ASD GOVT. DEGREE COLLEGE FOR WOMEN (A)

(Re- Accredited by NAAC with B Grade)

Jagannaickpur, Kakinada, East Godavari, AP – 533002

DEPARTMENT OF ZOOLOGY & AQUACULTURE TECHNOLOGY

2021-2022

ZOOLOGY

A.S.D.GOVERNMENT DEGREE COLLEGE FOR WOMEN (A)

(Re-Accredited NAAC with "B" Grade)

KAKINADA, EAST GODAVARI, A.P, 533002.

ZOOLOGY – SEMESTER --I

PAPER – I: ANIMAL DIVERSITY – BIOLOGY OF NON-CHORDATES

(Course Code: ZOO201306)

HOURS: 60 (5X12) **Max. Marks: 100**

Course Outcomes: By the completion of the course the graduate should able to –

CO1 Describe general taxonomic rules on animal classification

CO2 Classify Protozoa to Coelenterata with taxonomic keys

CO3 Classify Phylum Platyhelminthes to Annelida phylum using examples from parasitic adaptation and vermin composting

CO4 Describe Phylum Arthropoda to Mollusca using examples and importance of insects and Molluscans

CO5 Describe Echinodermata to Hemi chordata with suitable examples and larval stages in relation to the phylogeny

Learning objectives

1. To understand the taxonomic position of protozoa to helminthes.
2. To understand the general characteristics of animals belonging to protozoa to hemichordata.
3. To understand the structural organization of animals phylum from protozoa to hemichordata.
4. To understand the origin and evolutionary relationship of different phyla from protozoa to hemichordata.
5. To understand the origin and evolutionary relationship of different phylum from annelids to hemichordates.

Syllabus

UNIT I

1. Principles of Taxonomy – Binomial nomenclature – Rules of nomenclature
2. Whittaeker‟s five kingdom concept and classification of Animal Kingdom.

Phylum Protozoa

3. General Characters and classification of protozoa up to classes with suitable examples
4. Locomotion, nutrition and reproduction in Protozoans
5. Elphidium (type study)

UNIT –II

Phylum Porifera

1. General characters and classification up to classes with suitable examples

2. Skelton in Sponges

3. Canal system in sponges

Phylum Coelenterata

4. General characters and classification up to classes with suitable examples

5. Metagenesis in *Obelia*

6. Polymorphism in coelenterates

7. Corals and coral reefs

Phylum Ctenophora:

8. General Characters and Evolutionary significance(affinities)

Unit – III

Phylum Platyhelminthes

1. General characters and classification up to classes with suitable examples
2. Life cycle and pathogenecity of *Fasciola hepatica*
3. Parasitic Adaptations in helminthes

Phylum Nemathelminthes

4. General characters and classification up to classes with suitable examples

5. Life cycle and pathogenecity of *Ascaris lumbricoides*

Unit – IV

Phylum Annelida

1. General characters and classification up to classes with suitable examples
2. Evolution of Coelom and Coelomoducts
3. Vermiculture - Scope, significance, earthworm species, processing, Vermicompost, economic importance of vermicompost.

Phylum Arthropoda

4. General characters and classification up to classes with suitable examples
5. Vision and respiration in Arthropoda
6. Metamorphosis in Insects
7. *Peripatus* - Structure and affinities
8. Social Life in Bees and Termites

Unit – V

Phylum Mollusca

1. General characters and classification up to classes with suitable examples
2. Pearl formation in Pelecypoda
3. Sense organs in Mollusca

Phylum Echinodermata

4. General characters and classification up to classes with suitable examples

5. Water vascular system in star fish

6. Larval forms of Echinodermata

Phylum Hemichordata:

7. General characters and classification up to classes with suitable examples

8. *Balanoglossus* - Structure and affinities

Co-curricular activities (suggested)

- Preparation of chart/model of phylogenic tree of life, 5-kingdom classification, *Elphidium* life cycle etc.
- Visit to Zoology museum or Coral island as part of Zoological tour
- Charts on life cycle of *Obelia*, polymorphism, sponge spicules
- Clay models of canal system in sponges
- Preparation of charts on life cycles of *Fasciola* and *Ascaris*
- Visit to adopted village and conducting awareness campaign on diseases, to people as part of Social Responsibility.
- Plaster-of-paris or Thermocol model of *Peripatus*
- Construction of a vermicompost in each college, manufacture of manure by students and donating to local farmers
- Models of compound eye, bee hive and terminarium (termitaria) by students
- Visit to apiculture centre and short-term training as part of apprenticeship programme of the govt. Of Andhra Pradesh
- Chart on pearl forming layers using clay or Thermocol
- Visit to a pearl culture rearing industry/institute
- Live model of water vascular system
- Phylogeny chart on echinoderm larvae and their evolutionary significance
- Preparation of charts depicting the feeding mechanism, 3 coeloms, tornaria larva etc., of *Balanoglossus*

REFERENCE BOOKS

1. **L.H. Hyman** „*The Invertebrates' Vol I, II and V*. – M.C. Graw Hill Company Ltd.

2. **Kotpal, R.L. 1988 - 1992** Protozoa, Porifera, Coelenterata, Helminthes, Arthropoda, Mollusca, Echinodermata. Rastogi Publications, Meerut.
3. **E.L. Jordan and P.S**. Verma „*Invertebrate Zoology'* S. Chand and Company.
4. **R.D. Barnes** „*Invertebrate Zoology'* by: W.B. Saunders CO., 1986.
5. **Barrington. E.J.W**., „*Invertebrate structure and Function'* by ELBS.

6 P.S. Dhami and J.K. Dhami. Invertebrate Zoology. S. Chand and Co. New Delhi.

7. **Parker, T.J. and Haswell**,„*A text book of Zoology'* by, W.A., Mac Millan Co. London.
8. **Barnes, R.D. (1982).** *Invertebrate Zoology*, V Edition"

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KAKINADA, EAST GODAVARI, A.P, 533002.

ZOOLOGY PRACTICAL SYLLABUS FOR I SEMESTER

ANIMAL DIVERSITY - BIOLOGY OF NON-CHORDATES

(Course Code: ZOO201306 P)

Periods: 24 **Max. Marks: 50**

Learning Outcomes:

- To understand the importance of preservation of museum specimens
- To identify animals based on special identifying characters
- To understand different organ systems through demo or virtual dissections
- To maintain a neat, labeled record of identified museum specimens

Syllabus :

1. **Study of museum slides / specimens / models (Classification of animals up to orders)**

Protozoa: Amoeba, *Paramoecium, Paramoecium Binary fission and Conjugation, Vorticella, Entamoeba histolytica, Plasmodium vivax*

Porifera: *Sycon, Spongilla, Euspongia, Sycon*- T.S & L.S, Spicules, Gemmule **Coelenterata:** *Obelia – Colony & Medusa, Aurelia, Physalia, Velella, Corallium, Gorgonia, Pennatula*v.

