

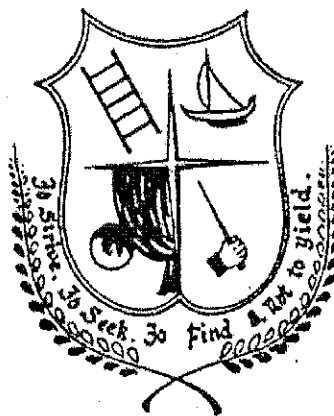
ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)

CHENNAI – 600 008

Re-accredited with 'A' Grade status by NAAC
College with Potential for Excellence by the UGC

PG

REVISED SYLLABUS 2018-2019
CHOICE BASED CREDIT SYSTEM



BRANCH VI - ZOOLOGY

DEPARTMENT OF ZOOLOGY

ETHIRAJ COLLEGE FOR WOMEN, CHENNAI- 8
POST GRADUATE AND RESEARCH DEPARTMENT OF ZOOLOGY
M.Sc., DEGREE IN ZOOLOGY
(EFFECT FROM THE ACADEMIC YEAR 2018 – 2019)

PREAMBLE

Zoology at the post graduate level offers a well organized curricula including advanced concepts in Biochemistry, Microbiology, Biotechnology, Genetics, Molecular Biology, Aquaculture, Environmental Science, Developmental Biology, Immunology, Bioinformatics. The course so offered shall inspire the students to pursue their career in Teaching and Research. It also ensures entrepreneurship and employment in research institutes and industries.

Department of ZOOLOGY is revising syllabi with effect from the academic year 2018 -2019, with 90 credits for core and elective subjects.

Every academic year is divided into two semesters. Each semester will have a minimum of 90 working days and each day will have 5 working hours. Teaching is organized into a modular pattern of credit courses. Credit is normally related to the number of hours a teacher teaches a particular subject. It is also related to the number of hours a student spends learning a subject or carrying out an activity.

REGULATIONS

1. ELIGIBILITY FOR ADMISSION

A candidate who has passed the B.Sc., degree examination in branch VI and VI a Zoology Main of Madras University or an examination of some other University accepted by the syndicate as equivalent, they shall be admitted and permitted to appear and qualify for the M.Sc., Degree examination of the University after a course of two academic year (4 semester).

2. ELIGIBILITY FOR THE AWARD OF DEGREE

A candidate shall be eligible for the award of the Degree only if she has undergone the prescribed course of study for a period of not less than two academic years and passed the examinations of all the four semesters prescribed.

3. EXAMINATION

There shall be four examinations; one at the end of each semester. A candidate who does not pass the examination in any subject of the first semester will be permitted to appear in such failed subject or subjects along with the second, third and fourth semester examinations.

4. COURSE OF STUDY - CBCS FOR PG

S.NO	SUBJECT	NO OF COURSES	CREDIT PER COURSE	TOTAL CREDITS
1.	CORE SUBJECT (INCLUDING PRACTICALS)	15	4	60
2.	ELECTIVES (MAJOR)	4 1	3 2	12 2
3.	ELECTIVES (NON MAJOR)	3	2	6
4.	SOFT SKILL	4	2	8
5.	INTERNSHIP	1	2	2
			TOTAL	90

5. RANKING CRITERIA

S.NO	CRITERIA	RANKING
1.	Pass Mark	50%
2.	II Class	50% - 60%
3.	I Class	60% and above

6. QUESTION PAPER PATTERN

COMPONENT	NATURE OF THE QUESTION	MAXIMUM MARKS
Part A	Descriptions	5 x 8 = 40
Part B	Application/ Analysis / Synthesis / Evaluation	3 x 20 = 60

Part A: 5 questions have to be answered out of 8 covering all 5 units.

Part B: 3 questions have to be answered out of 5 questions covering all the five units.

COURSE PROFILE

SEM	COURSE CODE	COURSE TITLE	HRS/WK	CREDITS	CA MARKS	END SEMESTER MARKS	TOTAL
I	5P18/1C/FMI	PAPER-I- Functional Morphology and Systematics of Invertebrates	5	4	40	60	100
I	5P18/1C/GEN	PAPER-II Genetics	5	4	40	60	100
I	5P18/1C/MBY	PAPER-III- Molecular Biology	6	4	40	60	100
I	5P18/1E1/MIC	ELECTIVE-I- Microbiology	4	3	40	60	100
I		SOFT SKILL- Personality Enrichment for Women	2	2			50
II	5P18/2C/FMC	PAPER-IV- Functional Morphology and Systematics of Chordates	4	4	40	60	100
II	5P18/2C/BBB	PAPER-V- Biophysics, Biostatistics and Bioinformatics	5	4	40	60	100
II	5P18/2E2/EAB	ELECTIVE-II Evolution and Animal Behaviour	4	3	40	60	100
II	5P18/2E3/MEY	ELECTIVE-III- Pisciculture	4	2	40	60	100

SEM	COURSE CODE	COURSE TITLE	HRS/ WK	CREDITS	CA MARKS	END SEMESTER MARKS	TOTAL
I & II	5P18/2C/MPI	PRACTICAL I- Invertebrata, Chordata and Microbiology	4	4	40	60	100
I & II	5P18/2C/MP2	PRACTICAL II- Molecular Biology, Genetics, Biophysics and Biostatistics	4	4	40	60	100
II	5P18/2D/INS	INTERNSHIP	--	2			100
II		SOFT SKILL-II- Other languages	2	2			50
III	5P18/3C/APY	PAPER-VI- Animal Physiology	4	4	40	60	100
III	5P18/3C/EBC	PAPER-VII- Environmental Biology and Biodiversity conservation	4	4	40	60	100
III	5P18/3C/IMM	PAPER-VIII- Immunology	4	4	40	60	100
III	5P18/3E4/RDT	ELECTIVE-IV- rDNA Technology	4	3	40	60	100
III	5P18/3S/DFG	Soft skill - III Dairy Farming	2	2			50
IV	5P18/4C/DBY	PAPER-IX- Developmental Biology	5	4	40	60	100
IV	5P18/4C/BIO	PAPER-X- Biochemistry	5	4	40	60	100

SEM	COURSE CODE	COURSE TITLE	HRS/WK	CREDITS	CA MARKS	END SEMESTER MARKS	TOTAL
IV	5P18/4C/AQU	PAPER-XI- Aquaculture	5	4	40	60	100
IV	5P18/4E5/RMY	ELECTIVE-V- Research Methodology	5	3	40	60	100
IV	5P18/4S/PFM	Soft Skill- IV Poultry Farming	2	2			50
III & IV	5P18/4C/MP3	PRACTICAL III- Animal Physiology, Biochemistry, Immunology and Recombinant DNA Technology	4	4	40	60	100
III & IV	5P18/4C/MP4	PRACTICAL IV- Developmental Biology, Environmental Biology, Aquaculture and Research Methodology	4	4	40	60	100

NON-MAJOR ELECTIVE

SEM	PAPER CODE	TITLE OF THE PAPER	HRS /WK	CRED ITS	CA MARKS	END SEMESTER MARKS	TOTAL
II	5P18/2E/MCC	Maternity and Child Care	4	3	40	60	100
III	5P18/3E/AQF	Aquarium Fishes	4	3	40	60	100

The above highlighted courses of PG programme enrich the skills in employability / Skill development / Entrepreneurship which caters to the needs of the student.

EVALUATION PATTERN – THEORY

Sem	Course code	Title of the paper	CA							End sem marks	Total
			Test		Assignment		Seminar		Total		
			No	Marks	No	Marks	No	Marks			
1	5P18/1C/FMI	PAPER-I- Functional Morphology and Systematics of Invertebrates	2	20	1	10	1	10	40	60	100
1	5P18/1C/ GEN	PAPER-II- Genetics	2	20	1	10	1	10	40	60	100
1	5P18/1C/MBY	PAPER-III- Molecular Biology	2	20	1	10	1	10	40	60	100
1	5P18/1E1/MIC	ELECTIVE-I- Microbiology	2	20	1	10	1	10	40	60	100
1		SOFT SKILL- I Personality Enrichment for women	2	20	1	10	1	10	40	60	100
2	5P18/2C/FMC	PAPER-IV- Functional Morphology and Systematics of Chordates	2	20	1	10	1	10	40	60	100
2	5P18/2C/BBB	PAPER-V- Biophysics, Bio statistics and Bio informatics	2	20	1	10	1	10	40	60	100
2	5P18/2E2/ EAB	ELECTIVE-II- Evolution and Animal Behaviour	2	20	1	10	1	10	40	60	100
2	5P18/2E3/ PIS	ELECTIVE-III- Pisciculture	2	20	1	10	1	10	40	60	100
2	5P18/2D/INS	INTERNSHIP								100	100
2		SOFT SKILL- II - Other languages	2	20	1	10	1	10	40	60	100

3	5P18/3C/APY	PAPER-VI- Animal Physiology	2	20	1	10	1	10	40	60	100
3	5P18/3C/EBC	PAPER-VII- Environmental Biology and Biodiversity conservation.	2	20	1	10	1	10	40	60	100
3	5P18/3C/IMM	PAPER-VIII- Immunology	2	20	1	10	1	10	40	60	100
3	5P18/3E4/RDT	ELECTIVE-IV- rDNA Technology	2	20	1	10	1	10	40	60	100
3	5P18/3S/DFG	Dairy Farming	2	2	-	-	-	-	-	-	50
4	5P18/4C/DBY	PAPER-IX- Developmental Biology	2	20	1	10	1	10	40	60	100
4	5P18/4C/BIO	PAPER-X- Biochemistry	2	20	1	10	1	10	40	60	100
4	5P18/4C/AQU	PAPER-XI- Aquaculture	2	20	1	10	1	10	40	60	100
4	5P18/4E5/REM	ELECTIVE-V- Research Methodology	2	20	1	10	1	10	40	60	100

EVALUATION PATTERN - PRACTICALS

Sem	Course code	Course title	CA							End sem marks	Total
			Test		Model Practicals		Observation		Total		
			No	Marks	No	Marks	No	Marks			
1&2	5P18/2C/MP1	PRACTICAL I- Invertebrata, Chordata and Microbiology	2	20	1	10	2	10	40	60	100
1&2	5P18/2C/MP2	PRACTICAL II- Molecular biology, Genetics, Biophysics and Biostatistics	2	20	1	10	2	10	40	60	100
3&4	5P18/4C/MP3	PRACTICAL III- Animal Physiology, Biochemistry, Immunology and rDNA technology	2	20	1	10	2	10	40	60	100
3&4	5P18/4C/MP4	PRACTICAL IV- Developmental biology, Environmental Biology and Aquaculture	2	20	1	10	2	10	40	60	100

SEMESTER-I
PAPER I – FUNCTIONAL MORPHOLOGY AND SYSTEMATICS OF
INVERTEBRATES

TEACHING HOURS: 75Hrs

CREDITS: 4

COURSECODE: 5P18/1C/FMI

LTP: 3 2 0

Objectives:

- To understand the morphology and anatomy of invertebrate animals.
- To understand the advances and the complexity of various habitats.
- To analyse the phylogenetic significance of invertebrate.

