional.

**B. ANIMAL PHYSIOLOGY**

1. Quantitative estimation of amylase activity.
2. Rate of salt loss and salt gain in fish using different experimental media.
3. Estimation of blood chloride.
4. Estimation of haemoglobin.
5. Blood - Bleeding time and clotting time.
6. Effect of osmolarity on erythrocytes

**C. IMMUNOLOGY**

1. Identification of lymphoid organs in fish.
2. Preparation of antigen and raising antibody -for BSA and SRBC.
3. Blood collection and serum separation
4. Immuno - diffusion.
5. ELISA

**Spotters:** ELISA reader, Micropipette, lymphoid organs

**D. ENTOMOLOGY**

1. Study of one specimen from each insect order
2. Study of different kinds of antennae, legs and mouth parts of insects
3. Study of head and sclerites of any one insect
4. Study of insect wings and their venation.
5. Study of insect spiracles
6. Methodology of collection, preservation and identification of insects.
7. Morphological studies of various castes of Aphis.
8. Study of any three insect pests and their damages
9. Field study of insects and submission of a project report on the insect diversity

## **COURSE OUTCOMES:**

Upon completion of the course, the students are able to

CO1: Get hands on training in quantitative estimation of biomolecules in tissue samples.CO2: Become familiar with physiological experiments on blood and saliva.

CO3: Acquire knowledge on lymphoid organs and immunological techniques.

CO4: Distinguish harmful and beneficial insects and obtain knowledge on pestcontrol management.

### **QUESTION PAPER PATTERN**

**Exam Hours : 5**

**Max.marks:60**

**QUESTION NO.I – Major Practical from allotted lot of 4 experiments 15 Marks**

**QUESTION NO.II – Minor Practical 10 Marks**

**QUESTION NO.III- Minor Practical 10 Marks**

**QUESTION NO.IV – 4 Spotters 4 X 3 =12 Marks**

## MAJOR BASED ELECTIVE COURSE II

### 1. ENTOMOLOGY

<b>THEORY HOURS</b> 5	<b>COURSE CODE</b> : P21Z2MBE2:1
<b>PRACTICAL HOURS:</b>	<b>CREDITS</b> : 4
<b>EXAM HOURS</b> 3	<b>MARKS</b> : ESE-75/CIA-25

#### Objectives:

1. To obtain a wide knowledge on types of insect and their morphology, anatomy and physiology of insects and their management system.
2. To know the risks of vector insects.

#### UNIT – I

Insect taxonomy up to orders level – Salient features with suitable examples of the insect orders – Thysanura, Odonata, Isoptera, Orthoptera, Hemiptera, Coleoptera, Lepidoptera, Hymenoptera and Diptera. Morphology of typical insect – integument system and mouth parts.

#### UNIT – II

Mouth parts of Insects- biting and chewing type, chewing and lapping type, piercing and sucking type, sponging type, siphoning type  
Classification of insects based on types of metamorphosis, hormonal control of metamorphosis  
Respiration in insects: tracheal, integumental, blood gills, spiracular gills. Reproduction in Insects: Reproductive cycle, other types of reproduction – parthenogenesis, viviparity, polyembryony; life span of insects.

#### UNIT – III

Medical Entomology – direct effects of medical pests, indirect effects of medical pests; Insects affecting health of man – damage and control of mosquitoes, house flies, bed bug, lice and fleas.

#### UNIT – IV

Agricultural pests- nature of damage and control measures of major pests of rice, cotton, sugarcane and coconut. storage pests – grain moth, granary weevil, red flour beetle, rice meal moth, pulse beetles, curative methods, Rodent control. (Specify pest name)

#### UNIT – V

Principles of Insect control – bio control, artificial control and chemical control. Pesticides and the environment, Integrated pest management (IPM).

## TEXTBOOKS

1. M.S. NalinaSundari and R.Shanthi (2017) Entomology.MJP Publishers, Chennai.

## REFERENCE BOOKS

1. Temphare, D.B. (2009). Modern Entomology. Himalaya Publishing, Mumbai.
2. Vasantharaj David. B and v.v. Ramamurthy (2011). Elements of Economic Entomology, Namrutha publications, Chennai 600116.
3. Temphare D.B. 1984. A Text book of Insect Morphology , Physiology and Endocrinology. S.Chand and Co., New Delhi.
4. Srivastava, K.P. (1993). A Text Book of Applied Entomology. Wiley Eastern Ltd. Delhi
5. Snodgrass, R.E. (1973). Principles of insect morphology, Publisher- Tata MCGRAWHill, Bombay.
6. Ambrose, D.P, (2004). The insects: structure, function and biodiversity. Kalyanipublishers, New Delhi.
7. Romoser, W S. (1982) .The science of Entomology. 2nd edition). Publisher Macmillan, New York.
8. David, B.V. And Ananthakrishnan.(2004). General and Applied Entomology. 2nd edition
9. Boudreaux, H. B. Arthropod phylogeny with special reference to insects,(1979).Publisher-John Willey and Sons New York.
10. Chapman R.F. 1982. The insect structure and functions. English Language Book Society

## COURSE OUTCOMES:

Upon completion of the course, the students are

able to CO1: Understand the taxonomy of insects

CO2: Gain the knowledge on different types mouth parts in insects, their physiology and reproductive cycles that enable them to select appropriate pest control strategies.

CO3: Acquire knowledge on medical entomology

CO4: Obtain information on agricultural pest management

QUESTION PAPER PATTERN		
Exam Hours	: 3	Max.marks: 75
PART-I (Answer ALL)		20X1=20
Q.No:1 to 20	–Objective type question: MCQ – 5; Fill up the blanks -5; Match the following-5	True or false – 5;
PART-II (Either OR)		
Q.No:21 to 25	- One question from each Unit	
PART-III (Answer any THREE out of FIVE)		
Q.No:26 to 30	- One question from each Unit	3X10=30



**MAJOR BASED ELECTIVE COURSE II**  
**2. COMPUTER APPLICATIONS IN BIOLOGY**

<b>THEORY HOURS</b>	<b>5</b>	<b>COURSE CODE</b>	<b>: P21Z2MBE2:2</b>
<b>PRACTICAL HOURS:</b>		<b>CREDITS</b>	<b>: 4</b>
<b>EXAM HOURS</b>	<b>3</b>	<b>MARKS</b>	<b>: ESE-75/CIA-25</b>

**Objectives:**

1. Students gain skills in basics of computers
2. To impart knowledge on usage of computers as a biologist
3. Applications of internet and statistical bioinformatics in research

**UNIT I**

Fundamentals of Computers: Block diagram of computer (input and output devices), Generations, Advantages and limitations of Computers; Basics of operating system: DOS, Windows NT & XP, UNIX and Application Software.

**UNIT II**

Communication Technology: Networking- LAN, WAN & MAN - Internet & Intranet - Data transfer, storage & retrieval via network- Email, DNS, WEB servers and browsers.

**UNIT III**

Fundamentals of database: Database models (Hierarchical, Network, Relational, Object-Oriented Models), RDBMS, Database System applications and Security.

**UNIT IV**

Introduction to M.S. office package: word- creating a new document - templates and wizards- scientific data representation and basic calculations with EXCEL- Creating Tables and databases using Access - interactive presentations using Power Point.

**UNIT V**

Basics of Biological databases: Types of data using in biological databases - Literature Databases and searches – Pub med Central – Medline – OMIM – SCOPUS – Science direct – Elsevier

**TEXT BOOKS:**

1. Fundamentals of Computers- Pradeep K. Sinha, Priti Sinha
2. Principles of database systems- Jeffery O. Ullma

## **COURSE OUTCOMES:**

Upon completion of the course, the students are able to

1. Handle different operating systems in computer
2. Apply bioinformatics tools
3. Use life science data bases.
4. Use MS office tools for routine teaching learning process

### **QUESTION PAPER PATTERN**

**Exam Hours : 3**

**Max.marks: 75**

#### **PART-I (Answer ALL)**

**20X1=20**

**Q.No:1 to 20 –Objective type question: MCQ – 5;Match Fill up the blanks -5; True or false – 5;  
the following-5**

#### **PART-II (Either OR)**

**Q.No:21 to25 - One question from each Unit**

#### **PART-III (Answer any THREE out of FIVE)**

**Q.No:26 to 30 - One question from each Unit**

**3X10=30**

## MAJOR BASED ELECTIVE COURSE II

### 3.FISH PROCESSING TECHNOLOGY

<b>THEORY HOURS</b> 5	<b>COURSE CODE</b> : P21Z2MBE2:3
<b>PRACTICAL HOURS:</b>	<b>CREDITS</b> : 4
<b>EXAM HOURS</b> 3	<b>MARKS</b> : ESE-75/CIA-25

#### Objectives:

1. To understand the methods of fish processing techniques.
2. To enrich the knowledge of role of microbes on the spoilage of fishes,
3. To gain the methods of preservation in fish processing.

#### UNIT – I

Fish Biochemistry –Major components of fish .Nutritive enzymes and their role in fish spoilage - Nutritive value of protein - General character of fish fat, spoilage of fish at different stages.

#### UNIT – II

Fish Microbiology - Microbial spoilage of fish - plant sanitation - importance - regulatory measures, Microbial spoilage of fish - microbial flora in various type of semi - processed and processed fishery products.

#### UNIT – III

Fresh fish handling and preservation: Mechanism of spoilage - (Fish analysis, bacterial chemical reactions). Handling of fish on board and shore - use of ice and salt, use of antibiotics and chemicals.