Platyhelminthes: *Planaria, Fasciola hepatica, Fasciola*larval forms – Miracidium, Redia, Cercaria, *Echinococcus granulosus, Taeniasolium, Schistosoma haematobium.*

Nemathelminthes: *Ascaris(Male & Female), Drancunculus, Ancylostoma, Wuchereria*

Annelida: *Nereis, Aphrodite, Chaetopteurs, Hirudinaria,* Trochophore larva **Arthropoda:** Cancer, Palaemon**,** Scorpion, *Scolopendra, Sacculina, Limulus, Peripatus,* Larvae - Nauplius, Mysis, Zoea, Mouth parts of male &female *Anopheles* and *Culex,* Mouthparts of Housefly and Butterfly.

Mollusca: *Chiton, Pila, Unio, Pteredo, Murex, Sepia, Loligo, Octopus, Nautilus,*Glochidium larva

Echinodermata: *Asterias, Ophiothrix, Echinus, Clypeaster, Cucumaria, Antedon,*

Bipinnaria larva

Hemichordata: *Balanoglossus,* Tornaria larva

2. Dissections:

1. **Prawn:** Appendages, Digestive system, Nervous system, Mounting of Statocyst
2. **Insect** Mouth Parts
3. Laboratory Record work shall be submitted at the time of practical examination
4. An **"Animal album**" containing photographs, cut outs, with appropriate write up about the above mentioned taxa. Different taxa/ topics may be given to different sets of students for this purpose
5. Computer -aided techniques should be adopted or show virtual dissections

RFERENCE MANUALS:

1. Practical Zoology- Invertebrates S.S. Lal
2. Practical Zoology - Invertebrates P.S. Verma
3. Practical Zoology - Invertebrates K.P. Kurl
4. Ruppert and Barnes (2006) Invertebrate Zoology,8th Edition, Holt Saunders International Edition

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ZOOLOGY –SEMESTER II

PAPER – II: ANIMAL DIVERSITY – BIOLOGY OF CHORDATES

(Course Code: ZOO202306)

Hours:60 (5x12) Max. Marks: 100

Course Outcomes: By the completion of the course the graduate should able to -

CO1 Describe general taxonomic rules on animal classification of chordates

CO2 Classify Protochordata to Mammalia with taxonomic keys

CO3 Understand Mammals with specific structural adaptaions

CO4 Understand the significance of dentition and evolutionary significance

CO5 Understand the origin and evolutionary relationship of different phyla from Prochordata to mammalia.

Learning objectives

1. To understand the animal kingdom.
2. To understand the taxonomic position of Protochordata to Mammalia.
3. To understand the general characteristics of animals belonging to Fishes to Reptilians.
4. To understand the body organization of Chordata.
5. To understand the taxonomic position of Protherian mammals.

Unit - I

1. General characters and classification of Chordata upto classes
2. Protochordata- Salient features of Cephalochordata , Affinities of Cephalochordata.
3. Salient features of Urochordata
4. Structure and life history of *Herdmania*
5. Retrogressive metamorphosis –Process and Significance

Unit - II

1. Cyclostomata, General characters, Comparison of *Petromyzon* and *Myxine*
2. Pisces : General characters of Fishes
3. *Scoliodon*: External features, Digestive system, Respiratory system, Structure and function of Heart, Structure and functions of the Brain.
4. Migration in Fishes
5. Types of Scales

6. Dipnoi

Unit - III

1. General characters of Amphibia
2. Classification of Amphibia up to orders with examples.
3. *Rana hexadactyla*: External features, Digestive system, Respiratory system, Structure and function of Heart, structure and functions of the Brain
4. Reptilia: General characters of Reptilia, Classification of Reptilia upto orders with examples
5. *Calotes*: External features, Digestive system, Respiratory system, Structure and function of Heart, structure and function of Brain
6. Identification of Poisonous snakes and Skull in reptiles

Unit - IV

1. Aves General characters of Aves
2. *Columba livia*: External features, Digestive system, Respiratory system, Structure and function of Heart, structure and function of Brain
3. Migration in Birds
4. Flight adaptation in birds

Unit – V:

1. General characters of Mammalia
2. Classification of Mammalia upto sub - classes with examples
3. Comparision of Prototherians, Metatherians and Eutherians
4. Dentition in mammals

Co-curricular activities (suggested)

- Preparation of charts on Chordate classification (with representative animal photos) and retrogressive metamorphosis
- Thermocol or Clay models of Herdmania and Amphioxus
- Visit to local fish market and identification of local cartilaginous and bony fishes
- Maintaining of aquarium by students
- Thermocol model of fish heart and brain
- Preparation of slides of scales of fishes
- Visit to local/nearby river to identify migratory fishes and prepare study notes
- Preparation of Charts on above topics by students (Eg: comparative account of vertebrate heart/brain/lungs, identification of snakes etc.)
- Collecting and preparation of Museum specimens with dead frogs/snakes/lizards etc., and/or their skeletons
- Additional input on types of snake poisons and their antidotes (student activity).
- Collection of bird feathers and submission of report on Plumology
- Taxidermic preparation of dead birds for Zoology museum

- Map pointing of prototherian and metatherian mammals
- Chart preparation for dentition in mammals

REFERENCE BOOKS

- J.Z. Young, 2006. The life of vertebrates. (The Oxford University Press, New Delhi). 646 pages. Reprinted
- Arumugam, N. Chordate Zoology, Vol. 2. SarasPlublication. 278 pages. 200 figs.
- A.J. Marshall, 1995. Textbook of zoology, Vertebrates. (The McMillan Press Ltd., UK). 852 pages. (Revised edition of Parker &Haswell, 1961).
- M. EkambaranathaAyyar, 1973. A manual of zoology. Part II. (S. ViswanathanPvt. Ltd., Madras).
- P.S. Dhami& J.K. Dhami, 1981. Chordate zoology. (R. Chand & Co.). 550 pages.
- Gurdarshan Singh & H. Bhaskar, 2002. Advanced Chordate Zoology. Campus Books, 6 Vols., 1573 pp., tables, figs.
- A.K. Sinha, S. Adhikari& B.B. Ganguly, 1978. Biology of animals. Vol. II. Chordates. (New Central Book Agency, Calcutta). 560 pages.
- R.L.Kotpal, 2000. Modern textbook of zoology, Vertebrates. (Rastogi Publ., Meerut). 632 pages.
- E.L. Jordan & P.S. Verma, 1998. Chordate zoology. (S. Chand & Co.). 1092 pages.
- G.S. Sandhu, 2005. Objective Chordate Zoology. Campus Books, vii, 169 pp.
- Sandhu, G.S. & H. Bhaskar, H. 2004. Textbook of Chordate Zoology. Campus Books, 2 vols., xx, 964 p., figs.
- Veena, 2008. Lower Chordata. (Sonali Publ.), 374 p., tables, 117 figs.