UNIT I

Origin of metazoan - organization of coelom: acoelomates, pseudocoelomates, coelomates. Origin of Bilateria, Locomotion- amoeboid, flagellar and ciliary movements in Protozoans. Hydrostatic movements in Coelenterata, Annelida and Echinodermata. **(15Hrs)**

UNIT II

Filter feeding in Polychaetes. Nutrition and digestion – patterns of feeding and digestion in Mollusca, Echinodermata. Respiration- Organs of respiration: gills, lungs and trachea. Respiratory pigments. Mechanism of respiration. **(15Hrs)**

UNIT III

Excretion in invertebrates. Mechanism of osmoregulation in invertebrates.

Nervous system-
1. Primitive nervous system- Coelenterata and Echinodermata.
2. Advanced nervous system – Annelida, Arthropoda (Crustacea and Insecta) and Mollusca (Cephalopoda) **(15Hrs)**

UNIT IV

Invertebrate larval forms and their evolutionary significance - Trematoda, Cestoda, Crustacea, Mollusca, Echinodermata. Sedentary invertebrates, Regeneration in invertebrates, reproduction in insects and crustaceans. **(15Hrs)**

UNIT V

Structures, affinities and life history of the following minor phyla- Rotifer, Entoprocta, Phoronida and Ectoprocta, Acanthocephala, Gastrotricha, Chaetognatha. Fossil records of important trilobites, ammonites and cephalopods. **(15Hrs)**

SUGGESTED READING:

1. Hyman, L.H. The invertebrates, Protozoa through Ctenophora, McGraw Hill Co.,
2. NYKardong, K.V. (2005) Vertebrates Comparative Anatomy, Function and Evolution. IV Edition. Mc Grawhill Higher Education.
3. Kent, G.C. And Carr R.K. (2000). Comparative Anatomy of the Vertebrates. IX Edition. The McGraw-Hill Companies.
4. Barrington, E.J.W. Invertebrate structure and function. Thomas Nelson and Sons Ltd., London. Jagerstein, G. Evolution of Metazoan life cycle, Academic Press, New York & London.
5. Hyman, L.H. The Invertebrates. Vol. 2. McGraw Hill Co., New York.
6. Hyman, L.H. The Invertebrates. Vol. 8. McGraw Hill Co., New York and London.
7. Barnes, R.D. Invertebrates Zoology, III edition. W.B. Saunders Co. Philadelphia.
8. Russel-Hunter, W.D. A biology of higher invertbrates, the Macmillan Co. Ltd., London.
9. Hyman, L.H. The Invertebrates smaller coelomate groups, Vol. V. Mc.Graw Hill Co., NY
10. Read, C.P. Animal Parasitism. Parasitism. prentice Hall Inc., New Jersey.
11. Parker, T.J., haswell W.A. Text book of Zoology, Macmillan Co., London.

Web link : <https://archive.org/details/zoologyofinverte00ship>

QUESTION PAPER PATTERN

COMPONENT	NATURE OF THE QUESTION	MAXIMUM MARKS
Part A	Descriptions – Contains 5 questions to be answered out of 8, covering all 5 units.	5X8= 40
Part B	Application/ Analysis / Synthesis / Evaluation – Contains 3 questions to be answered out of 5 questions covering all the five units.	3 x 20 = 60

SEMESTER-I

PAPER II - GENETICS

TEACHING HOURS: 75 Hrs

CREDITS: 4

COURSECODE: 5P18/1C/GEN

L T P: 3 2 0

Objectives:

- Understand the concept of molecular genetics.
- Understand the cell fusion and hybridoma techniques.
- Understand the importance of DNA replication and repair mechanism.
- Understand the regulatory mechanism of cell cycle.

UNIT I

Organisation of genes and chromosomes - chromatin – nucleosome – structure of eukaryotic chromosome – centromere – kinetochore – telomere – unique and repetitive chromosome - karyotyping and chromosome banding technique. (15Hrs)

UNIT II

Chromosome mapping - Sex-determination and dosage compensation in *C.elegans*, *Drosophila* and human - transposable elements in prokaryote and eukaryotes - Genetic imprinting Epigenetic regulation by DNA methylation. (15Hrs)

UNIT III

Somatic cell genetics - Cell fusion and technology - Heterokaryon selecting hybrids and hybridoma - microbial genetics - Bacterial conjugation, transformation and transduction. (15Hrs)

UNIT IV

Genetics of cell cycle - Genetic regulation of cell division in yeast and eukaryotes - Regulation of CDK- cyclin activities - Molecular basis of cellular check points - Molecular basis of neoplasia. (15Hrs)

UNIT V

Recombination and repair - Recombination: homologous and non-homologous recombination - Site-specific and transpositional recombination - DNA repair mechanism in prokaryotes and eukaryotes. (15Hrs)

PRESCRIBED TEXT BOOK:

1. Benjamin Lewin, 2000. Gene VII. Oxford University Press.

SUGGESTED READING:

1. Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). Viii Ed. Principles of Genetics. Wiley India.
2. Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V Edition. John Wiley and Sons Inc.
3. Klug, W.S., Cummings, M.R., Spencer, C.A. (2009). Concepts Of Genetics. XI Edition. Benjamin Cummings.
4. Russell, P. J. (2009). Igenetics- A Molecular Approach. Iii Edition. Benjamin Cummings.
5. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications Of Recombinant Dna. Asm Press, Washington.
6. Pevsner, J. (2009). Bioinformatics and Functional Genomics. II Edition. John Wiley & Sons.
7. Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. And Carroll, S.B. IX Edition. Introduction To Genetic Analysis. W. H. Freeman And Co.
8. Immanuel,C And Vincent ,S., Applied Genetics. Mjp Publishers.

Web links: 1. <http://www.genetics.org/> 2. <http://www.nature.com/subjects/genetics>

Question Paper Template

COMPONENT	NATURE OF THE QUESTION	MAXIMUM MARKS
Part A	Descriptions – Contains 5 questions to be answered out of 8, covering all 5 units.	5 X 8= 40
Part B	Application/ Analysis / Synthesis / Evaluation – Contains 3 questions to be answered out of 5 questions covering all the five units.	3 x 20 = 60

SEMESTER-I

PAPER III-MOLECULAR BIOLOGY

TEACHING HOURS: 90 hrs

CREDITS: 4

COURSE CODE: 5P18/IC/MBY

LTP: 4 2 0

Objectives:

- To understand the principles of molecular biology.
- To elaborate the molecular mechanisms of prokaryotic and eukaryotic DNA replication.

UNIT I

Genome organization – Gene structure, organelle genome, gene family, gene cluster, pseudo-genes. DNA damage and repair – types of DNA damages, excision repair system, mismatch repair, recombination repair, double strand break repair and transcription coupled repair. C value paradox – Cot $\frac{1}{2}$ and Rot $\frac{1}{2}$. (18 Hrs)

UNIT II

DNA replication – molecular mechanisms of prokaryotic and eukaryotic DNA, replication, regulation of replication. Transcription - prokaryotic and eukaryotic transcription, RNA polymerases, transcriptional unit, initiation, elongation, termination, transcriptional factors. Regulation of transcription – Operon, positive and negative control, attenuation phage strategies, anti-termination, response elements and inducible elements. (18 Hrs)

UNIT III

Translation - prokaryotic and eukaryotic translation, genetic code, altered code in elongation, termination factors, fidelity of translation, post translational modifications. Mobile DNA elements – transposable elements, IS elements, P elements, retroviruses, retrotransposons. Antisense and ribozyme technology – initiation of splicing, polyadenylation, molecular mechanisms of antisense molecules, miRNA, siRNA, gene silencing. (18 Hrs)

UNIT IV

Cancer – Mutational nature of cancer – Carcinogenesis – tumor viruses – tumor suppressor genes – hormones in relation to cancer – treatment of cancer at molecular level. Aging and senescence. Apoptosis in mammals and its significance. (18 Hrs)

UNIT V

Cell Signalling: Signalling mechanism, Signalling molecules, Cell surface receptors – G protein coupled receptors, Tyrosine kinase – Linked receptors – signal transduction pathway using second messengers – cAMP, cGMP and Ca²⁺. (18 Hrs)

PRESCRIBED TEXT BOOK:

1. Benjamin Lewin, 2000. Gene VII. Oxford University Press.

SUGGESTED READING:

1. David Frifielder, Molecular Biology.
2. De Robertis. E.D.P and E.M.F, De Robertis, 1990. Essentials of Cell and Molecular Biology. Saunders. College Publishing.
3. Gerald Karp, 1996. Cell and Molecular Biology – Wiley.
4. Lodish, Berk, Zipursky, Matsudaria and Baltimore, 1965. Molecular cell biology – IV edition W.H. Freeman and Company.