#### UNIT – IV

Freezing of fishes - different techniques -physico chemical changes and nutritional changes during freezing - spoilage of frozen fish.

#### UNIT - V

Canning of fishes - principles of canning - preservation, additives and pickle salting - salting of fish - Indian curing - Bacteriology of salted fish - smoking of fish - hot and coldsmoking - smoking methods.

#### Reference Books:

1. Biswas KP (1980). A text book of fish, fisheries and Technology. Narendra publishing house.
2. Gopakumar K (2000). Tropical fishery products. Oxford and IBH.
3. Govindan TK (1992). Fish processing technology. Oxford and IBH.
4. Mpeda (1995). Dried fish and fishery products.
5. Santhanam R (1987). Fisheries science. Daya publishing House.

6. Winton AL and Winton KB (1993). Fish and fish products. Agro Botanical Publishers.

### **COURSE OUTCOMES:**

Upon completion of the course, the students are able to

CO1: Understand the chief components of food in fish, nutritive enzymes and their role in fish spoilage, nutritive values, different stages of fish spoilage.

CO2: Learn the microbial spoilage of fish, plant sanitation, regulatory measures, microbial flora in various type of semi - processed and processed fishery products.

CO3: Gain the knowledge of fresh fish handling and preservation.

CO4: Acquire knowledge of freezing of fishes with different techniques, physicochemical and nutritional changes during freezing.

CO5: Understand the Canning techniques for fishes, preparation of pickle, curing techniques.

<b>QUESTION PAPER PATTERN</b>		
<b>Exam Hours</b> : 3		<b>Max.marks: 75</b>
<b>PART-I (Answer ALL)</b>		
<b>Q.No:1 to 20 –Objective type question: MCQ – 5;</b>	<b>Fill up the blanks -5;</b>	<b>20X1=20</b>
<b>Match the following-5</b>		<b>True or false – 5:</b>
<b>PART-II (Either OR)</b>		
<b>Q.No:21 to25 - One question from each Unit</b>		
<b>PART-III (Answer any THREE out of FIVE)</b>		
<b>Q.No:26 to 30 - One question from each Unit</b>		<b>3X10=30</b>

## EXTRA DISCIPLINARY COURSE (EDC)

### DIET FOR HEALTHY LIFE

<b>THEORY HOURS</b>	<b>2</b>	<b>COURSE CODE</b>	<b>: P21Z2EDC</b>
<b>PRACTICAL HOURS:</b>		<b>CREDITS</b>	<b>: 2</b>
<b>EXAM HOURS</b>	<b>3</b>	<b>MARKS</b>	<b>: ESE-75/CIA-25</b>

#### Objectives:

To deliver authentic health information and to create awareness on healthy life style innatural way

#### UNIT-I

**Processed and ready to eat food:** Balanced diet-need for balanced Diet - Types of food, according to their function (Energy rich, Body building and protective).

Processed food, instant foods, fast foods, street food, junk foods.

#### UNIT-II

Diet during different stages of Life-Diet for infant-Diet for growing child-Diet for pregnant and lactating mother

#### UNIT-III

Role of different kinds of food materials on health

- a) Vegetables and fruits in diet
- b) Different kinds of fats/oils (Animal fat, Vegetable fat, visible and nutritive fats, Vanaspati)
- c) Salt intake
- d) Sugars
- e) Whole grains
- f) Water & Beverages
- g) Milk & Soft drinks, Tea, Coffee, Energy drinks, Tender coconut water, Alcohol.

#### UNIT-IV

1. Best practices for storage-Handling of Perishable foods-Dairy, Fresh fruits and Vegetables, egg, Non vegetarian foods
2. Personal hygiene
3. Removal or reduction of pesticides-washing, balancing, peeling, cooling
4. Beware of adulterants-common adulterants.

## UNIT-V

Healthy cooking practices pre cooling preparation, washing and cutting of raw food, cooling methods

Diet and weight management-Healthy foods, Tips to reduce body weight -Naturopathy

### Learning materials:

Health diet-Published in Nation Health portal, Ministry of Health and family welfare validated by Nutritional IDD cell, DGHS, MOHFW, GOI.

### REFERENCES:

[www.indianmedicine.nic.in](http://www.indianmedicine.nic.in)

<http://ninindia.org/DietaryguidelinesforIndians-Finaldraft.pdf>

[http://readynutrition.com/resources/are-you-ready-series-best-practices-for-long-term-food-storage\\_03042011/](http://readynutrition.com/resources/are-you-ready-series-best-practices-for-long-term-food-storage_03042011/)

[https://www.ava.gov.sg/docs/default-source/tools-and-resources/resources-for-businesses/\(english\)-good-storage-practices](https://www.ava.gov.sg/docs/default-source/tools-and-resources/resources-for-businesses/(english)-good-storage-practices)

<http://www.fda.gov/Food/ResourcesForYou/Consumers/ucm114299.htm>

### COURSE OUTCOMES:

Upon completion of the course, the students can

CO1: Gain knowledge to have a

healthy life CO2: Acquire knowledge on

healthy foods. CO3: Adopt personal

hygiene

CO4: Obtain the concepts of nutritional requirements for healthy life.

CO5. Enrich the knowledge of faulty food habits and proper health management.

QUESTION PAPER PATTERN		
Exam Hours	: 3	Max.marks: 75
PART-I (Answer ALL)		20X1=20
Q.No:1 to 20 –Objective type question: MCQ – 5;	Fill up the blanks -5;	True or false – 5:
Match the following-5		
PART-II (Either OR)		
Q.No:21 to25 - One question from each Unit		
PART-III (Answer any THREE out of FIVE)		
Q.No:26 to 30 - One question from each Unit		3X10=30

## SKILL BASED ELECTIVE COURSE II

### TAXONOMY OF FISHES

<b>COURSE CODE : P21Z2SE 2</b>	<b>Hours/working</b>	<b>Credit</b>	<b>Exam hours</b>		<b>Marks</b>	
<b>Theory</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>CIA</b>	<b>ESE</b>	<b>TOTAL</b>
<b>Practical</b>	<b>1</b>			<b>20</b>	<b>-</b>	<b>10</b>
				<b>20</b>	<b>60</b>	<b>0</b>

#### Objectives:

The objective of the course is

1. To impart the learner with a basic knowledge on fish classification through diagnostic characters with reference to commercially important fishes of marine and inland sources.

#### UNIT- I

Origin & Evolution of fishes (Chondrichthys, Osteichthyes, Sarcopterygii) through Geological time scale. General characteristics of fishes- Status of fishery resources of the World and India

#### UNIT- II

General Principles of Taxonomy, Nomenclature, Types. ICZN Classification and interrelationships. Criteria for generic and specific identification. Method of morphometric and meristic characters.

#### UNIT-III

Major taxa of fishes up to Family level in commercially important marine and inland fishes of India. Modern taxonomic tools for fish identification: karyotaxonomy, protein analysis and DNA polymorphism. Resource materials for fish identification based on literature and online

#### UNIT- IV

##### Practical

Collection, preservation and labeling of fishes.

Identification of fishes based on external morphology and diagnostic features. Identification of commercially important marine and inland fishes

## **UNIT-V**

### **Practical**

Visit to fish landing centers and fish markets to identify commercially important fishes. Preparation of document record for the identified fishes based on taxonomy during fieldvisit

### **Reference books:**

1. J. S. Nelson (2016)Fishes of the World,
2. K.C. Jayaraman(2002) Fundamentals of fish taxonomy

### **COURSE OUTCOMES:**

CO1: Understanding the basics of origin and evolution of fishes through geological time scale and gaining the knowledge on the present status of the fisheries resourceof the world and India

CO2: Acquiring the knowledge on the fundamentals of nomenclature and the rulesof ICZN; realizing the importance of conventional methods through morphometric and meristic for identification of fishes.

CO3:Understanding the classification of fishes to family level in commercially importantFishes. Utilizing the available resource materials for fish identification based on literature and online

CO4: Learning the process of preservation and labeling of commercially important fishes.

CO5: Gaining the field knowledge on fish identification in the fish landing centers andfish markets through field visit and knowing the method of document recordpreparation based on fish classification.

### **QUESTION PATTERN**

**THEORY - 205X2=10**

**2 OUT OF 3 QUESTIONS (2X5=10)**

**PRACTICAL – 60 MARKS**

**ONE MAJOR PRACTICAL FOR 20 MARKS AND**

**ONE MINOR PRACTICAL FOR 10 MARKS**

**SPOTTERS 10X2=20**



## SELF STUDY COURSE – I

### GENERAL STUDIES FOR RESEARCH FELLOWSHIPS AND LECTURERSHIP

#### Objectives:

1. To learn the various concepts and methods of teaching.
2. To make the students understand the various types of research.

#### UNIT-1: TEACHING APTITUDE

Teaching – Nature, Objectives, Characteristics and basic requirements.  
Learners Characteristics, Factors affecting teaching, Methods of teaching, Teaching aids Evaluation systems.

#### UNIT-2: RESEARCH APTITUDE

Research – meaning, Characteristics and types, Steps of research, Methods of research, Research Ethics. Paper, Article, Workshop, Seminar, Conference and symposium. Thesis Writing – Its Characteristics and format.

#### UNIT-3: MATHEMATICAL REASONING

#### UNIT-4: LOGIC METHODOLOGY AND DATA ANALYSIS

Statement; Premises; Term – Types of Syllogism, Prepositions, Logical inferences; Fallacies or Possible errors in logical conclusions – Types of Tables and Graphs, Interpretation of data sources, acquisition and interpretation, Qualitative and quantitative data, Graphical representation and mapping of data.