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KAKINADA, EAST GODAVARI, A.P, 533002.

ZOOLOGY PRACTICAL SYLLABUS FOR II SEMESTER ZOOLOGY - PAPER - II

ANIMAL DIVERSITY - BIOLOGY OF CHORDATES

(Course Code: ZOO202306 P)

Periods: 24 **Max. Marks: 50**

Learning Outcomes:

- To understand the taxidermic and other methods of preservation of chordates
- To identify chordates based on special identifying characters
- To understand internal anatomy of animals through demo or virtual dissections, thus directing the student for "empathy towards the fellow living beings"
- To maintain a neat, labeled record of identified museum specimens

OBSERVATION OF THE FOLLOWING SLIDES / SPOTTERS / MODELS

1. Protochordata :*Herdmania, Amphioxus, Amphioxus* T.S through pharynx.
2. Cyclostomata :*Petromyzon and Myxine.*
3. Pisces : *Pristis, Torpedo, Hippocoampus ,Exocoetus, Echeneis, Labeo, Catla, Clarius,Channa, Anguilla*.
4. Amphibia :*Ichthyophis, Amblystoma, Axolotl larva, Hyla,*
5. Reptilia: *Draco, Chamaeleon, Uromastix,,Testudo, Trionyx, Russels viper, Naja,* Krait, *Hydrophis, Crocodile.*
6. Aves : *Psittacula, Eudynamis, Bubo, Alcedo.*
7. Mammalia: *Ornithorhynchus, Pteropus, Funambulus.*

Dissections-

1. *Scoliodon* IX and X, Cranial nerves
2. *Scoliodon* Brain
3. Mounting of fish scales

Note: 1. Dissections are to be demonstrated only by the faculty or virtual.

2. Laboratory Record work shall be submitted at the time of practical examination.

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ZOOLOGY – SEMESTER III

PAPER – III: CELL BIOLOGY, GENETICS, MOLECULAR BIOLOGY AND EVOLUTION

(Course Code:ZOO20306)

HOURS: 60(5X12) **Max. Marks:100**

Course Outcomes: The overall course outcome is that the student shall develop deeper understanding of what life is and how it functions at cellular level. This course will provide students with a deep knowledge in Cell Biology, Animal Biotechnology and Evolution and by the completion of the course the graduate shall able to –

CO1 To understand the basic unit of the living organisms and to differentiate the organisms by their cell structure.

CO2 Describe fine structure and function of plasma membrane and different cell organelles of eukaryotic cell.

CO3 To understand the history of origin of branch of genetics, gain knowledge on heredity, interaction of genes, various types of inheritance patterns existing in animals

CO4 Acquiring in-depth knowledge on various of aspects of genetics involved in sex determination, human karyotyping and mutations of chromosomes resulting in various disorders

CO5 Understand the central dogma of molecular biology and flow of genetic information from DNA to proteins.

CO6 Understand the principles and forces of evolution of life on earth, the process of evolution of new species and apply the same to develop new and advanced varieties of animals for the benefit of the society

Learning Objectives

- To understand the origin of cell and distinguish between prokaryotic and eukaryotic cell
- To understand the role of different cell organelles in maintenance of life activities
- To provide the history and basic concepts of heredity, variations and gene interaction
- To enable the students distinguish between polygenic, sex-linked, and multiple allelic modes of inheritance.
- To acquaint student with basic concepts of molecular biology as to how characters are expressed with a coordinated functioning of replication, transcription and translation in all living beings
- To provide knowledge on origin of life, theories and forces of evolution to understand the role of variations and mutations in evolution

Syllabus:

Unit – I Cell Biology

1. Definition, history, prokaryotic and eukaryotic cells, virus, viroids, mycoplasma
2. Electron microscopic structure of animal cell.
3. Plasma membrane –Models and transport functions of plasma membrane.
4. Structure and functions of Golgi complex, Endoplasmic Reticulum and ysosomes
5. Structure and functions of Ribosomes, Mitochondria, Nucleus, Chromosomes

(Note: 1. General pattern of study of each cell organelle – Discovery, Occurrence, Number, Origin, Structure and Functions with suitable diagrams**)**
2. Need not study cellular respiration under mitochondrial functions)

Unit – II Genetics - I

2. 1 Mendel's work on transmission of traits

2. 2 Gene Interaction – Incomplete Dominance, Dominance, Lethal Genes

2. 3 Polygenes (General Characteristics & examples); Multiple Alleles (General Characteristics and Blood group inheritance

2. 4 Sex determination (Chromosomal, Genic Balance, Hormonal, Environmental and Haplo-diploidy types of sex determination)

2. 5 Sex linked inheritance (X-linked, Y-linked & XY-linked inheritance)

Unit – III Genetics - II

1. Mutations & Mutagenesis
2. Chromosomal Disorders (Autosomal and Allosomal)
3. Human Genetics – Karyotyping, Pedigree Analysis (basics)
4. Basics on Genomics and Proteomics

UNIT IV: Molecular Biology

1. Central Dogma of Molecular Biology
2. Basic concepts of -

a. DNA replication – Overview (Semi-conservative mechanism, Semi- discontinuous mode, Origin & Propagation of replication fork)
b. Transcription in prokaryotes – Initiation, Elongation and Termination, Post- transcriptional modifications (basics)
c. Translation – Initiation, Elongation and Termination

3. Gene Expression in prokaryotes (Lac Operon); Gene Expression in eukaryotes

Unit - V

1. Origin of life
2. Theories of Evolution: Lamarckism, Darwinism, Germ Plasm Theory, Mutation Theory
3. Neo-Darwinism: Modern Synthetic Theory of Evolution, Hardy-Weinberg Equilibrium
4. Forces of Evolution: Isolating mechanisms, Genetic Drift, Natural Selection, Speciation

Co-curricular activities (Suggested):

- Model of animal cell
- Working model of mitochondria to encourage creativity among students
- Photo album of scientists of cell biology
- Charts on plasma membrane models/cell organelles
- Observation of Mendelian / Non-Mendelian inheritance in the plants of college botanical garden or local village as a student study project activity
- Observation of blood group inheritance in students, from their parents and grand parents
- Karyotyping and preparation of pedigree charts for identifying diseases in family history

- Charts on chromosomal disorders
- Charts on central dogma/lac operon/genetic code
- Model of semi-conservative model of DNA replication
- Model of tRNA and translation mechanism
- Power point presentation of transcription or any other topic by students
- Draw geological time scale and highlight important events along the time
- Chart on industrial melanism to teach directed selection, Darwin‟s finches to teach genetic drift, collection of data on weight of children born in primary health centres to teach stabilizing selection etc.
- Chart on industrial melanism to teach directed selection, Darwin‟s finches to teach genetic drift, collection of data on weight of children born in primary health centres to teach stabilizing selection etc.