Question Paper Template

COMPONENT	NATURE OF THE QUESTION	MAXIMUM MARKS
Part A	Descriptions – Contains 5 questions to be answered out of 8, covering all 5 units.	5 X 8 = 40
Part B	Application/ Analysis / Synthesis / Evaluation – Contains 3 questions to be answered out of 5 questions covering all the five units.	3 x 20 = 60

SEMESTER – I

ELECTIVE I – MICROBIOLOGY

TEACHING HOURS: 60 HRS

CREDITS: 3

COURSE CODE: 5P18/1E1/MIC

LTP : 3 1 0

Objectives:

- To understand the basic taxonomic procedures adapted in characterization.
- To understand the role of microbes in Environment and in Human health.
- To analyze the microbes in food production.

UNIT-I

Introduction to Microbiology – Discovery of Microorganisms - Classification of Microorganisms: Haeckel's three kingdom concept, Whittaker's five kingdom concept, three domain concept of Carl Woese - An outline classification of bacteria according to Bergey's Manual of determinative Bacteriology – Domain and Kingdom. (12 Hrs)

UNIT – II

Major groups of Microorganisms and their general characters. General characteristics of Prokaryotes. Morphology and ultra structure of bacteria: size, shape, and arrangement of bacteria, ultra structure of bacterial cell wall – peptidoglycan structure – Gram positive and Gram negative cell walls - Components external to cell wall: Structure and function of flagella, fimbriae and pilli, capsule- types, composition and function, slime layers, S-layers. (12 Hrs)

UNIT – III

Bacterial nutrition: Energy acquisition by chemotrophs and phototrophs - Basic nutritional requirements, growth factors, nutritional categories, physical requirements of bacterial growth. Bacteriological media: types (complex, synthetic, differential, enrichment and selective media) and their uses, culture characteristics of bacteria on different media.

Bacterial growth: growth kinetics, growth curve. Batch, continuous and synchronous culture. Measurement of growth and influence of environmental factors affecting the growth of bacteria.

Microbial metabolism - Chemosynthesis, photosynthesis, carbon assimilation – regulation of metabolism. (12 Hrs)

UNIT – IV

Microbial interactions and Microbial Ecology – Symbiosis, commensalism – mutualism between microbes, microbes and plants and animals – cooperation, competition, predation, antagonism, parasitism – animal parasites. (12 Hrs)

UNIT – V

Applied Microbiology – bacteria of air, water, soil – microbes associated with food production and spoilage, Microbiology of milk and dairy products – control of microorganisms – physical, chemical and antimicrobial agents – biological weapons and bioterrorism. (12 Hrs)

SUGGESTED READING:

1. Microbiology - Lansing M Prescott, John P. Harley, Donald A Klein, Sixth edition, Mc Graw Hill Higher education.
2. General Microbiology - R.Y. Ingraham, J.L. Wheels, M.L. Painter. Thess Macmillan Press Ltd.
3. Text book of Microbiology – Arora, D.R AND Arora. B 2008, CBS Publishers
4. Text book of Microbiology – Chakraborty, P.A. 2009. New Central Book Agency, NewDelhi.
5. Microbiology - (2nd edition) Ingraham, J.L and Ingraham,C.A. 2000. Brooks/cole – Thomson Learning, MA, USA.
6. Foundations of microbiology – Talaro, Park, Kathalee, N and Talaro,Arthur.2002. Mc Graw Hill Higher education.
7. Principles of Modern Microbiology - Wheelis, Mark.2010. Jones and Bartlett Publishers, NY, USA.

QUESTION PAPER TEMPLATE

COMPONENT	NATURE OF THE QUESTION	MAXIMUM MARKS
Part A	Descriptions – Contains 5 questions to be answered out of 8, covering all 5 units.	5 X 8= 40
Part B	Application/ Analysis / Synthesis / Evaluation – Contains 3 questions to be answered out of 5 questions covering all the five units.	3 x 20 = 60

SEMESTER-II

PAPER IV – FUNCTIONAL MORPHOLOGY AND SYSTEMATICS OF CHORDATES

TEACHING HOURS: 60Hrs

CREDITS: 4

COURSE CODE: 5P18/2C/FMC

LTP: 3 1 0

Objectives:

- To understand the morphology and anatomy of vertebrate animals.
- To understand the advances and the complexity of various habitats.
- To analyse the phylogenetic significance of chordates.

UNIT I

Origin and ancestry of Chordata, General organization and affinities of Cephalochordata. Origin of Fishes. General organisation and characters of Fishes. General characters and affinities of Dipnoi. Origin of Amphibia. General organisation and characters of Amphibians. (12Hrs)

UNIT II

Origin of Reptiles. General organisation and characters of Reptiles. General body organization and classification in Sphenodon and Chelonia. Origin of Birds. General organisation and characters of Aves. Origin of Mammals. General organisation and characters of Mammals General characters and adaptations of Cetacea. (12Hrs)

UNIT III

Comparative anatomy of the brain in vertebrates (teleost, frog, lizard, fowl and rat). Autonomous nervous system in vertebrates: structure and functions. Structure, development and metamorphosis of Ammocoetus larva. Evolution of heart in vertebrates. Sense organs in vertebrates: lateral line system and electroreception in fishes. (12Hrs)

UNIT IV

Appendicular skeleton (Limbs and girdles) in Amphibia, Reptilia, Aves and Mammals. Vertebrate integument and its derivatives. Organs and mechanism of respiration in Pisces, Amphibia, reptiles, birds and mammals. Evolution of urinogenital organs in vertebrates. (12Hrs)

UNIT V

Biological and cultural Evolution of Man. Evolution of Horse.

(12Hrs)

PRESCRIBED TEXTBOOK

1. Alexander R.N., The Chordata, Cambridge University Press London.

SUGGESTED READING:

1. Barrington EJW, The Biology of Hemichordates and Protochordates, Oliver and Boid Edinberg.
2. Bourne G.H., The structure and function of nervous tissue Academic press New York.
3. Honyelli A.R. The Chordates Cambridge University Press, London
4. Smith H.S. Evolution of Chordate structure, Hold Rinehart and Winton Inc. New York
5. Walter H.A. and Sayles L.D. Biology of Vertebrates Macmillan and co. New York
6. Romer A.S. Vertebrate body W.P. Sanders co., Philadelphia.
7. Young J.Z. Life of Vertebrates Oxford University Press, London.
8. Young J.Z. Life of Mammals Oxford University Press, London.
9. Colbert E.H. Evolution of Vertebrates John Wiley and sons Inc. New York.
10. Kent C.J. Comparative anatomy of Vertebrates.
11. Waterman A.J. Chordate Structure and Functions Macmillan Co. New York.
12. Lovettrup S. The phytogeny of Vertebrates John Wiley and sons Inc., London.
13. Joysey K.A. and Kemp T.S. Vertebrate Evolution Oliver and Boyd, Edinberg.
14. Romer A.S. Vertebrate Paleontology University of Chicago Press, Chicago.

Web links: <http://www.ucmp.berkeley.edu/chordata/chordata.html>

QUESTION PAPER PATTERN

COMPONENT	NATURE OF THE QUESTION	MAXIMUM MARKS
Part A	Descriptions – Contains 5 questions to be answered out of 8, covering all 5 units.	5X8= 40
Part B	Application/ Analysis / Synthesis / Evaluation – Contains 3 questions to be answered out of 5 questions covering all the five units.	3 x 20 = 60

SEMSESTER- II

CORE PAPER-V-BIOPHYSICS, BIOSTATISTICS AND BIOINFORMATICS

TEACHING HOURS: 75 Hrs

CREDITS: 4

COURSE CODE: 5P18/2C/BBB

L T P: 3 2 0

Objectives:

- To understand principles of biophysics
- To analyse the variations in biological samples.
- To study the techniques and application of various instruments

UNIT I

Microscopy- principle and applications- light microscope, phase contrast, electron microscope and fluorescence microscope. Histological techniques- principles of tissue fixation- microtomy- staining and mounting. (15 Hrs)

UNIT II

Separation techniques- chromatography-principle, types and applications- TLC and ion exchange electrophoresis- principle, types and applications- agarose gel electrophoresis and PAGE. General principles and applications of colorimeter and spectrophotometer, Beer and Lambert's law. (15 Hrs)

UNIT III

Radiation biophysics- ionizing radiation, units of radio activity- exposure and dose, biological effects of radiation: effect on nucleic acid, proteins, enzymes and carbohydrates. Cellular effects of radiation- somatic and genetic. Autoradiography. (15 Hrs)

UNIT IV

General principles of biostatistics- frequency distribution. Central tendency, correlation and regression. Sampling and analysis. Sampling theory- analysis of variance, Chi square, Non parametric tests (any 2). (15 Hrs)

UNIT V

Biology and bioinformatics. Genomics and proteomics, biological databases- National Center for Biotechnology and Informatics (NCBI); European Bioinformatics Institute (EBI) sequence alignment and database searching. Sequencing similarity search tools- BLAST and FASTA. Computational tools for DNA sequencing analysis. (15 Hrs)

SUGGESTED BOOKS:

1. Biometry. 3rd Edition (2001). R. R. Sokal And F. J. Rohlf. W. H. Publisher-Freeman And Company.
2. Biostatistical Analysis. 5th Edition (2008). J. H. Zar. Publisher-Pearson Education Inc. And Dorling Kindersley Publishing Inc.
3. Statistical Methods. 6th Edition (1967). G. W. Snedecor And W. G. Cochran. Publisher-Oxford Andibh Publishing Co.
4. Practical Statistics - S.P. Gupta
5. Jerold H. Zar Bio Statical Analysis (2nd Edition) Printice Hail Of International Edition, 1984 (Relevant Portions)
6. Rangaswamy R.A Text Book Of Agriculture Statistics, New Age International Publishers, 1995
7. Atwood And Parry-Smith. 2001. Introduction To Bioinformatics. Pearson Education Asia, New Delhi. Baxevanis & Ouellette. 2001.
8. A. Upadhyaya, K. Upathyaya And N. Nath, (2003) Biophysical Hemistry, Principles And Techniques, 3rd Ed, Himalaya Publishing House.
9. H.B. Bull, F.H. Davis, An Introduction To Physical Biochemisty 2nd Ed, Philadelphia 1971
10. Gurumani.N. 2006. Reasearch Methodology For Biological Sciences Mjp Publ. Chennai.
Web Links :[Http://Www.Biophysics.Org/Education/Whatisbiophysics/Tabid/2287/Default.aspx](http://Www.Biophysics.Org/Education/Whatisbiophysics/Tabid/2287/Default.aspx) Www.Ncbi.Nlm.Nih.Gov

QUESTION PAPER PATTERN

COMPONENT	NATURE OF THE QUESTION	MAXIMUM MARKS
Part A	Descriptions – Contains 5 questions to be answered out of 8, covering all 5 units.	5X8= 40
Part B	Application/ Analysis / Synthesis / Evaluation – Contains 3 questions to be answered out of 5 questions covering all the five units.	3 x 20 = 60

SEMESTER-II

ELECTIVE – II EVOLUTION AND ANIMAL BEHAVIOUR

TEACHING HOURS: 60Hrs

CREDITS: 3

COURSE CODE : 5PI8/2E2/EAB

L T P : 3 1 0

Objectives:

- To understand the evolutionary concepts and mechanisms in genetic diversity.
- To study the principles and mechanisms of animal behaviour and their types.
- To analyse the effects of mutation and selection on gene frequency

UNIT –I

Arguments of evolutionary ideas and evolutionary theories Evolutionary process - Evidences for evolution- fossils and stratification Natural selection - Basic patterns of evolution and adaptation. (12 Hrs)

UNIT – II

Gene frequencies in population - The hardy-Weinberg principle and analysis of gene frequencies in natural population -Major factors influencing gene frequencies Effects of selection and mutation on gene frequencies. -Genetic drift Molecular evolution and molecular phylogeny. (12 Hrs)

UNIT –III

The origin and evolution of primates -Evolution of anthropoid primates - The first hominids and origin of modern man. (12 Hrs)

UNIT - IV

Principles and mechanisms of animal behavior -Four propositions of Tinbergen-Individual vs group selection -Genotype and environment interaction. Phenotypic plasticity -Cooperation and conflict -Male-male competition and sexual selection -Elaborate ornaments: fisher's hypothesis and handicap hypothesis. Parent-offspring conflict. (12 Hrs)

UNIT – V

Territoriality and group foraging - Aggression - Aggressive behaviour Sensory system and communication -Signal content and structure. (12 Hrs)

PRESCRIBED TEXT BOOK

1. Dobzhansky, Th. Et. Al: Evolution, Surjeet Pubn., Delhi. Prakash M. Et. Al. Reena Mathur: Animal Behaviour, Rastogi & o., Meerut.

SUGGESTED BOOKS:

EVOLUTION

1. Darwin, C. The Origin Of Species, 6e. Oup. Desmond Morris, 1990. Animal Watching (Field Guide), Crown Pub Co., London.
2. Dobzhansky, Th.: Genetics And The Origin Of Species 1951, Columbia Uty. Press.
3. Dobzhansky, Th. Et Al: Evolution, Surjeet Pubn., Delhi. Prakash M. Et Al.
4. Organic Evolution – N. Armugam
5. Evolution – M. P. Arora
6. Dodson, Evolution – Process And Product
7. Moody, Introduction To Evolution suggested Books:

Animal Behaviour

8. Recent Advances In Animal Behaviour. 1994, 7 Vols., Anmol.
9. Reena Mathur: Animal Behaviour, Rastogi & Co., Meerut.

QUESTION PAPER PATTERN

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Part A	Descriptions – Contains 5 questions to be answered out of 8, covering all 5 units.	5 x 8 = 40
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SEMESTER-II

ELECTIVE- III- MAMMALIAN ENDOCRINOLOGY

TEACHING HOURS: 60hrs

CREDITS: 2

COURSE CODE: 5P18/2E3/MEY

LTP : 310

Objectives:

- To understand the chemical nature and mechanism of hormone action
- To study the structural organization of various endocrine glands
- To study their secretions and biological functions
- To Know the disorders associated with the endocrine glands.

UNIT I: Chemical nature and mechanism of hormone action

Introduction to Endocrinology. Classification of hormones based on chemical nature. Hormone secretions (apocrine, holocrine, and merocrine). Hormone transport. Hormonal feedback in homeostasis- Negative and positive feed back mechanisms through endocrine axis. Types of cell signalling (paracrine, autocrine and endocrine). Molecular mechanism of peptide and steroid hormone action

(12Hrs)

UNIT II : Hypothalamo-hypophysial system

Hypothalamic hormones- localization, chemistry and actions

Hypophysial hormones- Neurohypophysial hormones (oxytocin and vasopressin)

Adenohypophysial hormones: Chemistry and physiological roles of somatotropin and prolactin, Glycoprotein hormones (FSH, LH AND TSH), Pro-opiomelanocortin (ACTH, MSH, β -LPH and β -endorphin)

Neural control of adenohypophysis

Disorders with reference to Gigantism, Acromegaly, Diabetes insipidus

(12Hrs)

UNIT III: Thyroid, Parathyroid and Pancreas

Thyroid gland - Biosynthesis of thyroid hormones, Control of secretion and Biological functions – Disorders- Hypothyroidism, Hyperthyroidism

Parathyroid gland- Role of parathormone, calcitonin and vitamin D in calcium homeostasis

Endocrine pancreas- Chemistry of insulin. Physiological actions of insulin and glucagon, Diabetes mellitus

(12Hrs)

UNIT IV: Adrenal gland

Adrenal cortex: Structure, Hormone secretion, Biosynthesis and Control of mineralocorticoid and glucocorticoid secretions. Physiological roles of glucocorticoids and mineralocorticoids

Adrenal medulla: Catecholamine biosynthesis, release and its physiological role.

Disorders with reference to Addisons disease and Cushing's syndrome

(12Hrs)

UNIT V: Testis and Ovary

Testis: Organization and Hormone secretion – Chemical structure of testosterone. Physiological role of androgens

Ovary: Structure - Hormone secretion- Chemical structure of estrogens. Physiological role of estrogen, progesterone and relaxin . Hormones of placenta and their functions

(12Hrs)

PRESCRIBED TEXTBOOK

1. Hadley: Endocrinology, Prentice Hall. International Edition. 2000
2. Larson: Williams Text Book Of Endocrinology, 10th Edition. W. B. Saunders Company, Philadelphia. 2002.

SUGGESTED READING

1. Norris: Vertebrate Endocrinology (2nd Ed). Lea & Febriger. 1997
2. Brooks And Marshall: Essentials Of Endocrinology, Blackwell Science. 1995
3. Turner And Bagnara: General Endocrinology, W. B. Saunders Company Philadelphia. 1984

Question Paper Template

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SEMESTER-II

PRACTICAL I – INVERTEBRATA, CHORDATA AND MICROBIOLOGY

TEACHING HOURS: 120hrs

CREDITS : 4

COURSE CODE: 5P18/2C/MP1

L T P: 0 0 8

INVERTEBRATA

1. Identification and study of selected Protozoans and Helminthes of medical importance.
2. Identification and study of sections of certain animals from Coelenterata, Aschelminthes and Annelida to understand the evolution of different types of coelom.
3. Identification and study of larval forms from all major phyla of invertebrates.
4. Identification and study of invertebrate fossils (specimens).
5. Dissection of digestive, nervous and reproductive systems in
1. Scorpion , 2. Gryllotalpa
6. Dissection of the Nervous system in 1. Pila 2. Prawn
7. Mounting of Pedicellariae, Aristotle lantern in Sea Urchin and mounting of the sting of honey bee.

CHORDATA

1. Identification of important Prochordates, South Indian fishes, Amphibians, Reptiles, Birds and Mammals.
2. Dissection of aortic arches in Shark and Mullet.

MICROBIOLOGY

1. IDENTIFICATION

- a. *Staphylococcus aureus*
- b. *Escherischia coli*
- c. *Rhizopus*
- d. *Aspergillus niger*
- e. *Aspergillus flavus*
- f. *Penicillium*

g. *Nostoc*

h. *Oscillatoria*

i. *Volvox*

2. Culture medium and preparation.

i. Preparation of peptone water

ii. Preparation of nutrient broth

iii. Preparation of solid media.

1. Slant

2. Stab

3. Plate.

3. Simple and Differential staining of bacteria.

4. Identification of bacteria in Milk – Gram staining (*Lactobacillus* and *Streptococcus*)

5. Identification of Algae present in pond water – *Oscillatoria*, *Chlorella*, *Nostoc*.

SEMESTER-II

PRACTICAL II -MOLECULAR BIOLOGY, GENETICS, BIOPHYSICS AND BIOSTATISTICS

TEACHING HOURS: 120 HRS

CREDITS: 4

COURSE CODE: 5P18/2C/MP2

L T P: 0 0 8

MOLECULAR BIOLOGY

1. Cytological techniques

Micrometry: Microscopic calibration and Measurements of cell size using ocular and stage micrometers.

2. Study of different types of cells

Blood cells –Differential count in Human

Histochemical techniques

Demonstration: Fixation, Dehydration, Embedding, staining (vital staining) and Mounting.