#### UNIT-5: INFORMATION AND COMMUNICATION TECHNOLOGY

Overview of Computer- Hardware, Software, Internet, and e-mailing.  
EDUSAT- Space Science and Communication – Milestones, Space Transportation – Earth Observations.

#### Books for NET/SET Coaching:

##### TEXT BOOKS:

1. UGC- NET/JRF/SET Teaching & Research Aptitude by Dr. M.S. Ansari & RPH Editorial Board, 2014. Ramesh Publishing House, New Delhi
1. Dr. K. Kautilya, 2013 UGC – NET/JRF/SET Teaching research & Aptitude, Upkar Prakashan, Agra-2.
2. Sajit Kumar & M. Gagan (2011) UGC – NET/JRF/SET Teaching research & Aptitude. Damika Publishing Company, New Delhi.
3. Dr. M.S. Ansari (2011) UGC – NET/JRF/SET Teaching research & Aptitude. Ramesh Publishing House, New Delhi.
4. Dr. Lal, Jain & Dr. K.C. Vashiatha (2011) UGC – NET/JRF/SET Teaching research & Aptitude, Upkar Prakashan, Agra-2.
5. Editorial Board: Pratiyogita Darpan (2010) UGC – NET/JRF/SET Teaching research & Aptitude, Upkar Prakashan, Agra-2

#### QUESTION PAPER PATTERN

50 out of 60 multiple choice questions

50x2=100 marks

## **EXTRA CREDIT COURSE**

### **INTERNSHIP**

#### **SUBJECT CODE: INT**

The curriculum includes the internship for students for 30 hours during the summer vacation after the second semester of all PG programs.

#### **OBJECTIVES**

The following are the intended objectives of internship training:

- To Enhance the employability skills of the students.
- To expose students to the industrial/Societal environment, which cannot be simulated in the classroom hence creating competent professionals for the industry and other organizations.
- To Provide possible opportunities to learn, understand and sharpen the real-time technical/managerial skills required at the job.
- To Expose the current technological developments relevant to the subject area of training.
- To make use of Experience gained from the 'Industrial Internship' in classroom discussions.
- To create conditions conducive to quest for knowledge and its applicability on the job.

#### **Expected Outcome:**

- An opportunity to get hired by the Industry/ organization.
- Practical experience in an organizational setting.
- Help students to have a preference for the best career option to pursue.
- Opportunity to learn new skills, practice communication, and teamwork skills, and supplement knowledge.
- Provide an opportunity to obtain knowledge and evaluate the working environment of the Industry / Organisation.

#### **INTERNSHIP DURATION AND ACADEMIC CREDENTIALS:**

The following framework is proposed to award academic credit for the internship undergone as part of the programme.

1. Internship must be undertaken only with those Institutions /Labs /organizations/ industries the College has linkages.
2. The internship has to be carried out during the summer vacation and could be completed within the third semester.
3. The duration of the internship is 30 hours at the minimum.

4. The students should maintain a training diary during the internship.
5. A faculty mentor is allotted for the students by the Head of the Department.
6. The mentor will arrange suitable internships for the students allotted to them.
7. After completion of the internship, the mentor has to make arrangements to get a proper training certificate from the industry/institution.
8. The assessment of the internship will be based on the feedback given by the internship provider and the report submitted by the student by the mentor.
9. An abstract for details of the internship in the prescribed format has to be submitted by the departments to the COE on time.
10. Two credits are provided for the Internship as extra credits included under the Non-CGPA course for all PG programs.

**LETTER FORMAT**

**GOVERNMENT COLLEGE FOR WOMEN (AUTONOMOUS), KUMBAKONAM**

**REQUEST LETTER FROM THE COLLEGE TO INTERNSHIP PROVIDER**

To

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.....

.....

Subject: REQUEST FOR INSTITUTIONAL/INDUSTRIAL TRAINING of M.A./M.Com/M.Sc Degree Programme,

Dear Sir/Madam,

You must be aware that our College has made internship mandatory for all M.A./M.Com/M.Sc students.

In view of the above, I request your good self to allow following students of our college for practical training in your esteemed organization. Kindly accord your permission and give at least 30 hours of training for the students to complete the internship.

<b>S.NO</b>	<b>NAME OF THE STUDENT</b>	<b>REG.NO</b>	<b>DISCIPLINE</b>

If vacancies exist, kindly plan for Campus/Off Campus Interviews for \_\_\_\_\_ batch passing out students in above branches.

A line of confirmation will be highly appreciated.

With warm regards,

Yours sincerely,

Head of the Department.



**FORM - 1**

INTERNSHIP DETAILS (THIS WILL BE PREPARED IN CONSULTATION WITH FACULTY MENTOR AND TO BE MAINTAINED BY tHe department)

**Student**

Name: \_\_\_\_\_ Reg.No. \_\_\_\_\_ Class \_\_\_\_\_

Campus Address: \_\_\_\_\_

\_\_\_\_\_

Phone: \_\_\_\_\_ Email: \_\_\_\_\_

**Internship Provider**

Name: \_\_\_\_\_

Title: \_\_\_\_\_

Company/Organization: \_\_\_\_\_

Internship Company Adress \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Phone: \_\_\_\_\_ Email: \_\_\_\_\_

**Faculty Mentor**

Name: \_\_\_\_\_ Phone: \_\_\_\_\_

Designation: \_\_\_\_\_ Department: \_\_\_\_\_

**Academic Credit Information**

Internship Title: \_\_\_\_\_

Date of Initiation: \_\_\_\_\_ Date of Completion: \_\_\_\_\_

Total Hours: \_\_\_\_\_

**FORM - 2**

**STUDENT'S DAYWISE LOG ENTRY**

Name and Reg.No. of the Student:

Name and address of the Internship

Provider:

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**Period of Internship: From:** \_\_\_\_\_ **To:** \_\_\_\_\_

<b>Date</b>	<b>Hours</b>	<b>Details of work done</b>	<b>Signature of the Student</b>	<b>Signature of the Supervisor</b>

Signature of the Mentor:

Signature of the Internship Provider:

**FORM -3**

**SUPERVISOR EVALUATION OF CANDIDATE**

Student Name: \_\_\_\_\_ Date: \_\_\_\_\_

Work Supervisor: \_\_\_\_\_ Title: \_\_\_\_\_

Company/Organization: \_\_\_\_\_

Internship Address: \_\_\_\_\_

Dates of Internship: From \_\_\_\_\_ To \_\_\_\_\_

Please evaluate your candidate by indicating the frequency with which you observed the following behaviors:

<b>Parameters</b>	<b>Needs improvement</b>	<b>Satisfactory</b>	<b>Good</b>	<b>Excellent</b>
Interest in work				
Punctuality				
Reliability				
Responsibility				
Communication				
Team work				
Overall performance				

Additional comments, if any:

Signature of Internship Provider



**FORM - 4**

STUDENT FEEDBACK OF INTERNSHIP (TO BE FILLED BY STUDENTS AFTER INTERNSHIP COMPLETION)

Student Name: \_\_\_\_\_ Class: \_\_\_\_\_

Internship Provider: \_\_\_\_\_

Address: \_\_\_\_\_

Title of Internship : \_\_\_\_\_

Supervisor Email: \_\_\_\_\_

Faculty Mentor: \_\_\_\_\_

Indicate the degree to which you agree or disagree with the following statements.

<b>This experience has</b>	<b>Strongly Agree</b>	<b>Agree</b>	<b>Disagree</b>
Given me the opportunity to explore a career field			
Allowed me to apply classroom theory to Practice			
Expanded my knowledge			
Helped me develop my written and oral communication skills			
Given me a chance to improve my interpersonal skills			
Provided me with contacts which may lead to future employment			
Helped me clarify my career goals			

Considering your overall experience, how would you rate this internship?

(Tick one).(Satisfactory/ Good/ Excellent)

Signature of the Student

**FORM - 5**

**EVALUATION SHEET (FOR MENTOR)**

<b>S.NO</b>	<b>NAME OF THE STUDENT</b>	<b>REG.NO</b>	<b>NO. OF ACTUAL INTERNSHIP HOURS</b>	<b>GRADE*</b>

\* Evaluation based on report submitted by the student and evaluation by Internship provider.  
(Excellent/ Very good/ Good)

Signature of the Head of the Department

Signature of the Mentor

## CORE COURSE IX - DEVELOPMENTAL BIOLOGY AND EVOLUTION

<b>THEORY HOURS</b> : 6	<b>COURSE CODE</b> : P21ZC309
<b>PRACTICAL HOURS:</b>	<b>CREDITS</b> : 5
<b>EXAM HOURS</b> 3	<b>MARKS</b> : ESE-75/CIA-25

### Objectives:

1. To comprehend the various developmental biological events in living organisms.
2. To gain the knowledge in metamorphosis and regeneration.
3. To understand the basic concepts of animal evolution.

### UNIT- I

**Gametogenesis:** Spermatogenesis - Formation of spermatids, spermiogenesis, structure of spermatozoa, significance of spermatogenesis, seasonal and non seasonal breeders. Oogenesis- multiplication phase, growth phase- pre-vitellogenesis, vitellogenesis, types of eggs, polarity and gradient, maturation, significance of oogenesis.

### UNIT- II

**Fertilization:** Physiological events and Biochemical changes during fertilization.  
**Parthenogenesis:** Types, Natural and Artificial - significance.