REFERENCES:

1. Lodish, Berk, Zipursky, Matsudaria, Baltimore, Darnell „Molecular Cell Biology‟ W.H.Freeman and company New York.
2. Cell Biology by De Robertis
3. Bruce Alberts, Molecular Biology of the Cell
4. Rastogi, Cytology
5. Varma & Aggarwal, Cell Biology
6. C.B. Pawar, Cell Biology
7. Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008).Principles of Genetics. VIII Edition. Wiley India.
8. Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V Edition. John Wiley and Sons Inc.
9. Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). Concepts of Genetics. X Edition. Benjamin Cummings.
10. Russell, P. J. (2009). Genetics- A Molecular Approach. III Edition. Benjamin Cummings.
11. Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. Introduction to Genetic Analysis. IX Edition. W. H. Freeman and Co.
12. Ridley, M. (2004). Evolution. III Edition. Blackwell Publishing
13. Molecular Biology by freifielder
14. Instant Notes in Molecular Biology by Bios scientific publishers and Viva Books Private Limited
15. Hall, B. K. and Hallgrimsson, B. (2008). Evolution. IV Edition. Jones and Bartlett Publishers
16. Campbell, N. A. and Reece J. B. (2011). Biology. IX Edition, Pearson, Benjamin, Cummings.
17. Douglas, J. Futuyma (1997). Evolutionary Biology. Sinauer Associates.
18. Minkoff, E. (1983). Evolutionary Biology. Addison-Wesley.
19. James D. Watson, Nancy H. Hopkins „Molecular Biology of the Gene‟
20. Jan M. Savage. Evolution, 2nd ed, Oxford and IBH Publishing Co., New Delhi.

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Zoology Practical Syllabus For III Semester

PAPER III - CELL BIOLOGY, GENETICS, MOLECULAR BIOLOGY AND EVOLUTION

(Course Code: ZOO20306P)

Periods: 24 **Max. Marks: 50**

Learning Objectives:

- Acquainting and skill enhancement in the usage of laboratory microscope
- Hands-on experience of different phases of cell division by experimentation
- Develop skills on human karyotyping and identification of chromosomal disorders
- To apply the basic concept of inheritance for applied research
- To get familiar with phylogeny ad geological history of origin & evolution of animals

I. Cell Biology

1. Preparation of temporary slides of Mitotic divisions with onion root tips
2. Observation of various stages of Mitosis and Meiosis with prepared slides
3. Mounting of salivary gland chromosomes of *Chironomous*

II. Genetics

1. Study of Mendelian inheritance using suitable examples and problems
2. Problems on blood group inheritance and sex linked inheritance
3. Study of human karyotypes (Downs syndrome, Edwards, syndrome, Patau syndrome, Turner's syndrome and Klinefelter syndrome)

III. Evolution

1. Study of fossil evidences
2. Study of homology and analogy from suitable specimens and pictures
3. Phylogeny of horse with pictures
4. Study of Genetic Drift by using examples of Darwin's finches (pictures)
5. Visit to Natural History Museum and submission of report

REFERENCE BOOKS

1. Burns GW. 1972. *The Science of Genetics. An Introduction to Heredity.* Mac Millan Publ. Co.Inc.
2. Gardner EF. 1975. *Principles of Genetics.* John Wiley & Sons, Inc. New York.
3. Harth and Jones EW. 1998. *Genetics – Principles and Analysis.* Jones and BarHett Publ. Boston.
4. Levine L. 1969. *Biology of the Gene.* Toppan.
5. Pedder IJ. 1972. *Genetics as a Basic Guide*. W. Norton & Company, Inc.
6. Rastogi VB. 1991. *A Text Book of Genetics.*KedarNath Ram Nath Publications, Meerut, Uttar Pradesh, India.
7. Rastogi VB. 1991. *Organic Evolution.*KedarNath Ram Nath Publications, Meerut,Uttar Pradesh, India.
8. Stahl FW. 1965. *Mechanics of Inheritance.* Prentice-Hall.

9. White MJD. 1973. *Animal Cytology and Evolution.* Cambridge Univ.Press.

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ZOOLOGY – SEMESTER-- IV

PAPER – IV: ANIMAL PHYSIOLOGY, CELLULAR METABOLISM AND EMBRYOLOGY

(Course Code: ZOO204311)

HOURS : 60 (5X12) **Max. Marks: 100**

Course Outcomes: This course will provide students with a deep knowledge in Physiology, Cellular metabolism and Molecular Biology and by the completion of the course the graduate shall able to –

CO1: Understand the functions of important animal physiological systems including digestion, cardio-respiratory and renal systems.

CO2: Understand the muscular system and the Neuro-endocrine regulation of animal growth, development and metabolism with a special knowledge of hormonal control of human reproduction.

CO3: Describe the structure, classification and chemistry of biomolecules and enzymes responsible for the sustenance of life in living organisms

CO4: Develop broad understanding of the basic metabolic activities pertaining to the catabolism and anabolism of various biomolecules

CO5: Describe the key events in early embryonic development starting from the formation of gametes upto gastrulation and formation of primary germ layers.

Learning Objectives:

- To achieve a thorough understanding of various aspects of physiological systems and their functioning in animals.
- To insist the concept of hormonal regulation of physiology, metabolism and reproduction in animals.
- To understand the disorders associated with the deficiency of hormones
- To demonstrate a thorough knowledge of the intersection between the disciplines of Biology and Chemistry.
- To provide insightful knowledge on the structure and classification of carbohydrates, proteins, lipids and enzymes
- To demonstrate an understanding of fundamental biochemical principles such as the function of biomolecules, metabolic pathways and the regulation of biochemical processes
- To make students gain proficiency in laboratory techniques in biochemistry and orient them to apply the scientific method to the processes of experimentation and hypothesis testing.