Histochemical localisation of

a. Lipids

b. Proteins

Genetics

1. Preparation of culture medium for Drosophila.

2. Observation of Drosophila in culture medium.

3. Identification of sex in Drosophila. Development and life cycle.

4. Identification of Drosophila mutants.

1. Yellow body 2. White eye 3. Vestigial wing 4. cut wing 5. Rotated abdomen
6. Curled wing 7. bi-thorax 8. bar eyes 9. Cinnabar.

5. Preparation of human karyotypes. Analysis of normal and abnormal karyotypes.
Down's syndrome and Klinefelter's syndrome.

6. Genomic imprinting analysis- Prader Willi syndrome.
7. Mitochondrial diseases and modes of inheritance.
8. Gene Therapy – ADA deficiency and CFTR.

Biophysics

1. Principle and application of Spectrophotometer
- Determination of proteins
2. Principle and application of Electrophoresis

Biostatistics

1. Construction of bar diagram - simple, component and percentage
2. Construction of histogram and pie diagram
5. Measures of central tendency
 - a) Calculation of mean for continuous series -direct method.
 - b) Calculation of median for continuous series.
 - c) Calculation of mode for continuous series.
6. Measures of dispersion: calculation of standard deviation – direct method.

SEMESTER III

PAPER VI- ANIMAL PHYSIOLOGY

TEACHING HOURS: 60Hrs

CREDITS: 4

PAPER CODE: 5P18/3C/APY

L T P: 3 1 0

Objectives:

To understand the structural organisation of organ system in animals.

To study the physiological regulatory mechanisms in various systems

UNIT I

Branches of Physiology - Digestion- Digestive enzymes- Digestion and absorption of carbohydrate, proteins and lipids in the gastrointestinal tract. Role of gastrointestinal hormones in digestion. Basal metabolic rate and its measurement

Circulation - Blood - composition and functions – Haemoglobin: structure and function – Lymph - composition. Heart – Haemodynamics, origin and conduction of cardiac impulse. Pace maker , ECG, phases of cardiac cycle. Myogenic and neurogenic heart. (12 Hrs)

UNIT II

Respiratory pigments- Types, Distribution and properties, Gaseous exchange through respiratory membrane and tissues. **Mechanism of oxygen and carbon dioxide transport.** Pulmonary ventilation - Respiratory centres : organization and function
Respiratory adjustments - hypoxia and oxygen therapy , dyspnoea , periodic breathing. **Adaptations at High altitude- decreased pressure of gas, hypoxic effects, mountain sickness and acclimatization** (12 Hrs)

UNIT III

Excretion – Mechanism of urine formation - counter current mechanism - hormonal regulation - acid-base balance and homeostasis
Osmoregulation in crustaceans. Osmoregulation in Fishes- Mechanism of salt and water transport by gills and kidney.

Thermoregulation in poikilotherms and homeotherms- Adaptations and regulatory mechanisms. (12 Hrs)

UNIT IV

Nervous system - Types of neurons –Conduction of nerve impulse through neuron- Sodium potassium pump. Types of synapses – Synapse structure- synaptic transmission. Neurotransmitters (acetylcholine, catecholamines, serotonin and GABA)- Cerebrospinal fluid: chemistry and functions. Mechanism of reflex action.

Muscle – Types of vertebrate muscles. Ultrastructure of skeletal muscle fibers - Contractile proteins – Molecular mechanism of muscle contraction - Isotonic and isometric contraction - Muscle twitch, summation, tetanus and fatigue - Energetics of muscle contraction (12 Hrs)

UNIT V

Vision- Retinal pigments - Photochemistry of vision and colour vision. Ear- Organs of Corti and mechanism of hearing

Colour change mechanism: chromatophores and melanophores- structure, physiology and significance.

Bioluminescence: light producing organs in invertebrates and vertebrates- physiology and significance (12 Hrs)

SUGESSTED READING

1. Textbook of Medical Physiology: Guyton, A.G. (1968). 7th Edn. Saunders Pub
2. General & Comparative Animal Physiology : W.S. Hoar.
3. Medical Physiology : W.F. Ganong (1981) : 10th Edn. Lange Medical Publications.
4. Animal Physiology : Mechanism & Application, R. Eckert, W.H. Freeman & Company.
5. Mineral Metabolism : Comar, C.L. & Felix Bronner (1961) Acad Press, New York & London
6. Comparative Animal Physiology C.L. Prosser, W.B. Saunders & Company.
7. Reproductive Physiology of Vertebrates: Van Tienhoven, A. (1983): 2nd Edn

QUESTION PAPER PATTERN

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	5 units.	
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SEMESTER III

PAPER VII- ENVIRONMENTAL BIOLOGY AND BIODIVERSITY

CONSERVATION

TEACHING HOURS: 60Hrs

CREDITS: 4

COURSE CODE: 5P18/3C/EBC

LTP : 3 1 0

Objectives

- To study the scope and the importance of biosphere, its components and its conservation
- To examine the causes effects and mitigation practice concerning pollution and other natural hazards.
- To analyse various biodiversity predicaments.

UNIT- I

Basic concept and Scope of Environmental Biology, Biosphere and Biogeochemical cycles. Environmental monitoring and impact assessment. Environmental and sustainable development. Water conservation, rain water harvesting, water shed management. (12 Hrs)

UNIT- II

Cause, effects and remedial measure of Air pollution, Water pollution. Noise, radioactive and thermal pollution. Agriculture pollution, Basic concepts of Bioaccumulation, Solid waste management, Global warming and disaster management, Cause of global warming, Impact of global warming – acid rains and ozone depletion, green house effect, Control measures of global warming, Afforestation, Reduction in the use of CFCS. (12 Hrs)

UNIT- III

Disaster management -floods, earthquake, Cyclones landslides, Environmental legislation. Natural Resource, Forests of India, Use and over exploitation of forests, Timber

extraction. Land degradation, Landslides, Soil-erosion and desertification, Use and over utilization of surface and ground water, Floods. Drought dams- benefits and problems.

(12 Hrs)

UNIT- IV

Mineral Use and exploitation, Environmental effect of extracting and using mineral resources, World food problem, Effects of modern agriculture and overgrazing, Conventional and non- conventional energy resources, alternate energy source, Equitable use of resources for sustainable life.

(12 Hrs)

UNIT- V

Biodiversity crisis – habitat degradation , poaching of wild life, Socio economic and political causes of loss of biodiversity, Conservation of Biodiversity, *In situ* and *ex situ* conservation of biodiversity, Hot spots of Biodiversity.

(12 Hrs)

SUGGESTED READING

1. Kormondy : Concepts of ecology
2. May : Model ecosystems
3. Odum : Ecology
4. Perkins : Ecology
5. Arora : Fundamentals of environmental biology
6. Anathakrishnan : Bioresources ecology
7. Bottain : Environmental studies
8. Bouhey : Ecology of populations
9. Clark : Elements of ecology
10. Dowdoswell : An introduction to animal ecology

QUESTION PAPER PATTERN

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SEMESTER III

PAPER VIII – IMMUNOLOGY

TEACHING HOURS: 60 Hrs

CREDITS: 4

COURSE CODE: 5P18/3C/IMM

LTP : 3 1 0

Objectives:

- To study the scope and importance of immunology and related techniques.
- To emphasize on the cellular types and the functioning of the immune system.
- To obtain knowledge about hypersensitivity, autoimmunity and transplantation immunology.

UNIT- I

Immune system - innate and adaptive immunity. Cells and organs of immune system – hematopoiesis, primary and secondary lymphoid organs. Antigens and antibodies – antigenicity, immunogenicity, antigen – antibody interactions, superantigens, antibody diversity. (12 Hrs)

UNIT- II

Organization of immunoglobulin genes – antibody structure, heavy, light, kappa, lambda; chain gene rearrangements. Complement system – classical, alternative and lectin pathways, regulation of complement system, biological consequences of complement activation. Major Histocompatibility Complex (MHC) - general organization and inheritance of the MHC, MHC molecules and genes, cellular distribution and regulation of MHC expression. (12 Hrs)

UNIT- III

T cells - maturation, activation and differentiation, T cell receptors. B cells - maturation, activation and differentiation, B cell receptors. Cytokines - properties of cytokines, cytokine receptors, cytokine-related diseases, therapeutic uses of cytokines and their receptors. Cell mediated cytotoxic responses – effector mechanisms, leukocyte activation and migration. (12 Hrs)

UNIT- IV

Hypersensitivity reactions – types, prevalence, factors, mechanisms of type I to IV hypersensitivity reactions. Immune tolerance and Autoimmunity – organ specific autoimmune diseases, animal models, treatment of autoimmune diseases. Transplantation immunology – blood antigens, transplantation rejection, graft rejection, familial grafting, tissue typing, cross matching, immune suppression. (12 Hrs)

UNIT- V

Immune response to infectious diseases– bacterial, fungal, viral, parasitic diseases and Immune deficiency - AIDS. Vaccine production - immune therapies, immunization. Applications of immunology and immune techniques –, ELISA, precipitation reaction, agglutination reaction, radioimmunoassay. (12 Hrs)

SUGGESTED READING

1. Immunology – R. C. Kuby *et al.*.
2. Immunology - Tizzard.
3. Immunology -. Roitt, Brostoff and D. Male.
4. Microbiology- M. T. Pelzer. Jr. E. C. S. Chan and N. R. Krieg. Tata McGraw –Hill

QUESTION PAPER PATTERN

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SEMESTER III

ELECTIVE PAPER-IV-RECOMBINANT DNA TECHNOLOGY

TEACHING HOURS: 60 Hrs

CREDITS : 3

COURSE CODE: 5P18/3E4/RDT

L T P: 3 1 0

Objectives

- To understand the steps involved in recombinant DNA technology
- To study the various types of cloning vectors and molecular tools
- To appreciate the applications of recombinant DNA technology