**Cleavage:** Types of cleavage- peculiarities - chemical changes - patterns of cleavage - planes of cleavage, Role of egg cortex in sea urchin  
Embryonic induction of lens and competence. Differentiation - Types and levels; Homeotic genes; Nuclear transplantation experiment.

### UNIT - III

Gene activity and general metabolism during gastrulation - Morphogenetic movements- Organogenesis of eye in Frog.

**Metamorphosis:** Moulting and metamorphosis in insects - mechanism of action - insect hormones.

**Regeneration:** Regenerative ability in planaria, Stimulation and suppression of regeneration - polarity and gradients in regeneration.

Infertility, Super ovulation, ICSI, GIFT, IVF and Test tube baby. (Add recent reproductive assisted techniques)

### EVOLUTION

#### UNIT - IV

Origin of basic biological molecules - chemical evolution, Evolution of prokaryotes and eukaryotes, Evolution of Anaerobic metabolism, photosynthesis and aerobic metabolism. Darwinism and Modern synthetic theory of evolution.

#### UNIT - V

Darwinism - Natural selection, Variation, Adaptation. Modern Synthetic theory of Evolution - Mutation, Isolation, Gene pool, Gene frequency, Genetic drift, Hardy-Weinberg law, Speciation - Trends in Evolution and Extinction.

### Text Books

#### Developmental

#### Biology:

1. Balinsky B.L (1981). An Introduction to Embryology. V Ed., Saunders Co., Philadelphia.
2. Berrill N.J (1986). Developmental Biology. Tata McGraw Hill, New Delhi.

**Evolution:**

1. Sanjibchattopadhyay (2009). Evolution on Adaptation and Ethology Books and Allied(p)ltd, Kolkata.
2. StrickbergerM.W (1996). Evolution. Jones and Barlett publishers Inc., London.
3. Dobzhansky T., Ayala F.J., Stebbins G.L and Valentine J.W (1975).Evolution.SurjeetPublications.

**Reference Books:****Developmental Biology:**

1. Berrill N.J and Karp G. (1976). Developmental Biology. McGraw Hill Inc. New York.
2. Browder L.N (1980). Developmental Biology, Saunders College. Philadelphia.
3. Deuchar E.M (1976). Cellular interaction in Animal Development. Chapman and Hall,London.
4. Gilbert S.F (1995). Developmental Biology. II Edn., Sinamer Associates Inc., Publishers,Saunderland, Massachusetts, USA.
5. Saunders A.W (1982). Developmental Biology. Patterns / Principles / Problems.Macmillan Publishing Co., NewYork.
6. StevanB and Oppenheimer (1980). Introduction to Embryonic Development. Alley andBern.
7. TimirasP.S (1972). Developmental Physiology and Aging. The Macmillan Company,New York.
8. Willer B.H and Oppenheimer J.M (1964). Fundamentals of Experimental Embryology,Prentice Hall

**Evolution:**

1. Dodson E.O and Dodson P (1976). Evolution: Process and Product (II Edn). VanNostrand Company, New York.
2. Dowdeswell W.H (1963). The Mechanism of Evolution. Arnold-Heinmann India, Delhi.
3. Joha A.P (1992). Gene and evolution. The Macmillan Co., New Delhi.
4. Merrel D.P (1962). Evolution and Genetics: The Modern theory of Evolution. Holt, Rinehart and Winston Inc., New York.

**COURSE OUTCOMES:**

Upon completion of the course, the students are able to

CO1: Understand the biological process involved in the development.CO2: Describe the intricate process of fertilization.

CO3:Explain organogenesis.

CO4:Understand the origin of life.

CO5: Understand various theories of evolution.

QUESTION PAPER PATTERN		
Exam Hours	: 3	Max.marks: 75
PART-I (Answer ALL)		
Q.No:1 to 20 –Objective type question: MCQ – 5;	Fill up the blanks -5;	20X1=20
Match the following-5		
Q.No:21 to25	- One question from each Unit	
PART-III (Answer any THREE out of FIVE)		

## CORE COURSE X- BIOTECHNOLOGY AND BIOINFORMATICS

<b>THEORY HOURS</b> : 6	<b>COURSE CODE</b> : P21ZC310
<b>PRACTICAL HOURS:</b>	<b>CREDITS</b> : 5
<b>EXAM HOURS</b> 3	<b>MARKS</b> : ESE-75/CIA-25

### Objectives:

1. To acquire knowledge on the application of biotechnology in various fields.
2. learn gene cloning, gene transfer technique,
3. Applications of biotechnology in bioremediation for the industrial wastes.
4. Applications of biotechnology in agriculture and transgenic animals
5. awareness on GMOs

### UNIT-I

#### Basic Tools for Gene Manipulation

**Cloning vectors:** Plasmids, Cosmids, Phagemids, Lambda Bacteriophage, M13, BAC, YAC, MAC and Expression vectors (characteristics). Restriction enzymes: Nomenclature, Types. **Transformation techniques:** Calcium chloride method, electroporation and biolistic method. Construction of genomic and cDNA libraries and screening by colony and plaque hybridization

### UNIT-II

#### Advance Tools and Techniques

Southern, Northern and Western blotting DNA sequencing: Sanger method, Polymerase Chain Reaction, DNA Finger Printing and DNA micro array.

#### Genetically Modified Organisms

Production of cloned and transgenic animals: Nuclear Transplantation, Retroviral Method, DNA microinjection; Applications of transgenic animals: Production of pharmaceuticals, production of donor organs, knock out mice.

### UNIT-III

Applications of biotechnology in agriculture (Agrobacterium-mediated transformation. Applications of transgenic plants: insect and herbicide resistant plants, Biopesticides and Biofertilizers) medicine (insulin) and food science. Genetically modified organism (GMO'S) - GM foods.

Bioremediation - bioremediation of hydrocarbons - Industrial wastes - Heavy metals - Xenobiotics - bioleaching - biomining - biofuels.

### UNIT-IV

Introduction to Bioinformatics, Databases-Nucleic acid databases, Protein sequence databases, Databases of structures, Specialized databases, Bibliographic databases. Outline of Genomics and Proteomics. Steps involved in Drug Discovery.

## UNTI-V

structure based Protein classification, Protein structure databases-PDB, NCBI. Visualization databases - Rasmol, Swiss-PDB and PDBsum. Structure visualization database

### Recommended Text Books:

1. Dubey R.C (2008). A text Book of Biotechnology. S. Chand and Company, New Delhi.
2. Sathyanarayana U (2005). Biotechnology. Books and Allied P. Ltd. Kolkata.
3. B.D.Singh(2003).Biotechnology,Kalyanipublishers.Ludhiana,New Delhi
4. Prakash.S.Lohar(2017),Bio informatics,MJP Publishers,Chennai.

### References Books:

1. Brown C.M., Campbel I and F.G Priest (1988). Introduction to Biotechnology. BlackwellScientific Publications, UK.
2. Primrose S.B (2000). Modern Biotechnology. Blackwell Scientific Publications, Oxford,London.
3. KeshavTrehan (1996). Biotechnology. New Age International Pvt. Ltd. Publishers, NewDelhi.
4. Watson *et.al.*, (1999). Recombinant DNA. Freeman and Company, New York
5. Ignacimuthu S (1998). Basic Biotechnology. Tata McGraw Hill Publishing Co., NewDelhi.
6. Sharma.Munjal.Shanker(2016) Text book of Bioinformatics, Rastogi publication, Meerut.
7. Arthur M.Lesk(2003).Introduction to Bioinformatics, University of Cambridge, OxfordUniversity Press.

### COURSE OUTCOMES:

Upon completion of the course, the students are able to

CO1: Master the theoretical knowledge of various field in biotechnology.

CO2: Acquire and perform various experiment related aspects of biotechnology.

CO3: Understand and acquire the knowledge of cloning vector, gene transfer techniques andequip the students to get job opportunity in these field of biotechnology based companies.

CO4: Understand and acquire the knowledge of data base, types, and drug discovery with bioinformatics tools and equip the students to get job opportunity in these field

CO5: Understand and carry out the bioinformatics applications in the field of medicineAnd environmental fields.

QUESTION PAPER PATTERN		
Exam Hours	: 3	Max.marks: 75
PART-I (Answer ALL)		20X1=20
Q.No:1 to 20 –Objective type question: MCQ – 5;	Fill up the blanks -5;	True or false – 5;
Match the following-5		
PART-II (Either OR)		
Q.No:21 to25	- One question from each Unit	
PART-III (Answer any THREE out of FIVE)		
Q.No:26 to 30	- One question from each Unit	
		3X10=30

## CORE COURSE XI - MICROBIOLOGY

<b>THEORY HOURS</b> <b>6</b>	<b>COURSE CODE</b> : <b>P21ZC311</b>
<b>PRACTICAL HOURS:</b>	<b>CREDITS</b> : <b>5</b>
<b>EXAM HOURS</b> <b>3</b>	<b>MARKS</b> : <b>ESE-75/CIA-25</b>

### Objectives:

1. To learn the basics of microbes and their environment.
2. To gain the knowledge of nutritional requirements for microbial growths.
3. To give awareness on microbial world and microbial diseases.

### UNIT - I

Scope and history of microbiology - Classification of microorganisms - Microbial diversity, general methods of classifying bacteria, fungi, algae and virus. Morphology and fine structure of bacterial cells - cell wall and peptidoglycan in Gram positive and Gram negative bacteria - Reproduction of bacteria and viruses (lytic and lysogenic cycles).