UNIT I Animal Physiology - I

1. Process of digestion and assimilation
2. Respiration - Pulmonary ventilation, transport of oxygen and CO_2 (Note: Need not study cellular respiration here)
3. Circulation - Structure and functioning of heart, Cardiac cycle

4. Excretion - Structure and functions of kidney urine formation, counter current Mechanism

UN IT II Animal Physiology - II

1. Nerve impulse transmission - Resting membrane potential, origin and propagation of action potentials along myelinated and non-myelinated nerve fibers
2. Muscle contraction - Ultra structure of muscle, molecular and chemical basis of muscle contraction
3. Endocrine glands - Structure, functions of hormones of pituitary, thyroid, parathyroid, adrenal glands and pancreas
4. Hormonal control of reproduction in a mammal

UNIT III Cellular Metabolism – I (Biomolecules)

1. Carbohydrates - Classification of carbohydrates. Structure of glucose
2. Proteins - Classification of proteins. General properties of amino acids
3. Lipids - Classification of lipids
4. Enzymes: Classification and Mechanism of Action

UNIT--IV Cellular Metabolism – II

1. Carbohydrate Metabolism - Glycolysis, Krebs cycle, Electron Transport Chain, Glycogen metabolism, Gluconeogenesis
2. Lipid Metabolism – β-oxidation of palmitic acid
3. Protein metabolism - Transamination, Deamination and Urea Cycle

Unit – V Embryology

1. Gametogenesis
2. Fertilization
3. Types of eggs
4. Types of cleavages
5. Development of Frog upto formation of primary germ layers

Co-curricular activities (Suggested)

- Chart on cardiac cycle, human lung, kidney/nephron structure etc.
- Working model of human / any mammalian heart.
- Chart of sarcomere/location of endocrine glands in human body
- Chart affixing of photos of people suffering from hormonal disorders
- Student study projects such as identification of incidence of hormonal disorders in the local primary health centre, studying the reasons thereof and measures to curb or any other as the lecturer feels good in nurturing health awareness among students
- Chart on structures of biomolecules/types of amino acids (essential and non- essential)Chart preparation by students on Glycolysis / kreb's cycle / urea cycle etc.
- Model of electron transport chain
- Preparation of models of different types of eggs in animals
- Chart on frog embryonic development, fate map of frog blastula, cleavage etc.

REFERENCE BOOKS:

1. Eckert H. *Animal Physiology: Mechanisms and Adaptation.* W.H. Freeman & Company.
2. Floray E. *An Introduction to General and Comparative Animal Physiology.* W.B. Saunders Co., Philadelphia.
3. Goel KA and Satish KV. 1989. *A Text Book of Animal Physiology*, Rastogi Publications, Meerut, U.P.
4. Hoar WS. *General and Comparative Physiology.* Prentice Hall of India, New Delhi.
5. Lehninger AL. Nelson and Cox. *Principles of Biochemistry.* Lange Medical Publications, New Delhi.
6. Prosser CL and Brown FA. *Comparative Animal Physiology.* W.B. Saunders Company, Philadelphia.
7. Developmental Biology by Balinksy
8. Developmental Biology by Gerard Karp
9. Chordate embryology by Varma and Agarwal
10. Embryology by V.B. Rastogi
11. Austen CR and Short RV. 1980. *Reproduction in Mammals*. Cambridge University Press.
12. Gilbert SF. 2006. *Developmental Biology,* 8th Edition. Sinauer Associates Inc., Publishers,Sunderland, USA.
13. Longo FJ. 1987. *Fertilization.* Chapman & Hall, London.
14. Rastogi VB and Jayaraj MS. 1989. *Developmental Biology.*KedaraNath Ram Nath Publishers, Meerut, Uttar Pradesh.
15. Schatten H and Schatten G. 1989. *Molecular Biology of Fertilization.* Academic Press, New York.

A.S.D.GOVERNMENT DEGREE COLLEGE FOR WOMEN (A)

(Re-Accredited NAAC with "B" Grade)

KAKINADA, EAST GODAVARI, A.P, 533002.

ZOOLOGY PRACTICAL SYLLABUS FOR IV SEMESTER

PAPER – IV: ANIMAL PHYSIOLOGY, CELLULAR METABOLISM AND EMBRYOLOGY

(Course Code: ZOO204311P)

Periods: 24 **Max. Marks: 50**

Learning Objectives:

- Identification of an organ system with histological structure
- Deducing human health based on the information of composition of blood cells
- Demonstration of enzyme activity *in vitro*
- Identification of various biomolecules of tissues by simple colorimetric methods and also quantitative methods
- Identification of different stages of earl embryonic development in animals

I. ANIMAL PHYSIOLOGY

1. Qualitative tests for identification of carbohydrates, proteins and fats
2. Study of activity of salivary amylase under optimum conditions
3. T.S. of duodenum, liver, lung, kidney, spinal cord, bone and cartilage
4. Differential count of human blood

II. CELLULAR METABOLISM

1. Estimation of total proteins in given solutions by Lowry's method.
2. Estimation of total carbohydrate by Anthrone method.
3. Qualitative tests for identification of ammonia, urea and uric acid
4. Protocol for Isolation of DNA in animal cells

III. EMBRYOLOGY

1. Study of T.S. of testis, ovary of a mammal
2. Study of different stages of cleavages (2, 4, 8 cell stages)
3. Construction of fate map of frog blastula

REFERENCE BOOKS:

- Harper's Illustrated Biochemistry
- Cell and molecular biology: Concepts & experiments. VI Ed. John Wiley &sons. Inc.
- Lab Manual on Blood Analysis and Medical Diagnostics, S. Chand and Co. Ltd.
- Laboratory techniques by Plummer

A.S.D.GOVERNMENT DEGREE COLLEGE FOR WOMEN (A)

(Re-Accredited NAAC with "B" Grade)

KAKINADA, EAST GODAVARI, A.P, 533002.

ZOOLOGY – SEMESTER IV

Paper - V: IMMUNOLOGY AND ANIMAL BIOTECHNOLOGY

(Course Code: ZOO204312)

HOURS : 60 (5X12) **Max. Marks: 100**

Course Outcomes: This course will provide students with a deep knowledge in immunology, genetics, embryology and ecology and by the completion of the course the graduate shall able to –

CO1 To get knowledge of the organs of Immune system, types of immunity, cells and organs of immunity.

CO2 To describe immunological response as to how it is triggered (antigens) and regulated (antibodies)

CO3 Understand the applications of Biotechnology in the fields of industry and agriculture including animal cell/tissue culture, stem cell technology and genetic engineering.

CO4 Get familiar with the tools and techniques of animal biotechnology.

Learning Objectives

- To trace the history and development of immunology
- To provide students with a foundation in immunological processes
- To be able to compare and contrast the innate versus adaptive immune systems and humoral versus cell-mediated immune responses
- Understand the significance of the Major Histocompatibility Complex in terms of immune response and transplantation
- To provide knowledge on animal cell and tissue culture and their preservation
- To empower students with latest biotechnology techniques like stem cell technology, genetic engineering, hybridoma technology, transgenic technology and their application in medicine and industry for the benefit of living organisms
- To explain *in vitro* fertilization, embryo transfer technology and other reproduction manipulation methodologies.
- To get insight in applications or recombinant DNA technology in agriculture, production of therapeutic proteins.