UNIT- I

Introduction to recombinant DNA technology, General strategies of recombinant DNA technology and gene cloning – Restriction digestion, ligation – types of ligation, selectable marker and reporters used in rDNA technology. Genomic and cDNA libraries – chromosome walking and jumping. (12 Hrs)

UNIT- II

Vectors in gene cloning, Types of vectors and choice of vectors. Plasmids – pBR 322, pBR 327, pUC 8. cosmids, lambda phage vectors – M13 phage vectors, phagemids, shuttle vectors, YACS, BAC. Enzymes of gene cloning – restriction endo nucleases, exo nucleases, DNA modifying enzymes, polymerases, transferases, kinases, ligase. (12 Hrs)

UNIT- III

Methods of transferring recombinant DNA to different host cells, Screening for transformants, Characterisation of transformants, Selection of recombinants. Nucleic acid hybridization techniques, Molecular Probe and its construction: probe labeling – nick translation, end labeling, random primer labeling – Expression of cloned genes in prokaryotes and eukaryotes. (12 Hrs)

UNIT- IV

DNA sequencing - first generation sequencing methods – Maxam and Gilbert method, Sangers – dideoxy sequencing, pyrosequencing, automated sequencing. PCR and its variants. DNA microarray. (12 Hrs)

UNIT-V

Applications of Biotechnology in prenatal diagnosis – gene therapy, pharmaceutical products – Humilin. Crop management – pesticide and herbicide resistance – transgenic animals and GM foods. (12 Hrs)

PRESCRIBED TEXTBOOK

1. Primrose S., Twyman R., Old D., Sixth Edition (2001) Principles of Gene Manipulation, Blackwell Science Ltd.

SUGGESTED BOOKS

2. Prirose S., Twyman R., Third Edition (2003) Principles of Genome Analysis And Genomics., Blackwell Science Ltd.
3. Alcamo I. Second Edition (2001) DNA Technology, The Awesome Skill, Harcourt Academic Press
4. Brown T.A., Third Edition (2007) Genomes 3, Garland Science , Taylor And Francis Group

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SEMESTER IV

PAPER-IX- DEVELOPMENTAL BIOLOGY

TEACHING HOURS : 75 Hrs

CREDIT: 4

PAPER CODE : 5P18/4C/DBY

LTP : 3 2 0

Objectives:

- To understand the various metamorphic stages of insects
- To study the advanced methods followed in reproductive biology
- To have a better understanding in cloning methodologies

UNIT- I

Various methods of asexual and sexual reproduction in Protozoa -Morphogenesis and hormonal control. -Metamorphosis in insects: Partial and complete metamorphosis, metamorphic forms nymph, larvae and pupae - Mechanism of vitellogenesis in insects. Neurohormonal control of fish reproduction and mechanism of vitellogenesis. Metamorphosis in Amphibia: morphogenetic and biochemical mechanism, hormonal control.

(15Hrs)

UNIT- II

Gametogenesis-Spermatogenesis-Ultra-structure of human spermatozoa, Hormonal control of spermatogenesis - semen- biochemical composition and sperm abnormality -Sperm capacitation and decapacitation- molecular mechanism and significance -oogenesis- Mechanism of oogenesis, biochemical events, hormonal regulation.

(15Hrs)

UNIT- III

Fertilization-Cytological and molecular events of fertilization –Cleavage and early embryonic development - Patterns and molecular mechanism of cleavage- blastula formation- gastrulation and formation of germ layers- Implantation in Mammals. Foetal membranes- types, structure and functions - Pheromones and sexual behavior in mammals - Molecular induction (Morphogenetic gradients) and organizer concept.

(15Hrs)

UNIT- IV

Cryopreservation of gametes, embryo and test-tube baby - In vitro fertilization (IVF) and its significance - Multiple ovulation and embryo transfer technology (MOET) -

Application of embryonic stem cells, clinical significance. Embryonic sexing, cloning, screening for genetic disorder diagnosis (ICSI, GIFT etc.), Cloning of animals by nuclear transfer.

(15Hrs)

UNIT- V

Immunocontraception- fertilization, inhibition and pregnancy termination - Classical contraceptive techniques: Physical, chemical, surgical and IUCD devices. Anti-androgen and anti-spermiogenic compounds (LDH-CY and SP-10).

(15 Hrs)

SUGGESTED READING

1. Developmental Biology. 2nd Edition. Leon W. Browwer Saunders College publishing.
2. Current Topics in Developmental Biology eds. R. A. Pedersen and G. P. Schatten.
3. Developmental Biology, S.F. Gilbert. 4th Edn. Sinauer Associates Inc. Publishers.
4. Principles of developmental: Paul Weiss edited by Hafner publishers , New York.
5. Cells into organs. 2nd Edn. The forces that shape the Embryo. Philip, Trinkaus
6. Principles of development: Lewis Wolpert et al. 1998. Oxford University Press.
7. Foundations of Embryology. B. M. Patten & B. M. Carlson. Tata McGraw Hill Publishing Company Ltd., New Delhi.
8. An Introduction to Embryology: Balinsky (1981) 5th Ed. (CBS College Publishing).
9. Marshall's Physiology of Reproduction Longmont, Green & Co. London Vol. 1 & 2. Flammig 1984, 2000.

QUESTION PAPER PATTERN

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SEMESTER IV

PAPER X- BIOCHEMISTRY

TEACHING HOURS: 75Hrs

CREDITS: 4

COURSE CODE: 5P18/4C/BIO

L T P: 3 2 0

Objectives:

- To understand the metabolism of different components and their assimilation.
- To study the nuclear components and their role in life sciences.
- To understand the principles of thermodynamics.

UNIT I:

Chemical bonds - covalent bonds, hydrogen bonds, disulphide bonds- Forces between molecules- Electrostatic force, Vanderwal's force, Hydrophilic and Hydrophobic force- Biological importance

pH and Acid - Base balance. Henderson - Hasselbach equation - Acidosis, Alkalosis. Buffers - Buffer systems of blood- biological importance, Laws of thermodynamics, entropy, enthalpy, free energy - Reversible thermodynamics and irreversible thermodynamics (15Hrs)

UNIT- II

Carbohydrates - Classification and structure - Metabolism - Glycolysis, Citric acid cycle, Glycogenesis, Glycogenolysis and Gluconeogenesis, Bioenergetics - Electron transport chain and Oxidative phosphorylation. Synthesis of ATP. (15Hrs)

UNIT- III

Proteins - Classification of proteins and Aminoacids - Primary, secondary, tertiary and quaternary structures of proteins, protein folding. Ramachandran plot. Protein metabolism- Deamination, Transamination, Transmethylation, Decarboxylation, Ornithine cycle.

Enzymes - Nomenclature - Classification of enzymes - Mechanism and Regulation of enzyme action. Enzyme kinetics - Michaelis Menten Hypothesis - Line Weaver Burk equation - Factors affecting enzyme action. (15Hrs)

UNIT- IV

Lipids – Classification of lipids- Functional importance of membrane lipids and steroids, cholesterol biosynthesis- Fatty acid metabolism- Biosynthesis of fatty acids - β - oxidation of fatty acids. Ketogenesis Energetics of fatty acid metabolism (15 Hrs)

UNIT- V

Metabolism of Xenobiotics - detoxification – definition – Phase I reactions- oxidation, Reduction, Hydrolysis – Phase II conjugation reaction – Glucuronic acid, Glutathione sulphate, acetate and methyl group. (15Hrs)

PRESCRIBED READING

1. Voet, D. and J.G. Voet. Biochemistry John Wiley & Sons.

SUGGESTED READING

1. Freifelder, D. Physical Biochemistry W.H. Freeman & Co.
2. Segal, I.H. Biochemical calculations John Wiley and Sons
3. Creighton, T.E. Protein Structure and Molecular Properties W.H. Freeman & Co.
4. Freifelder, D. Essentials of Molecular Biology
5. Wilson, K. and K.H. Goulding A Biologists Guide to Principals and Techniques of Practical Biochemistry
6. Cooper, T.G. Tools of Biochemistry
7. Hawk, Practical Physiological Chemistry
8. Garret, R.H. and C.M. Grisham. Biochemistry. Saunders college Publishers.

QUESTION PAPER PATTERN

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SEMESTER IV

PAPER XI- AQUACULTURE

TEACHING HOURS: 75 Hrs

CREDITS: 4

COURSE CODE : 5P18/4C/AQU

LTP : 3 2 0

Objectives:

- To study the fishery resources of the world.
- To emphasize on economically important fishes and their nutritive value.
- To study the different culture methods, preservation techniques and fishery management.