### UNIT- II

Bacterial growth and nutritional requirements, nutritional media and growth conditions; methods for culturing microbes - culture media (general and specific media)- microbial growth; Isolation of pure culture. SPC and MPN techniques.

### UNIT - III

Industrial microbiology - Structure of fermentor and fermentation process, fermentation products, production of ethanol, Pharmaceuticals - antibiotic, vitamins, microbial enzymes and vaccines.  
Food microbiology - Food spoilage and food preservation techniques.

### UNIT- IV

Environmental microbiology - nitrogen fixation (symbiotic and non-symbiotic) mechanism of nitrogen fixation, carbon, nitrogen, sulphur and phosphorous cycle.  
Water microbiology - bacteriological examination of domestic water, purification of water, sewage and its disposal, Aeromicroflora of hospitals.

### UNIT - V

Medical microbiology - Microorganisms and infectious diseases Epidemiology, symptoms, clinical types and therapy of Fungal (Mycoses and Mycotoxicoses), Bacterial (Tuberculosis and Typhoid) and viral (Dengue, Hepatitis and HIV) diseases.

### Text Books:

1. Pelczar M.J., Reid R.D and E.C.S Chan (1996). Microbiology. V Ed., TataMcGraw Hill Publishing Company Ltd., New Delhi.
2. Ananthanarayanan T and C.K Jayaram Paniker (2000). Text Book of Microbiology. VI Ed., Orient Longman Ltd., Madras.

3. Dubey,R.C.andMaheswari.D.K.(1999),Text book of Microbiology, S. Chand andCompany Ltd., New Delhi.
4. Michel. J,Pelczar,Jr.,Chan,E.C.S,Krieg,R(1993)Tata Mccraw-Hill edition,New Delhi.

**References Books:**

1. David Freifelder (1998). Microbial Genetics.Narosa Publishing House, NewDelhi.
2. Powar C.B and Diginawala H.F (1982). General Microbiology. Volume I and II, Himalaya Publishing House, Bombay.
3. Michael T. Madigan, John M. Martinkl and Jack Parker (1997). Biology of Microorganisms. VIII Ed., Prentice Hall International Inc., USA.

**COURSE OUTCOMES:**

Upon completion of the course, the students are able to

CO1: Understand the classification and structure of microorganisms.

CO2:Obtain the knowledge of nutritional requirements for growth of microbes. CO3: Understand the fermentation, food spoilage and preservation techniques. CO4: Enrich the knowledge of microbial mechanism involved in environment. CO5: Attain the knowledge of infectious diseases caused by microbes.

<b>QUESTION PAPER PATTERN</b>		
<b>Exam Hours</b>	<b>: 3</b>	<b>Max.marks: 75</b>
<b>PART-I (Answer ALL)</b>		
<b>Q.No:1 to 20 –Objective type question:</b>	<b>MCQ – 5;      Fill up the blanks -5;</b>	<b>20X1=20</b>
<b>Match the following-5</b>		
<b>PART-II (Either OR)</b>		
<b>PART-III (Answer any THREE out of FIVE)</b>		



## CORE COURSE XII - PRACTICAL- III

### DEVELOPMENTAL BIOLOGY AND EVOLUTION, MICROBIOLOGY, BIOTECHNOLOGY, BIostatISTICS AND RESEARCH METHODOLOGY

THEORY HOURS : 6	COURSE CODE : P21ZC312P
PRACTICAL HOURS: -	CREDITS : 3

#### Objectives:

To impart practical skills for the theoretical knowledge gained through core courses IX, X and XI

#### A. DEVELOPMENTAL BIOLOGY

1. Whole mount of chick embryo – 24hrs, 36 hrs, 72hrs and 96 hrs.
2. Observation of prepared slides for developmental stages in frog.
3. Effect of thyroxine on metamorphosis of tadpoles.
4. Observation of regeneration in tail of tadpoles.

#### B. EVOLUTION

1. Observation of forelimbs or hind limbs of vertebrates (Frog, Calotes, Bird and Mammal) to demonstrate the common pattern of pentadactyl limb and common ancestry of vertebrates.
2. Report on evidences for evolution based on your observation in field visit.
3. Observation of leaf insects and stick insects in the museum to demonstrate adaptation by cryptic colouration and natural selection.
4. Observation of Monarch and Viceroy butterflies to demonstrate Batesian mimicry.
5. Spotters: Archeopteryx, Grand Canyon, Limulus, Peripatus and fossils.

#### C. BIOTECHNOLOGY

1. Isolation of genomic DNA
  2. Agarose gel electrophoresis of DNA
- Spotters:** PCR, southern blotting, vectors, transgenic animals

#### BIOINFORMATICS

1. Sequence analysis - Human insulin - Fasta - Blast
  2. Molecular Docking.
- Spotters** -homepages of NCBI, Swiss-Prot and PDB,

#### D. MICROBIOLOGY

1. Culture techniques – culture of bacteria
  2. Bacterial growth curve
  3. Enumeration of bacteria by serial dilution
  4. Enumeration of bacteria by counting method
  5. Antibiotic susceptibility test.
  6. Milk purity test by MBR method
- Spotters:** Laminar air flow, inoculation needle, Autoclave, Incubator

## **F. BIOSTATISTICS**

1. Collection of data (Height, Weight, Blood group, Hb, BMI) from class,
2. Analysis of data using Microsoft excel

## **G. RESEARCH METHODOLOGY**

1. Preparation of bibliography for research paper

## **COURSE OUTCOMES:**

Upon completion of the course, the students are able to

CO1: Obtain skills in identification of embryogenic developments in chick and frog.

CO2: Understand common patterns of Pentadactyle limbs and common ancestry of vertebrates.

CO3: Acquire the knowledge of recent developments in biotechnology and their application.

CO4: Develop skills to isolate and culture the microbes.

CO5: Improve the knowledge for collection, interpretation, analyzing and publishing the research data.

### **QUESTION PAPER PATTERN**

**Exam Hours : 5**

**Max.marks:60**

**QUESTION NO.I – Major Practical from allotted lot of 4 experiments 15**

**Marks QUESTION NO.II – Minor Practical 10 Marks**

**QUESTION NO.III- Minor Practical 10 Marks**

**QUESTION NO.IV – 4 Spotters 4 X 3 =12 Marks**

**Viva 3 Marks**

**Record 10 Marks**

## MAJOR BASED ELECTIVE COURSE III

### 1. BIostatISTICS AND RESEARCH METHODOLOGY

<b>THEORY HOURS</b> 6	<b>COURSE CODE</b> : P21Z3MBE3:1
<b>PRACTICAL HOURS:</b>	<b>CREDITS</b> 4
<b>EXAM HOURS</b> 3	<b>MARKS</b> : ESE-75/CIA-25

#### Objectives:

1. To understand the importance of Statistics and presentation of biological data.
2. To learn the research methodology for scientific writing
3. To know the basic principles of microscopes and biotechniques.

#### UNIT-I

Introduction to biostatistics - scope and definition, functions and limitations .Collection, organization (classification and tabulation of data) and presentation (graphical representations) of data. Measures of central tendency - mean, median and mode. Measures of dispersion - range, inter quartile range, mean deviation, standard deviation and Standard error.

#### UNIT - II

Skewness and kurtosis, measures of skewness, Karl-Pearson's coefficient of skewness, Bowley's measures of skewness, types of coefficient of skewness, types of kurtosis, Correlation analysis (Karl-Pearson's)- types and methods, Regression analysis - regression line and regression equation.

#### UNIT - III

Hypothesis testing, Chi-square test, One-way Analysis of variance, Student's t-test. Probability theory - Normal, Binomial and Poisson distributions (theory only).

#### UNIT-IV

Literature collection: Sources, Details of books, edited volumes, peer reviewed journals, e-journals, biological abstracts and Magazines. Online browsing of research articles: infonet and inflibnet .Preparation of research dissertation - components of thesis, proof reading, preparation of bibliography. Preparation of Scientific paper for publication in a peer reviewed Journal.Web of science, SCOPUS, SCI Index,Thompson Rheutter, Details of impact factor, citation index and h-index.

#### UNIT -V

Principles and their application of Electron Microscope (SEM and TEM), Centrifuge (Ultracentrifuge), Electrophoresis (SDS-PAGE), Chromatography (TLC, GCand HPLC) Spectroscopy (UV, Infrared and NMR).

**Text Books:**  
**BIostatistics**

1. Milton J.S(1992). Statistical methods in Biological and Health Sciences. McGraw Hill Inc., New York.
2. Gupta S.P (1988). An easy approach to statistics. Chand and Co., New Delhi.

**RESEARCH METHODOLOGY**

1. Gurumani N (2006). Research Methodology for Biological Sciences MJP Publishers.
2. Daniel M. Basic Biophysist - student Edition.
3. Prescott. Harley. Klein. Microbiology
4. Jain J.L., Sanjay Jain and Nitin Jain. Fundamentals of Biochemistry. S. Chand publication.

**Reference Books:**

1. Anderson, Durston and Polle (1970). Thesis and Assignment writing. Wiley Eastern Ltd., New Delhi.
2. Comir and Peter Wood Ford (1979). Writing scientific papers in English. Pitman Medical Publishing Co., London.
3. Day R.A (1994). How to write and publish a scientific paper. Cambridge University Press, London.
4. Palanichamy S and M. Shanmugavelu (1997). Research methods in biological sciences. Palani Paramount Publications, Tamil Nadu, India.
5. Wilson and Walker (2000). Practical biochemistry - principles and techniques. Cambridge University Press.