Unit – I **Immunology – I (Overview of Immune system)**

1. Introduction to basic concepts in Immunology
2. Innate and adaptive immunity, Vaccines and Immunization programme
3. Cells of immune system
4. Organs of immune system

Unit – II Immunology – II (Antigens, Antibodies, MHC and Hypersensitivity)

1. Antigens: Basic properties of antigens, B and T cell epitopes, haptens and

adjuvants; Factors influencing immunogenicity

2. Antibodies: Structure of antibody, Classes and functions of antibodies
3. Structure and functions of major histo compatibility complexes
4. Exogenous and Endogenous pathways of antigen presentation and processing
5. Hypersensitivity – Classification and Types

Unit – III Techniques

1. Animal Cell, Tissue and Organ culture media: Natural and Synthetic media,
2. Cell cultures: Establishment of cell culture (primary culture, secondary culture, types of cell lines; Protocols for Primary Cell Culture); Established Cell lines (common examples such as MRC, HeLa, CHO, BHK, Vero); Organ culture; Cryopreservation of cultures
3. Stem cells: Types of stem cells and applications
4. Hybridoma Technology: Production & applications of Monoclonal antibodies (mAb)

Unit – IV Applications of Animal Biotechnology

1. Genetic Engineering: Basic concept, Vectors, Restriction Endonucleases and Recombinant DNA technology
2. Gene delivery: Microinjection, electroporation, biolistic method (gene gun),liposome and viral-mediated gene delivery
3. Transgenic Animals: Strategies of Gene transfer; Transgenic - sheep, - fish; applications
4. Manipulation of reproduction in animals: Artificial Insemination, *In vitro* fertilization, super ovulation, Embryo transfer, Embryo cloning

Unit - V

1. PCR: Basics of PCR.
2. DNA Sequencing: Sanger's method of DNA sequencing- traditional and automated sequencing (2 hrs)
3. Hybridization techniques: Southern, Northern and Western blotting
4. DNA fingerprinting: Procedure and applications
5. Applications in Industry and Agriculture: Fermentation: Different types of Fermentation and Downstream processing; Agriculture: Monoculture in fishes, polyploidy in fishes

Co-curricular activities (suggested)

- Organizing awareness on immunization importance in local village in association with NCC and NSS teams
- Charts on types of cells and organs of immune system
- Student study projects on aspects such as – identification of allergies among students (hypersensitivity), blood groups in the class (antigens and antibodies duly reported) etc., as per the creativity and vision of the lecturer and students
- Visit to research laboratory in any University as part of Zoological tour and exposure and/ or hands-on training on animal cell culture.

- Visit to biotechnological laboratory in University or any central/state institutes and create awareness on PCR, DNA finger printing and blot techniques or Visit to a fermentation industry or Visit to a local culture pond and submit report on culture of fishes etc.

REFERENCE BOOKS

1. Immunology by Ivan M. Riott
2. Immunology by Kubey
3. Sreekrishna V. 2005. *Biotechnology –I, Cell Biology and Genetics.* New Age International Publ.New Delhi, India.

A.S.D.GOVERNMENT DEGREE COLLEGE FOR WOMEN (A)

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ZOOLOGY PRACTICAL SYLLABUS FOR V SEMESTER

Paper - V: IMMUNOLOGY AND ANIMAL BIOTECHNOLOGY

(Course Code: ZOO204312P)

Periods: 24 **Max. Marks: 50**

Learning Objectives:

- Acquainting student with immunological techniques vis-à-vis theory taught in the class room
- Interconnect the theoretical and practical knowledge of immunity with the outer world for the development of a healthier life.
- Demonstrate basic laboratory skills necessary for Biotechnology research
- Promoting application of the lab techniques for taking up research in higher studies

I. IMMUNOLOGY:

1. Demonstration of lymphoid organs (as per UGC guidelines)
2. Histological study of spleen, thymus and lymph nodes (through prepared slides)
3. Blood group determination
4. Demonstration of
   a. ELISA
   b. Immuno electrophoresis

II. Animal biotechnology:

1. DNA quantification using DPA Method.
2. Techniques: Western Blot, Southern Hybridization, DNA Fingerprinting
3. Separation, Purification of biological compounds by paper, Thin-layer and Column chromatography
4. Cleaning and sterilization of glass and plastic wares for cell culture.
5. Preparation of culture media.

REFERENCE BOOKS

1. Immunology Lab Biology 477 Lab Manual; Spring 2016 Dr. Julie Jameson
2. Practical Immunology A Laboratory Manual; **LAP LAMBERT Academic Publishing**
3. Manual of laboratory experiments in cell biology by Edward, G
4. Laboratory Techniques by Plummer

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ZOOLOGY SYLLABUS FOR V SEMESTER 2021 - 2022

PAPER - V -ANIMAL BIOTECHNOLOGY

(Course Code: ZOO5311)

Periods: 60 **Max. Marks: 100**

Unit 1

- **Tools of Recombinant DNA technology -** Enzymes and Vectors
- **Restriction modification systems:** Types I, II and III. Mode of action, nomenclature, applications of Type II restriction enzymes in genetic engineering
- **DNA modifying enzymes and their applications:** DNA polymerases. Terminal deoxynucleotidyl transferase, kinases and phosphatases, and DNA ligases
- **Cloning Vectors**: Plasmid vectors: pBR and pUC series, Bacteriophage lambda and M13 based vectors, Cosmids, BACs, YACs,

Unit 2

- **Techniques of Recombinant DNAtechnology :**
- Cloning: Use of linkers and adaptors
- Gene delivery**:** Microinjection, electroporation, biolistic method (gene gun), liposome and viral- mediated delivery
- PCR: Basics of PCR.
- DNA Sequencing: Sanger's method of DNA sequencing- traditional and automated sequencing Hybridization techniques: Southern, Northern and Western blotting,
- Genomic and cDNA libraries: Preparation and uses

Unit 3

Animal Cell Technology

- Cell culture media: Natural and Synthetic
- Cell cultures: primary culture, secondary culture, continuous cell lines; Protocols for Primary Cell Culture; Established Cell lines (common examples such as MRC, HeLa, CHO, BHK, Vero); Organ culture; Cryopreservation of cultures.
- Hybridoma Technology: Cell fusion, Production of Monoclonal antibodies (mAb), Applications of mAb
- Stem cells: Types of stem cells, applications

Unit 4

Reproductive Technologies & Transgenic Animals

- Manipulation of reproduction in animals: Artificial Insemination, *In vitro* fertilization, super ovulation, Embryo transfer, Embryo cloning
- Transgenic Animals: Strategies of Gene transfer; Transgenic - sheep, - fish; applications