UNIT- I

Aquaculture: history, definition, scope and importance, Fishery resources of India in general and Tamil Nadu in particular, Abiotic and biotic factors of water necessary for fish life. Ecological characteristics of lakes and rivers, General ecological characteristics of reservoirs of India. (15Hrs)

UNIT- II

Fresh water fish farm: selection of site, construction of fish farm and soil chemistry, Designing, layout and construction of different types of fish ponds, Setting and management of fresh water aquarium, Water pollution, its effects on fisheries and methods of its abatement. Common fish diseases & their control. (15Hrs)

UNIT- III

Fish culture :- Mono, Poly, mixed and composite Fish culture, Fresh water prawn culture and its prospects in India, Culture of Mussels, clams, oysters and pearl culture, Sewage fed fish culture, paddy cum fish culture, Frog culture, Sea weed culture. (15Hrs)

UNIT- IV

Fish breeding in natural conditions , bundh breeding, hypophysation & stripping, Transport of live fish and seed, Different types of crafts and gears used for fish catching,

Plankton- its definition, culture & identification, Common weeds of fish ponds and methods of their eradication. Polyploidy and hybridization, sex determination in fishes, super males and super females, transgenic fishes. (15Hrs)

UNIT- V

Preservation and processing of fish, By products of fish Industry and their utility, Biochemical composition and nutritional value of fish, Fisheries economics and marketing, Fisheries managements and extension. (15Hrs)

SUGGESTED READING:

1. C.B.L. Shrivastava : Fishes of India
2. Jhingaran : Fish and fisheries of India
3. S.S. Khanna : An Introduction to fishes
4. R.S. Rath : Fresh water Aquaculture
5. Gopalji Shrivastava : Fishes of U.P. & Bihar
6. H.D. Kumar : Sustainability & Management of Aquaculture & Fisheries
7. A.J.K. Mainan : Identification of fishes
8. R. Sanatam : A Manual of fresh water Aquaculture
9. S.K. Gupta : Fish & Fisheries

QUESTION PAPER PATTERN

COMPONENT	NATURE OF THE QUESTION	MAXIMUM MARKS
Part A	Descriptions – Contains 5 questions to be answered out of 8, covering all 5 units.	5X8= 40
Part B	Application/ Analysis / Synthesis / Evaluation – Contains 3 questions to be answered out of 5 questions covering all the five units.	3 x 20 = 60

SEMESTER IV

ELECTIVE-V - RESEARCH METHODOLOGY

TEACHING HOURS: 75 Hrs

CREDITS : 3

COURSE CODE: 5P18/4E5/RMY

LTP: 3 2 0

Objectives:

- To gain knowledge on scientific methods relevant to research.
- To obtain information on scientific writing and publishing.
- To understand the need for patenting, piracy and bioethics.

UNIT-I

Life Science - Basic concepts, Definition, Laws, Characteristics, knowledge, Information and Data, Pseudoscience. Units of measurements, Concepts of Research - Meaning, Objectives, Motivation and Approaches, Types of Research (Descriptive / Analytical, Applied / Fundamental, Quantitative / Qualitative, Conceptual / Empirical, Research Methodology. (15Hrs)

UNIT-II

Research Formulation-Observation and Facts, Prediction and explanation, Induction, Deduction. Defining and formulating the research problem, Selecting the problem and necessity of defining the problem. Literature review - Importance of literature reviewing in defining a problem, Critical literature review, Identifying gap areas from literature review, Hypothesis - Null and alternate hypothesis and testing of hypothesis. (15Hrs)

UNIT-III

Research Designs-Basic principles, Meaning, Need and features of good design, Important concepts, Types of research designs, Development of a research plan -Exploration, Description, Diagnosis, Experimentation, determining experimental and sample designs, Data collection techniques. (15Hrs)

UNIT-IV

Project proposal writing, Research report writing (Thesis and dissertations, Research articles, Oral communications). Presentation techniques - Assignment, Seminar, Debate, Workshop, Colloquium, Conference. Information Science, Extension and Ethics, Sources of Information -Primary and secondary sources, Library - books, journals, periodicals, reference sources, Abstracting and indexing sources, Reviews, Treatise, Monographs, Patents, Internet -Search engines and software, Online libraries, e-Books, e-Encyclopedia, TED Talk, Institutional Websites. (15Hrs)

UNIT-V

Intellectual Property Rights - Copy right, Designs, Patents, Trademarks, Geographical indications. Safety and precaution - ISO standards for safety, Lab protocols, Lab animal use, care and welfare, animal houses, radiation hazards. Extension: Lab to Field, Extension communication, Extension tools, Bioethics: Laws in India, Working with man and animals, Consent, Animal Ethical, Committees and Constitution. (15Hrs)

PRESCRIBED TEXTBOOK:

1. Research Methodology by Gurumani.

SUGGESTED READING:

1. Ahuja,V.K. 2010. Law of Copy Rights and Neighbouring Rights : National and International Perspectives..Lexis Nexis- Butterworths Wadhwa, Nagpur Ahuja,V.K. 2007.
2. Law Relating to Intellectual Property Rights. Lexis Nexis-Butterworths Wadhwa, Nagpur. Anitha Goel.2010
3. An Introduction to Scientific Research. Dover Publications. NY. Chap T.Le.2003. Introductory Biostatistics. John Wiley & Sons, NJ, USA. Clough,P.and C.Nutbrown.2002.
4. A Student's Guide to Methodology: Justifying Enquiry. Sage, London. Daniel, W.W. 2006. Biostatistics: A Foundation for Analysis in the Health Sciences (7th edn). John Wiley & Sons, New York. Dharmapalan, Biju. 2012.

5. Scientific Research Methodology. Narosa Publishing House, New Delhi Finney ,D.J. 1980. Statistics for Biologists. Chapman and Hall, London Frank, Harry and Steven C. Althoen, 1995.
6. Advice to Young Scientist. Harper and Row, London. Phillippe Cullet.2005.
7. Intellectual Property Protection and Sustainable Development. Lexis NexisButterworths Wadhwa, Nagpur Prabhakara ,G.N. 2006. Biostatistics. Jaypee Bro. New Delhi Pradeep Sinha and Priti Sinha.2010.
8. Introduction to Biostatistics and Research Methods (4th edn). Prentice Hall, New Delhi.
9. WHO.2011. Laboratory Quality Standards and Their Implementation. WHO Regional Office. New Delhi.

QUESTION PAPER PATTERN

COMPONENT	NATURE OF THE QUESTION	MAXIMUM MARKS
Part A	Descriptions – Contains 5 questions to be answered out of 8, covering all 5 units.	5X8= 40
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SEMESTER – IV

PRACTICAL III- ANIMAL PHYSIOLOGY, BIOCHEMISTRY, IMMUNOLOGY AND RECOMBINANT DNA TECHNOLOGY

TEACHING HOURS: 120 HRS

CREDITS: 4

COURSE CODE: 5P18/4C/MP3

LTP : 0 0 8

ANIMAL PHYSIOLOGY

1. Estimation of RQ in fish with reference to temperature
2. Oxygen consumption in terrestrial animal (cockroach)
3. Salt loss and Salt gain in Fish
4. Determination of aminoacids in the tissues (paper chromatography)
5. Estimation of Blood glucose level – Glucose oxidase peroxidase method
6. Principles and applications of the following instruments: Kymograph, spectrophotometer, Sphygmomanometer, Electrophoretic unit
7. Study of fauna in their natural habitats by visiting places of zoological interest

BIOCHEMISTRY

1. Blood: Clotting time, bleeding time.
2. Estimation of haemoglobin
3. Erythrocyte Sedimentation Rate (ESR)-Chick Blood
4. Estimation of Blood Urea (DAM Method)
5. Estimation of Blood creatinine (Jaffe's method)
6. Estimation of Blood Cholesterol (Zaks method)

IMMUNOLOGY

1. Histology of Lymphoid organs- Thymus, spleen, Bone marrow, Lymph nodes
2. Isolation of lymphocytes and enumeration – DC
3. Immunodiffusion
4. Determination of antigenic determinants.

BIOTECHNOLOGY

Demonstration:

- a. PCR
- b. Agarose gel electrophoresis of DNA

SEMESTER IV

PRACTICAL IV- DEVELOPMENTAL BIOLOGY, ENVIRONMENTAL BIOLOGY AND AQUACULTURE

TEACHING HOURS: 120Hrs

CREDITS: 4

COURSE CODE:5P18/4C/MP4

LTP: 0 0 8

DEVELOPMENTAL BIOLOGY

1. Histological studies in a mammal: (i) T.S of mammalian Ovary (ii) T.S of mammalian Testes
2. Development in chick embryo-Observation of live chick embryo using vital stain
3. Developmental stages of Frog metamorphosis.
4. Induced ovulation in fish using hormone (Demonstration)
5. Observation of maturity stages of ovary and testes
6. Determination of gonadosomatic index and fecundity

ENVIRONMENTAL BIOLOGY

1. Identification of
 - i. Marine plankton
2. Study of
 - i. Rocky shore fauna
 - ii. Sandy shore fauna
 - iii. Muddy shore fauna
3. Determination of hydrobiological features of different samples (tap water, sea water, brackish water and polluted water)
 - i. pH
 - ii. Salinity
 - iii. Free carbon dioxide
 - iv. Dissolved oxygen
 - v. Calcium

4. Animal association- Parasitism, Mutualism and Commensalism
5. Study of fauna in their natural habitats by visiting places of zoological interest.

AQUACULTURE

- i. Fish morphology-Morphometric characters –Head structure
- ii. Types of scales in fishes
- iii. Identification of Marine fishes (5 nos) up to species level.
- iv. Commercially important invertebrates: Crab,Lobsters, Pearl Oyster, Edible Oyster, Mytilus, Sepia and Loligo- their importance.
- v. Observation of Gears and Crafts.
- vi. Observation of Larvivorous fishes.
- vii. Identification of commercially important fresh water fishes (2 nos) and estuarine fishes (1 no) belonging to different families using Day volumes.
- viii. Identification of cultivable Prawns.
- ix. Identification of Sea weeds –their economic importance.
- x. Observation of fish farm implements- Sacchi's disc,pH meter,Aerator and Plankton net.
- xi. Observation of fish parasites.
- xii. Identification of 5 common ornamental fishes.
- xiii. Study of different types of Formulated feeds and live feeds (Artemia, Rotifers and Diatoms)
- xiv. Visit to hatchery, Fish landing and Fishery institutes.
- xv. Field report to be submitted.