**COURSE OUTCOMES:**

Upon completion of the course, the students are able to

CO1: Acquire in depth knowledge on Statistical methods and presentation of data in research.

CO2: Acquire a clear understanding about correlation and regression analysis. CO3: Know about the framing of research hypothesis.

CO4: Understanding of online collection of data and preparation of article in peer reviewed journals for publication.

CO5: Inculcate the modern techniques and tools applied in research field.

<b>QUESTION PAPER PATTERN</b>		
<b>Exam Hours</b>	<b>: 3</b>	<b>Max.marks: 75</b>
<b>PART-I (Answer ALL)</b>		
<b>Q.No:1 to 20 –Objective type question: MCQ – 5;</b>	<b>Fill up the blanks -5;</b>	<b>20X1=20</b>
<b>Match the following-5</b>		
<b>Q.No:21 to25</b>	<b>- One question from each Unit</b>	
<b>PART-III (Answer any THREE out of FIVE)</b>		

**MAJOR BASED ELECTIVE COURSE III**  
**2. NUTRITION AND DIETICS**

<b>THEORY HOURS</b>	<b>6</b>	<b>COURSE CODE : P21Z3MBE3:2</b>	
<b>PRACTICAL HOURS: EXAM</b>		<b>CREDITS</b>	<b>4</b>
<b>HOURS</b>	<b>3</b>	<b>MARKS</b>	<b>: ESE-75/CIA-25</b>

**Objectives:** To incubate the knowledge on the values of nutritive substances for healthy living of mankind through nutritive foods, balanced diet, gastrotrich nutrition and managing the faculty food habits by therapeutic diets.

**UNIT - I**

Food as a source of nutrition, Physiological importance of carbohydrates, Proteins, Lipids, Vitamins and Minerals

**UNIT - II**

Water as nutrient - regulation of water balance. Determination of energy value of foods - direct and indirect calorimetry - basal metabolic rate.

**UNIT - III**

Nutritional value of foods - cereals, fruits, milk, egg, meat, fish - Nutritional value of common Indian recipes - Balanced diet.

**UNIT - IV**

Effect of cooking and heat processing on the nutritive value of foods - Nutritional requirements: Infants, School children, Pregnant and lactating mothers - Geriatric Nutrition.

**UNIT - V**

Faulty food habits: obesity, Diabetes and cardiac problems - Health education - Malnutrition: Marasmus and Kwashiorkor - Therapeutic diets.

**Reference Books:**

1. Banerjee G.C (1978). Animal Nutrition. Oxford & IBH publishing co, New Delhi.
2. Swaminathan M (1978). Advanced text book on Food and Nutrition, Volume II, The Bangalore printing and Publishing Co, Ltd. Bangalore.
3. Swaminathan M (1989). Handbook of Food and Nutrition. A Bappco Publication Bangalore.
4. Sheel Sharma (2006). Human Nutrition and Meal Planning. JnanadaPrakashan (P&D), New Delhi.

## **COURSE OUTCOMES:**

CO1: Understand about nutrition and physiological importance of biochemical properties.

CO2: Acquire knowledge of role of water, determination of energy values, direct and Indirect calorimetry and basal metabolic rate.

CO3: Gain the knowledge of nutritional value of foods and value of common Indian recipes

CO4: Learn the effect of cooking process on the nutritive value of foods and its requirements for infants, school children, pregnant and lactating mothers.

CO5: Understand the faulty food habits, health education and malnutrition.

<b>QUESTION PAPER PATTERN</b>		
<b>Exam Hours</b> : 3		<b>Max.marks: 75</b>
	<b>PART-I (Answer ALL)</b>	<b>20X1=20</b>
<b>Q.No:1 to 20</b> –Objective type question: MCQ – 5; Match the following-5	<b>Fill up the blanks -5;</b>	<b>True or false – 5</b>
	<b>PART-II (Either OR)</b>	
<b>Q.No:21 to25</b> - One question from each Unit	<b>PART-III (Answer any THREE out of FIVE)</b>	
<b>Q.No:26 to 30</b> - One question from each Unit		<b>3X10=30</b>

**MAJOR BASED ELECTIVE COURSE III**  
**3.DAIRY SCIENCE**

<b>THEORY HOURS</b> <b>6</b>	<b>COURSE CODE</b> : <b>P21Z3MBE3:3</b>
<b>PRACTICAL HOURS:</b>	<b>CREDITS</b> : <b>4</b>
<b>EXAM HOURS</b> <b>3</b>	<b>MARKS</b> : <b>ESE-75/CIA-25</b>

**Objectives:**

1. To understand to role of co - operative society for milk production and marketing.
2. To learn upon dairy needs.
3. To know the difference between native and exotic cow breeds.
4. To gain knowledge on cattle feed and their nutritive value.
5. To know the significance of pasteuration of milk and bacterial diseases on cattle.

**UNIT I**

Dairy farming-Definition-Scope-Role of Co-operative societies in milk production and marketing

**UNIT II**

Dairy breeds of India and its Classification-Exotic Cow Breeds-Jersey and Red sindhi. Indian breeds-Kangayam, Buffalo-Murrah

**UNIT III**

Common cattle feed and their nutritive value-Balanced ration for cattle

**UNIT IV**

Milk-composition-Nutitive value and Pasteurization of milk. Milk products - Butter, Ghee, Cheese

**UNIT V**

Bacterial diseases - Anthrax, Mastitis, Viral disease - Foot and mouth disease, Non - contagious disease, Milk fever

**REFERENCES:**

1. Shivasharayasingh (2013) Dairy technology vol- 01: Milk and milk processing
2. Shivasharayasingh (2013) Dairy technology vol-02: Dairy products and quality assurance
3. Y.H.Hui (1992) Dairy science and technology Handbook.
4. Jadish Prasad (2016) Principles and practices of Dairy farm management

## **COURSE OUTCOMES:**

Upon completion of the course, the students will be able to

CO1: Know the role of co-operative society for milk production and marketing  
CO2: Differentiate the dairy breeds as exotic cow breeds and native breeds.

CO3: Acquire knowledge of cattle feed and their nutritive value.

CO4: Understand the nutritive value of milk and the significance of pasteurization of milk

CO5: Gain knowledge on the bacterial diseases of cattle and to manage them.

<b>QUESTION PAPER PATTERN</b>		
<b>Exam Hours</b> : 3		<b>Max.marks: 75</b>
	<b>PART-I (Answer ALL)</b>	<b>20X1=20</b>
<b>Q.No:1 to 20</b> –Objective type question: MCQ – 5; Match the following-5	<b>Fill up the blanks -5;</b>	- - - - -
	<b>PART-II (Either OR)</b>	
	<b>PART-III (Answer any THREE out of FIVE)</b>	
<b>Q.No:26 to 30</b> - One question from each Unit		<b>3X10=30</b>



**SELF STUDY COURSE-II**  
**PART II-LIFE SCIENCES FOR SET/CSIR EXAMINATION**

<b>THEORY HOURS</b> :		<b>COURSE CODE</b> :	<b>P21Z3SS2</b>
<b>PRACTICAL HOURS:</b>		<b>CREDITS</b> :	<b>2</b>
<b>EXAM HOURS</b>	<b>2</b>	<b>MARKS</b>	<b>: ESE-75/CIA-25</b>

**Objectives:** To enable students to be competent for CSIR/SET examination in Life sciences.

**UNIT-I**

Molecules and their interaction relevant biology: Cellular organization, Fundamental process. Cell communication and cell signaling

**UNIT-II**

Developmental biology: Basic concepts of development. Gametogenesis-Fertilization-Morphogenesis and Organogenesis in animals  
System physiology in animals: Blood  
circulation, cardiovascular, digestive, Respiratory, Nervous, Excretory  
Systems-Sense organs-Thermoregulation, stress and adaptation

**UNIT-III**

Inheritance biology: Mendelian principles - concepts of genes-gene mapping  
methods-microbial, Quantitative and human genetics-mutation and  
recombination  
Diversity of Life forms: Principles and methods of taxonomy-structural  
organization Levels-Outline classification of animals and micro organisms-  
Organisms of health and agricultural importance

**UNIT-IV**

Ecological principles: Environment-Habitat and niche population, Community  
and applied ecology-Species interaction-Ecological succession-Biogeography  
and conservation biology. Evolution and behavior: Emergence of  
evolutionary thoughts-origin of cells and unicellular evolution-paleontology  
and evolutionary history – molecular evolution – mechanisms-Brain behavior  
and evolution

## **UNIT-V**

Applied biology: Microbial fermentation and production Tissue and cell culture methods for animals-Transgenic animals-Genomics-Bioresource-Bioremediation-Biosensors Methods in biology: Molecular biology and recombination DNA methods- Histochemical and immune techniques – Bio physiological methods-Statistical, computational methods-Radio labeling techniques, microscopic techniques and methods in field biology

## **REFERENCES**

CSIR-UGC/NET/JRF/SET Life sciences ,Kumar Pushkar& Dr. A. P. Sigh, Upkar's prakashan,Agra-2

## **COURSE OUTCOMES:**

CO1: Familiarizes with objective type question paper

patternCO2: Get in depth knowledge of their main

subject

CO3: Enable them to become qualified for doing research and for lecturer ship

### **QUESTION PAPER PATTERN**

**50 out of 60 multiple choice questions**

**50x2=100 marks**

### CORE COURSE XIII - ECOLOGY AND ETHOLOGY

<b>THEORY HOURS</b> 6	<b>COURSE CODE</b> : P21ZC413
<b>PRACTICAL HOURS:</b>	<b>CREDITS</b> : 5
<b>EXAM HOURS</b> 3	<b>MARKS</b> : ESE-75/CIA-25

#### Objectives:

1. To learn the fundamentals of environment Components, functions and biogeochemical cycles.
2. To know the sources of pollution and their impact on environment.
3. To familiarize with animal behavior in related to environmental changes.