Unit 5

Applied Biotechnology

Industry: Fermentation: Different types of Fermentation: Short notes on - Submerged & Solid state; batch, Fed batch & Continuous; Stirred tank, Air Lift, Fixed Bed and Fluidized; Downstream processing - Filtration, centrifugation, extraction, chromatography, spray drying and lyophilization Agriculture: fisheries – monoculture in fishes, polyploidy in fishes; DNA fingerprinting

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ZOOLOGY PRACTICAL SYLLABUS FOR V SEMESTER

PAPER: V- ANIMAL BIOTECHNOLOGY (Course Code: ZOO5311P)

Periods: 24 **Max. Marks: 50**

Any SIX of the following:

1. Isolation of Plasmid DNA from *E.coli*
2. Restriction digestion of lambda (λ) DNA using EcoR1 and Hind III.
3. Preparation for insertion and vector for ligation.
4. Preparation of competent cells
5. Techniques: Western Blot, Southern Hybridization, DNA Fingerprinting
6. Interpretation of sequencing gel electropherograms
7. Amplification of DNA by PCR
8. Packing and sterilization of glass and plastic wares for cell culture.
9. Preparation of culture media.

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ZOOLOGY SYLLABUS FOR V SEMESTER 2021 -2022

PAPER - VI - ANIMAL HUSBANDRY (Course Code: ZOO5312)

Periods: 60 **Max. Marks: 100**

UNIT – I

General introduction to poultry farming. Principles of poultry housing. Poultry houses. Systems of poultry farming. Management of chicks, growers and layers. Management of Broilers.

UNIT – II

Poultry feed management – Principles of feeding. Nutrient requirements for different stages of layers and broilers. Methods of feeding. Poultry diseases – viral, bacterial, fungal and parasitic (two each); symptoms, control and management.

UNIT – III

Selection, care and handling of hatching eggs. Egg testing. Methods of hatching. Brooding and rearing. Sexing of chicks.

UNIT- IV

Breeds of Dairy Cattle and Buffaloes – Definition of breed; Classification of Indian Cattle breeds, exotic breeds and Indian buffalo breeds. Systems of inbreeding and crossbreeding. Housing of dairy animals – Selection of site for dairy farm; systems of housing – loose, housing system. Conventional dairy barn. Cleaning and sanitation of dairy farm. Weaning of calf. Castration and dehorning. Deworming and Vaccination programme. Records to be maintained in a dairy farm.

UNIT - V

Care and management of dairy animals - Care and management of calf, heifer, milk animal, dry and pregnant animal, bulls and bullocks.

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ZOOLOGY PRACTICAL SYLLABUS FOR V SEMESTER 2021- 2022

PAPER - VI ANIMAL HUSBANDRY **(Course Code: ZOO5312 P)**

Periods: 24 **Max. Marks: 50**

1. Study of various breeds of layers and broilers (photographs)
2. Identification of disease causing organisms in poultry birds (as per theory)
3. Study of the anatomy of a poultry bird by way of dissecting a bird. (Demonstration)
4. Study of various activities in a poultry farm (layers and broilers) and submission of a report.
5. Study of various breeds of cattle (photographs/microfilms)
6. Study of various activities carried out in a dairy farm and submission of a report.

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ZOOLOGY SYLLABUS FOR VI SEMESTER 2021-2022

ZOOLOGY – ELECTIVE PAPER: VII-(A) **IMMUNOLOGY (Course Code: ZOO6308)**

Periods:60 **Max. Marks:100**

Unit - I

1. Overview of Immune system

1. Introduction to basic concepts in Immunology
2. Innate and adaptive immunity

2. Cells and organs of Immune system

1. Cells of immune system
2. Organs of immune system

Unit - II

1. Antigens

1. Basic properties of antigens
2. B and T cell epitopes, haptens and adjuvants
3. Factors influencing immunogenicity

Unit - III

1. Antibodies

1. Structure of antibody
2. Classes and functions of antibodies
3. Monoclonal antibodies

Unit - IV

1. Working of Immune system

1. Structure and functions of major histocompatibility complexes
2. Exogenes and Endogenes pathways of antigen presentation and processing
3. Basic properties and functions of cytokines

Unit - V

1. Immune system in health and disease

1. Classification and brief description of various types of hyper sensitivities
2. Introduction to concepts of autoimmunity and immunodeficiency

2. Vaccines

1. General introduction to vaccines
2. Types of vaccines

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ZOOLOGY PRACTICAL SYLLABUS FOR VI SEMESTER 2021-2022

ZOOLOGY - ELECTIVE PAPER – VII-(A) **IMMUNOLOGY** ***(Course Code: ZOO6308P)***

Periods: 24 **Max. Marks: 50**

1. Demonstration of lymphoid organs (as per UGC guidelines)
2. Histological study of spleen, thymus and lymph nodes (through prepared slides)
3. Blood group determination
4. Demonstration of
    a. ELISA
    b. Immuno electrophoresis

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ZOOLOGY SYLLABUS FOR VI SEMESTER 2021-2022

ZOOLOGY ELECTIVE PAPER –VIII-B **AQUACULTURE**

Zoology Elective Paper: VIII-B-1

PRINCIPLES OF AQUACULTURE (Course Code: ZCE21316)

Periods:60 **Max.Marks:100**

1. **Introduction / Basics of Aquaculture:**

Unit – I

1. Definition, Significance and History of Aquaculture
2. Present status of Aquaculture – Global and National scenario
3. Major cultivable species for aquaculture: freshwater, brackish water and marine. Criteria for the selection of species for culture

Unit – II

1. Types of Aquaculture Freshwater, Brackish water and Marine
2. Concept of Monoculture, Polyculture, Composite culture, Monosex culture and integrated fish farming
3. Culture systems Ponds, Raceways, Cages, Pens, Rafts and water recirculating systems
4. *Culture practices Traditional, extensive, modified extensive, semi-intensive and intensive cultures of fish and shrimp*

Unit – III *Design and construction of aquaforms*

1. Criteria for the selection of site for freshwater and brackish water pond farm
2. Design and construction of fish and shrimp farms
3. *Seed resources Natural seed resources and Procurement of seed for stocking: Carp and shrimp*
4. Nutrition and feeds *Nutritional requirements of a cultivable fish and shellfish*

   Natural food and Artificial feeds and their importance in fish and shrimp culture , Management of carp culture ponds

Unit – IV

Culture of Indian major carps:

1. Pre-stocking management – Dewatering, drying, ploughing/desilting; Predators, weeds and algal blooms and their control, Liming and fertilization;
2. Stocking management – Stocking density and stocking;
3. Post-stocking management – Feeding, water quality, growth and health care; and Harvesting of ponds Culture of giant fresh water prawn, Macrobrachium rosenbergi

Unit – V

1. **Culture of shrimp** (*Penaeus monodon* or *Litopenaeus vannamei*) Culture of pearl oysters
2. Culture of seaweeds-species cultured, culture techniques, important by-products, prospects Culture of ornamental fishes – Setting up and maintenance of aquarium and breeding.