SOFT SKILL-III DAIRY FARMING

TEACHING HOURS: 30 Hrs

CREDIT: 2

PAPER CODE: 5P18/3S/DFG

LTP: 2 0 0

Objectives:

- To enable the students to understand different breeds of cow
- To understand different breeding techniques in dairy farming

Unit-I

Dairy breeds, breeding, feeding and nutrition scope of dairy farming dairy breeds of India both cows and buffaloes exotic cow breeds systems of breeding hybrid vigor grading pure breeding merits and demerits of inbreeding and out breeding feeding and nutrition structure of digestive system and physiology of digestion common cattle feed –their nutritive minerals feed additives and silage preparation. (10 Hrs)

Unit II

Live stock diseases: Viral diseases Rinderpest, Foot and Mouth disease and Cow pox. Bacterial diseases-Mastitis, Anthrax, Tuberculosis Hemorrhagic septicemia Brucellosis-Fungal diseases Protozoan and Helminth diseases. (10 Hrs)

Unit III

Dairy technology, Marketing and Farm management. Milk Composition and nutritive value techniques to detect milk adulteration – spoilage of milk Pasteurization of milk preparation of Dahi, butter, ghee and milk products. Role of Co-operative societies in milk production and marketing. Technique of producing quality milk- artificial insemination – semen collection storage and insemination techniques. (10 Hrs)

BOOKS FOR REFERENCE:

1. G.C Banerjee- A textbook of Animal Husbandry- Oxford &IBH publication,New Delhi
2. KAR- Handbook of Animal Husbandry-,1990
3. G.H Schmidt &T.D Van Vleck- Principlesof Dairy Science- Surget Pvt,Ltd,1982
4. N.S.R Sasting & Ck Thomas- Farm Animal Management-Vikas Publishing house Pvt Ltd1976
5. Dr.A.K.Sachetic- Animal reproduction and Artificial insemination:NCERT,1989
6. M.M Rai- Dairy Chemistry and Animal Nutrition- Kalarant publishers 1985

QUESTION PAPER TEMPLATE

COMPONENT	NATURE OF THE QUESTION	MAXIMUM MARKS
Part A	3 questions to be answered out of 4, covering all 3 units	3x10=30
Part B	1 question to be answered out of 2, from 3 units	1x20=20

SOFT SKILL-IV POULTRY FARMING

TEACHING HOURS: 30 Hrs

CREDIT: 2

PAPER CODE: 5P18/4S/PFM

LTP: 2 0 0

Obejectives:

- To develop the skill on poultry rearing and management.
- To understand different breeds of Fowls

Unit-I

External features of fowls- Sexual dimorphism-Maturity and egg laying capacity- different types of egg (black fowl) - Nutritive value of eggs -Genetics of fowl- Inheritance of morphological characters- list of autosomal and sex linked characters. Breeds of fowl- breeding methods- systems of breeding- modern methods of breeding. (10 Hrs)

Unit II

Poultry industry in India a survey- Choosing commercial layers and broilers- Poultry housing- Deep Litter system- cage rearing poultry methods. Practical aspects of chick rearing- management of Growers- management of Layers and Broilers- Lighting, summer and winter management debunking. (10 Hrs)

Unit III

Poultry nutrition, energy and diseases. Protein and amino acids- vitamins- essential organic elements- non nutritive feed additives- feed stuffs for poultry- feed formulation. Diseases- virus, bacteria, fungi and parasites. vaccination program- Poultry products making. (10 Hrs)

BOOKS FOR REFERENCE:

1. Veterinary books and Journals.
2. The Poultry Science: The Selection Rearing and General Treatment of Poultry by L.C.R
3. Poultry Farming and Keeping by W. Powell Owen.
4. Poultry Breeds and Management; An introductory Guide by David Scrivener

QUESTION PAPER TEMPLATE

COMPONENT	NATURE OF THE QUESTION	MAXIMUM MARKS
Part A	3 questions to be answered out of 4, covering all 3 units	3x10=30
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I M.SC ELECTIVE (OFFERED TO OTHER DEPARTMENT STUDENTS)
SEMESTER – II

TITLE OF THE PAPER: MATERNITY AND CHILD CARE

TEACHING HOURS: 60 Hrs

CREDITS: 3

PAPER CODE: 5P18/2E/MCC

L T P: 3 1 0

Obejectives:

- To understand the structure and function of female reproductive organs.
- To understand the periodical foetal growth and associated problems.
- To analyse the role of hormones in reproduction.

Unit I:

Structure and functions of Reproductive organs in male and female – Structure of a mammalian sperm – Sperm longevity – Morphology and cyclic changes of ovary – uterus – vagina. Hormonal changes in mammary gland during menstrual cycle – puberty – menarche – menopause. (12 Hrs)

Unit II:

Formation of gametes – spermatogenesis– spermiogenesis – oogenesis – structure of human ovum – Ovulation – Hormonal control of ovulation. (12 Hrs)

Unit III:

Fertilization – mechanism – chemotaxis – capacitation – Acrosomal reaction – activation of ovum – cortical reaction – amphimixis – monospermic and polyspermic fertilization – implantation – development of foetus – Identical and non-identical twins- siamese twins. (12 Hrs)

Unit IV:

Pregnancy – maternal body changes –Test for pregnancy – parturition – Role of hormones – Birth control – necessity for birth control – contraceptive devices – Infertility – causes – Male and female infertility – Artificial insemination – test tube babies – amniocentesis. (12 Hrs)

Unit V:

Prenatal – postnatal care – ABO Blood group, Rh factor – Erythroblastosis foetalis Immunoprophylaxis – immunization schedule - Typhoid, Cholera, Diphtheria, Tetanus, Polio, Plague, Pertusis, Tuberculosis, MMR vaccine. (12 Hrs)

RECOMMENDED TEXT BOOK:

1. Inderbir Singh and Pal, G.P, 2005. Human Embryology, 7th Ed.

REFERENCE BOOKS:

1. Arumugam N, A Text book of Chordate Embryology – Saras Publication - 420pp.
2. Gerard, J. Tortora and Sandra Reynolds Grabowski, 2003. Principles of Anatomy and Physiology, 10th Ed., Mac Millan. John Wiley and Sons, IMC.
3. K.V. Sastry and Dr. Vineeta Shukul, 2004. Developmental Biology, 1st Ed. Rastogi publications.
4. Verma P.S., V.K. Agarwal and Tyagi, 1995. Chordate Embryology, S. Chand & Co New Delhi 110 055, 420 pp.

QUESTION PAPER TEMPLATE

COMPONENT	NATURE OF THE QUESTION	MAXIMUM MARKS
Part A	Descriptions – Contains 5 questions to be answered out of 8, covering all 5 units.	5X8= 40
Part B	Application/ Analysis / Synthesis / Evaluation – Contains 3 questions to be answered out of 5 questions covering all the five units.	3x20 = 60

SEMESTER - III

ELECTIVE – II (OFFERED TO OTHER DEPARTMENT STUDENTS)

TITLE OF THE PAPER: AQUARIUM FISHES

TEACHING HOURS: 60 hrs

CREDITS: 3

COURSE CODE: 5P18/3E/AQF

LPT: 3 1 0

Objectives:

- To understand and obtain an in depth knowledge of fishery sciences.
- To know the business aspects of ornamental fishes and maintenance of aquaria.
- To understand the role of women in aquaculture.

Unit I:

Introduction: Taxonomy and biology of some common fresh water and marine ornamental fishes – *Carassius auratus*; *Betta splendens*; *Poecilia reticulata*; *Colisa lalia*; *Pterophyllum*; *Scleropages*; *Amphiprion percula*; *Macropharyngodon negrosensis*; *Paracanthurus hepatus*; *Chaetodon vergabundus*; *Pterois volitans*. (12 Hrs)

Unit II:

Food and Feeding Management: Live feed organisms (*Daphnia*, *Tubifex*, *Cyclops*, *Brachionus*, *Chlorella*, etc.) - Formulated feed (Freeze dried tubifex, liver, vegetable food, etc.) - Method of preparation of commercial feed and quality assessment of feed. (12 Hrs)

Unit III:

Aquarium Keeping and Management: Setting up of an aquarium tank – selection of stone and gravel – Decors - aquarium plants – water quality management – aeration – Illumination devices - salinity – pH - temperature maintenance – filtration (mechanical and biological filters). Safety measures and devices for maintenances. (12 Hrs)

Unit IV:

Breeding techniques and Health assessment: Development of brood stocks – Selection of brood fishes - Breeding of Egg layers and Live bearers – Induced breeding – Common diseases of aquarium fishes and their control – Microbial: Bacterial, Viral and Fungal diseases; non – microbial – Protozoans, Trematodes, Cestodes, Nematodes and Crustaceans. (12 Hrs)

Unit V:

Prospects of ornamental fishes: Export and industrial importance - Hobby and household industry – Tips for hobbyists - List of fresh water and marine ornamental fishes available in India for export with its indicative prices - Role of women in ornamental fish culture. (12 Hrs)

RECOMMENDED TEXT BOOK:

1. Donald Wilkie, 1985. Aquarium fish Pelhem Book, Ltd.

REFERENCE BOOKS:

1. Boulenger, E.G, 1939. Keep an Aquarium.
2. Dey V.K., Ornamental fishes-MPEDA Hand book of Aquafarming.
3. Gregory C. Bateman, 1921. Fresh water Aquaria - 7th edition. Revised by Jack Hen.
4. Harvey Jack Hims. Georg, F, 1973. A guide to fresh water Aquarium fishes. HamylInn publications.
5. John G. Shedd, 1933. Aquarium.
6. Robert Goldstein, 1971. Diseases of aquarium fishes T.F.H. Publication.
7. Stephen Spotte, 1973. Marine Aquarium keeping. The Science, Animals and Art. John Wiley & Sons.

Question Paper Template

COMPONENT	NATURE OF THE QUESTION	MAXIMUM MARKS
Part A	Descriptions - Can have 5 questions to be answered out of 8 covering all 5 units.	5x8= 40
Part B	Application/ Analysis / Synthesis / Evaluation - Can have 3 questions to be answered out of 5 questions covering all the five units.	3x20 = 60