#### UNIT- I

Ecology: Scope of Ecology - kinds of Ecosystem; Structure of Ecosystem - Abiotic (Temperature and Soil) and Biotic component. Liebig's law of Minimum, Shelford law of Tolerance. Ecological pyramids - Pyramids of numbers, biomass, energy. Functions of an Ecosystem - productivity of Ecosystem, Food chain, Food webs - Energy flow in Ecosystem. Biogeochemical cycle - Carbon and Nitrogen.

#### UNIT- II

Population Ecology: Density, Dispersion, Age structure, Natality, Mortality, Dispersal, Dispersion, Regulation of population density, Population interactions- Animal associations.

Community Ecology: Structure, Stratification, Periodicity, Interdependence, Ecological niche, Ecotone, Edge effect, Succession, Climax.

#### UNIT -III

Pollution - Ecological Aspects of Pollution, kinds of pollution - (Air, water, Soil, Noise, Thermal, Radiation, Plastics and Pesticides) and their source, effects and control measure. Acid Rain- Green house effect-Ozone and its importance- Global warming. Environmental Impact Assessment - Need, Methods.

#### UNIT - IV

Animal behaviour: Definition of Ethology- Approaches to behavioural study (Field and Laboratory methods). Types of behavior: Innate - Reflexes, Taxes Instincts, Acquired behaviour- Habituation, Imprinting, learning (Conditioning, trial and error, insight or reasoning).

#### UNIT-V

Animal behaviour: Feeding and Anti predator behaviour, Aggressive behaviour, Sexual behaviour and Selection, Family and group behaviour, Dominance behaviour.

Animal Communication: Visual, Olfactory, Auditory, Tactile and Chemicals.

#### Text Books:

1. Veer Bala Rastogi and Jayaraj M.S. (1998) Animal Ecology and distribution of animals - Eighth edition - Kedar Nath Ramnath Publications, Meerut.

2. Verma P.S and Dr. Agarwal .V.K (1983). Environmental Biology- S. Chand and Company Pvt. Ltd – New Delhi.
3. Dr.V.K.Agarwal(2009)Animal behavior(Ethology)First edition S.Chand&CompanyPVT-New Delhi.

**Reference Books:**

1. Gundevia H.S and Hare Govind Singh (1998). A text book of Animal Behaviour-S.Chand and Company Ltd, New Delhi.
2. Sharma P.D (2008-2009). Ecology and Environment-Rastogi Publications. NewDelhi.
3. MathurReena(1998).Animal behavior. Rastogi Publications, Meerut.
4. Eugene Odum Gray W.Barrett(2005)Fundamentals of ecology 5<sup>th</sup> edition Cengage publisher. (Add place)

**COURSE OUTCOMES:**

Upon completion of the course, the students are

able to CO1: Understand the role of components

on ecosystem.

CO2: Acquire knowledge of population ecology, community ecology and animal association.

CO3: Collect information on the impact of environmental pollution and global warming. CO4: Understand different animal behaviors through field trips and laboratory study.

CO5: Assess the animal communication at various situations.

<b>QUESTION PAPER PATTERN</b>		
<b>Exam Hours</b>	<b>: 3</b>	<b>Max.marks: 75</b>
<b>PART-I (Answer ALL)</b>		
<b>Q.No:1 to 20 –Objective type question: MCQ – 5;</b>	<b>Fill up the blanks -5;</b>	<b>True or false – 5;</b>
<b>Match the following-5</b>		
<b>PART-II (Either OR)</b>		
<b>PART-III (Answer any THREE out of FIVE)</b>		
<b>Q.No:26 to 30- One question from each Unit 3X10=3</b>		

**CORECOURSE XIV - PRACTICAL – IV**  
**ECOLOGY, ETHOLOGY AND BIODIVERSITY**

<b>THEORY HOURS</b> :		<b>COURSE CODE</b> :	<b>P21ZC414P</b>
<b>PRACTICAL HOURS:</b>	<b>6</b>	<b>CREDITS :</b>	<b>4</b>
<b>EXAM HOURS</b> :	<b>5</b>	<b>MARKS :</b>	<b>ESE-60/CIA-40</b>

**Objectives:**

To impart practical skills for the theoretical knowledge gained through core course XIII

**APPLIED ECOLOGY**

1. Maintenance of microcosms.
2. Estimation of pH, dissolved oxygen, salinity and free CO<sub>2</sub> in water.
3. Determination of carbonates and bicarbonates in water.
4. Estimation of chlorides and total dissolved solids in water.
5. Enumeration of planktons.
6. Visit to drinking water treatment plants.
7. Visit to nearest Forest ecosystem.
8. Study of a Pond ecosystem -Mahamaham tank and write a report on its biodiversity.
9. Effect of pollutants on primary productivity.

**SPOTTERS**

Secchi disc, Water analyzer.

**ETHOLOGY**

1. Observation of habituation in *Pilaglobosa*.
2. Observation of photo taxis in earthworms.

**BIODIVERSITY**

1. Calculation of Shannon index.
2. Calculation of plankton biodiversity.

**COURSE OUTCOMES:**

CO1: Analyze various water quality parameters.

CO2: Collect and enumerate planktons from various sources.

CO3: Acquire the knowledge to measure primary productivity of an ecosystem. CO4: Obtain skills to identify various animal behavior.

CO5: Awareness about animal diversity and hands on experience to calculate its indices.

**QUESTION PAPER PATTERN**

**Exam Hours : 5**

**Max.marks:60**

**QUESTION NO.I – Major Practical from allotted lot of 4 experiments**

**15 Marks**

**QUESTION NO.II – Minor Practical**

**10 Marks**

**QUESTION NO.III- Minor Practical**

**10 Marks**

**QUESTION NO.IV – 4 Spotters**

**4 X 3 =12 Marks**

**Record**

**10 Marks**

**Viva**

**3 Marks**

## CORE COURSE – XV PROJECT / DISSERTATION WITH VIVA VOCE

**Objectives:** To promote original thinking, insemination of knowledge, modulation and innovation of thought, as an exercise, to transport the young minds to the expanding horizon of their chosen area of knowledge and transform them into knowledge generators.

**Project / Dissertation      80 Marks**

2 Reviews                      20+20 = 40marks

Report Valuation            40 Marks

**Viva voce                      20 Marks**

**COURSE OUTCOMES:**

Upon completion students should be able to

CO1 : demonstrate a sound technical knowledge on selected project topic.

CO2 : undertake problem identification, formulation and solution.

CO3 : design solutions to complex problems utilising a systems approach

CO4 : communicate research outcomes in written and oral forms

CO5 : undertake research as a profession.

CO	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1		√	√	√						√	√
CO2		√	√	√						√	√
CO3		√	√	√						√	√
CO4		√	√	√						√	√
CO5		√	√	√						√	√

**MAJOR BASED ELECTIVE COURSE -IV**  
**1. BIODIVERSITY AND CONSERVATION**

<b>THEORY HOURS</b> <b>6</b>	<b>COURSE CODE</b> : <b>P21Z4MBE4:1</b>
<b>PRACTICAL HOURS:</b>	<b>CREDITS</b> : <b>4</b>
<b>EXAM HOURS</b> <b>3</b>	<b>MARKS</b> : <b>ESE-75/CIA-25</b>

**Objectives:**

1. To understand the concepts of biodiversity and conservation strategies.
2. To create the awareness for conservation of various threatened/endangered organisms.
3. To popularize the current practices in conservation of biodiversity.

**UNIT - I**

Biodiversity: Concept and definition – Scope of Biodiversity -Types of biodiversity - Genetic, Species, Ecosystem and Agro biodiversity. Biodiversity values and uses - Ethical, Asthetic, Ecological, Cultural Benefits. Methodologies for valuation of Biodiversity (Changes in productivity method, Contingent valuation method and Hedonic pricing method), diversity assessment (Shannon Weiner Index).

**UNIT-II**

Loss of Biodiversity: Genetic diversity - Factors causing for loss, Founder effects, Demographic Bottlenecks, Genetic Drift, Inbreeding depression. Species diversity-extinction, population size. Ecosystem diversity- Factors affecting Ecosystem Degradation and loss. Agrobiodiversity – loss of Biodiversity as an Economic process- Hot spots of Biodiversity.

**UNIT -III**

Conservation of Biodiversity: Current practices in conservation -*In -Situ* Conservation; Sanctuary, National parks and Biosphere reserves. *Ex-Situ* Conservation: Zoological park, Botanical Garden, Germplasm collections (Seed banks, Test-tube Gene banks, Pollen banks, Field Gene bank, DNA Bank). *In-vitro* Conservation methods – Ecosystem restoration. Social Approaches to conservation - Sacred Groves, Sthalavrikshas, Chipko movement. Role of Educational Institution in Biodiversity and Conservation.

**UNIT -IV**

Management of Biodiversity: IUCN, UNEP, UNESCO, WWF, ICSU, FAO, CAB International WCMC, ISBI, GEF, WHF. Biodiversity Legislation and Conservations (International and National-Laws) CITES, Ramsar Conservation, UPOV, ITTA and ITTO. IUCN threat categories. Red data book. Remote sensing- basic concepts and applications in environmental conservation.

**UNIT -V**

Biotechnology and its role and impacts in Biodiversity -Ecoterrorism, Data and Information Relating to Biodiversity of India, EEZ - importance, Protected areas in India- The silent valley movement- Biopiracy- Biodiversity information networks in India. Problems and prospects in participatory management of Biodiversity.



**Text Books:**

1. Krishnamoorthy K.V(2004). An Advanced text Book on Biodiversity. Oxford and IBHPublishing Co.Pvt.Ltd New Delhi.
2. Sharma P.D(2008-2009). Ecology and Environment. Rastogi Publications, New Delhi.
3. VermaP.S and V.K Agarwal(1983).Environmental Biology. S. Chand and CompanyPvt.Ltd, New Delhi.

**COURSE OUTCOMES:**

CO1: Familiarize with various types of bio diversity and their values.  
CO2:Understand the loss of biodiversity and its degradation.

CO3: Recognize the importance of conservation of biodiversity.

CO4: Impart knowledge on therole of government agencies and NGO's to protectthe environment.

CO5:Obtain the information about the biotechnological implications in the managementOf bio diversity.

<b>QUESTION PAPER PATTERN</b>		
<b>Exam Hours</b> : 3		<b>Max.marks: 75</b>
<b>PART-I (Answer ALL)</b>		<b>20X1=20</b>
<b>Q.No:1 to 20 –Objective type question: MCQ – 5;</b>	<b>Fill up the blanks -5;</b>	<b>True or false – 5;</b>
<b>Match the following-5</b>		
<b>PART-II (Either OR)</b>		
<b>Q.No:21 to25 - One question from each Unit</b>		
<b>PART-III (Answer any THREE out of FIVE)</b>		
<b>Q.No:26 to 30 - One question from each Unit</b>		<b>3X10=30</b>

**MAJOR BASED ELECTIVE COURSE IV 2.SILKWORM  
CULTURE TECHNIQUES AND MARKETING MANAGERMENTS**

<b>THEORY HOURS</b> : 6 <b>PRACTICAL HOURS:</b> <b>EXAM HOURS</b> 3	<b>COURSE CODE</b> : P21Z4MBE4:2 <b>CREDITS</b> 4 <b>MARKS</b> : ESE-75/CIA-25
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**Objectives:**

1. To educate the scope, management of mulberry cultivation for silkworm.
2. To introduce the egg incubation and rearing techniques, seed production and silkproduction technology.
3. To inculcate knowledge on mulberry & Non mulberry disease and pest management insericulture.
4. To introduce techniques in harvesting and marketing of silkworm cocoons.

**UNIT – I**

Scope, silk worm types and soil management for mulberry cultivation: Scope of sericulture of India; classification of silkworms; life history, growth stages of mulberry silkworm; climatic condition and site suitability for mulberry cultivation, soil management: types of soil, physic-chemical properties of soil and preparation of land for mulberry cultivation.

**UNIT – II**

Pre-requisite for rearing, egg incubation &Chawki rearing and late age silk worm rearing: silk worm breeds for rearing, estimation of mulberry leaf yield and quality, estimation of brushing capacity for rearing, disinfection for silkworm; egg incubation, black boxing, hatching, brushing of larvae, chawki rearing, leaf quality for chawki rearing and commercial chawki rearing; Characteristics of late age silkworms methods of rearing: tray, shelf, floor rearing, environment condition for silkworm rearing.

**UNIT – III**

Silk worm seed and silk technology: egg production, embryonic development diapause and non diapause eggs, acid treatment for incubation; brief introduction to natural and synthetic fibers for silk industry, assessment of cocoon properties , silk reeling, stiffing and storage of cocoon in silk reeling unit, cocoon cooking, reeling and re- reeling, raw silk testing, silk weaving.

**UNIT – IV**

Mulberry and non mulberry silk worm disease and pest management: common disease of mulberry silk worm, grasserie, flacherie, muscardine, pebrine diseases: Ommon

disease of Non mulberry silkworm, tasar, oak tasar, muga and eri silkworm diseases, Diseases management. Mulberry identification of pest, life cycle of uzi fly, uzi fly - management and economics dermest beetles, Non mulberry silk worm Pest of tasar silkworm and oak tasar silkworm, pest of muga silkworm, pest of eri silkworm

#### **UNIT-V**

Seri culture harvesting and marketing of cocoons, economics. Time of Harvest, Method of Harvest, De flossing, sorting, assessment transportation and marketing of cocoons, Economic of different scales of rearing and cost benefit ratio, Classification of cost, Relationship of fixed and variable cost to greater profits. Economics of seed cacoon, economics of silk production, Extension education.

#### **REFERENCES:**

1. Tazima, Y. (1978); The Silkworm an Important Laboratory tool, Hodanshapublication, Tokyo.
2. Anonymous (1972); Hand Book of Silk rearing, Agriculture Techniques manual, Fujipublication. Tokyo.
3. Strunnikov. V.A (1983); Control of silkworm reproduction, development and sexMIR publications, Mascow.
4. Problamatic soils of Tropical mulberry garden and their management, technicalpublication, central sericulture Research& Training institute, Mysore.
5. Tips of successful silkworm cocoon Crops, Technical publication, central

#### **COURSE OUTCOMES**

Upon completion of the course, the students will be able to

- CO1. Understand the scope, management of mulberry cultivation for silkworms  
 CO2. Acquire knowledge on the egg incubation and rearing techniques.  
 CO3. Gain skill in seed production and silk production technology  
 CO4. Handle the mulberry & Non mulberry disease and pest management  
 CO5. Implement the harvesting and marketing of silkworm cocoons.

<b>QUESTION PAPER PATTERN</b>		
<b>Exam Hours</b> : 3		<b>Max.marks: 75</b>
<b>PART-I (Answer ALL)</b>		
<b>Q.No:1 to 20 –Objective type question: MCQ – 5;Match the following-5</b>	<b>20X1=20</b>	<b>True or false – 5:</b>
<b>PART-II (Either OR)</b>		
<b>Q.No:21 to25 - One question from each Unit</b>	<b>PART-III (Answer any THREE out of FIVE)</b>	
<b>Q.No:26 to 30 - One question from each Unit</b>		<b>3X10=30</b>

## MAJOR BASED ELECTIVE COURSE-IV

### 3.TOOLS AND TECHNIQUES IN BIOLOGY

<b>THEORY HOURS</b> : 6	<b>COURSE CODE</b> : P21Z4MBE4:3
<b>PRACTICAL HOURS:</b>	<b>CREDITS</b> : 4
<b>EXAM HOURS</b> 3	<b>MARKS</b> : ESE-75/CIA-25

#### Objectives:

1. To make the learner to know the basic concepts on handling and separation of biological samples.
2. To familiarize the use of chromatography and spectroscopy for biology.
3. To develop skills on bio-analytical techniques.

#### UNIT-I

**Microscopy:** Principle and application of different types of microscopes- light microscope, phase contrast microscopes, fluorescence microscope, and confocal microscopes. Electron microscopes: TEM and SEM

#### UNIT-II

**Centrifugation:** Differential and density gradient centrifugation, sucrose density gradient, CsCl gradient, analytical centrifugation, ultracentrifugation and marker enzymes.

#### UNIT-III

**Chromatography:** Principles and application of paper chromatography, column chromatography, TLC, GLC, HPLC, Ion exchange and affinity chromatography.

#### UNIT-IV

**Spectroscopy:** Principles and application of Uv/visible, fluorescence, FT-IR, NMR, ESR spectroscopy.

#### UNIT-V

**Demonstration:** Demonstration of the working of PCR thermocycler, HPLC system and SDS-PAGE system, visit to bioinstrumentation lab/facility and submission of the observation report.

## REFERENCES

1. Sharma, V.K. (1991): Techniques in microbiology and cell biology Tata McGraw Hill, New Delhi.
2. Wilson & Walker, (2000): Principles and techniques of Practical Biochemistry (4<sup>th</sup> ed.), Cambridge Univ. Press. UK.
3. Wilson & Walker, 2010. Principles and techniques of Biochemistry and Molecular biology, Cambridge Univ. Press. UK.
4. Jayaraman, (2015) Laboratory manuals in biochemistry. New Age International (P) Ltd, New Delhi.
5. Bisen & Mathw, (2016). Tools and techniques in life sciences- CBS Publishers & Distributors. New Delhi.
6. Khandpur, R.S., (2004). Biomedical instrumentation, Tata McGraw Hill, New Delhi.
7. Plumber D.S (1971). An introduction to practical biochemistry. Tata McGraw Hill Co., New Delhi.

## COURSE OUTCOMES:

Upon completion of the course, the students will be able to

CO1. Obtain knowledge on imaging and separation of biological samples.

CO2. Develop knowledge to detect, identify and quantification of biomolecules. CO3. Inculcate skills on analytical techniques in biological science.

CO4. Apply the skills in research.

CO5. Select the apt technique for conducting an experiment.

QUESTION PAPER PATTERN		
Exam Hours	: 3	Max. marks: 75
PART-I (Answer ALL)		
Q.No: 1 to 20 – Objective type question: MCQ – 5;	Fill up the blanks -5;	20X1=20
Match the following-5		
PART-II (Either OR)		
PART-III (Answer any THREE out of FIVE)		