REFERENCES BOOKS

1. Bardach, JE *et al*. 1972. *Aquaculture – The farming and husbandry of freshwater and marine organisms*, John Wiley & Sons, New York.
2. Bose AN et al.1991. *Coastal aquaculture Engineering*. Oxford & IBH Publ.Co.Pvt.Ltd.
3. Chakraborty C & Sadhu AK. 2000. *Biology Hatchery and Culture Technology of Tiger Prawn and Giant Freshwater Prawn.* Daya Publ. House.
4. FAO. 2007. *Manual on Freshwater Prawn Farming*.
5. Huet J. 1986. *A text Book of Fish Culture*. Fishing News Books Ltd.
6. ICAR. 2006. *Hand Book of Fisheries and Aquaculture*. ICAR.
7. Ivar LO. 2007. *Aquaculture Engineering*. Daya Publ. House.
8. Jhingran V.G. 2007. *Fish and Fisheries of India*. Hindustan Publ. Corporation, India.
9. Landau M. 1992. *Introduction to Aquaculture*. John Wiley & Sons.
10. Lovell RT.1998. *Nutrition and Feeding of fishes*. Chapman & Hall.
11. Mcvey JP. 1983. *Handbook of Mariculture*. CRC Press.
12. MPEDA: *Handbooks on culture of carp, shrimp, etc*.
13. New MB. 2000. *Freshwater Prawn Farming*. CRC Publ.
14. Pillay TVR.1990. *Aquaculture- Principles and Practices,* Fishing News Books Ltd., London.
15. Pillay TVR & Kutty MN. 2005. *Aquaculture- Principles and Practices*. 2nd Ed. Blackwell
16. Rath RK. 2000. *Freshwater Aquaculture*. Scientific Publ.
17. Stickney RR. 1979. *Principles of Warmwater Fish Culture*, John Wiley & Sons 15. Wheaton FW. 1977. *Aquacultural Engineering*. John Wiley & Sons.

ASD GOVT. DEGREE COLLEGE FOR WOMEN (A)

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ZOOLOGY- SEMESTER-VI

ZOOLOGY - Cluster Elective Paper: VIII-B-1 (2021-2022)

PRINCIPLES OF AQUACULTURE PRACTICAL: I (Course Code: ZCE21316P)

Periods : 24 Max.Marks : 50

Cultivable fishes

1. Identification and study of important cultivable and edible fishes - Any ten
2. Identification and study of important cultivable and edible crustaceans - Any five
3. Identification and study of common aquarium fishes – Any five
4. General description and recording biometric data of a given fish.

Diseases

1. Identification and study of fish and shrimp diseases - Using specimens / pictures
2. External examination of the diseased fish – diagnostic features and procedure.
3. Autopsy of fish – Examination of the internal organs.
4. Determination of dosages of chemicals and drugs for treating common diseases.

Pond Management

1. Water Quality -Determination of temperature, pH, salinity in the pond water sample; Estimation of dissolved oxygen, free carbondioxide, total alkalinity, totalhardness, phosphates and nitrites.
2. Soil analysis – Determination of soil texture, pH, conductivity, available nitrogen, availablephosphorus and organic carbon.
3. Identification and study of common zooplankton, aquatic insects and aquatic weeds – Each

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ZOOLOGY SYLLABUS FOR VI SEMESTER 2021-2022

Zoology Elective Paper: VIII-B-2 AQUACULTURE MANAGEMENT

(Course Code: ZCE21317)

Periods:60 **Max Marks : 100**

Unit – I Breeding and Hatchery Management

1. Bundh Breeding and Induced breeding of carp by Hypophysation; and use of synthetic hormones
2. Types of fish hatcheries; Hatchery management of Indian major carps
3. Breeding and Hatchery management of *Penaeus monodon*/ *Litopenaeus vannamei*
4. Breeding and Hatchery management of giant freshwater prawn.

Unit – II Water quality Management

1. Water quality and soil characteristics suitable for fish and shrimp culture
2. Identification of oxygen depletion problems and control mechanisms in culture ponds
3. Aeration: Principles of aeration and Emergency aeration
4. Liming materials, Organic manures and Inorganic fertilizers commonly used and their implications in fish ponds

Unit – III Feed Management

1. Live Foods and their role in shrimp larval nutrition.
2. Supplementary feeds: Principal foods in artificial diets; Types of feeds; Feed additives and Preservatives; role of probiotics.
3. Feed formulation and manufacturing; Feed storage
4. Feeding strategies: Feeding devices, feeding schedules and ration size; Feed evaluation- feed conversion efficiencies and ratios

Unit – IV Disease Management

1. Principles of disease diagnosis and health management
2. Prophylaxis, Hygiene and Therapy of fish diseases
1. Specific and non-specific defense systems in fish; Fish immunization and vaccination
2. Etiology, Symptoms, prophylaxis and therapy of common fish diseases in fish ponds
   4.1.5Etiology, Symptoms, prophylaxis and therapy of common shrimp diseases in shrimp ponds

Unit – V Economics and Marketing

1. Principles of aquaculture economics – Capital costs, variable costs, cost-benefit analysis Fish marketing methods in India; Basic concepts in demand and price analysis
2. Fisheries Extension : Fisheries Training and Education in India; Role of extension in community development.
3. Fish Genetics: Genetic improvement of fish stocks – Hybridization of fish. Gynogenesis, Androgenesis, Polyploidy, Transgenic fish, Cryopreservation of gametes, Production of monosex and sterile fishes and their significance in aquaculture.

REFERENCE BOOKS

1. Boyd CE. 1979. *Water Quality in Warm Water Fish Ponds*. Auburn University
2. Boyd, CE. 1982. *Water Quality Management for Pond Fish Culture.* Elsevier Sci. Publ. Co.
3. Chakraborty C & Sadhu AK. 2000. *Biology Hatchery and Culture Technology of Tiger Prawn and Giant Freshwater Prawn*. Daya Publ. House
4. Conroy CA and Herman RL. 1968. *Text book of Fish Diseases*. TFH (Great Britain) Ltd, England. 5Halver J & Hardy RW. 2002. *Fish Nutrition*. Academic Press.
6. Ian C. 1984. *Marketing in Fisheries and Aquaculture*. Fishing News Books.
7. ICAR. 2006. *Handbook of Fisheries and Aquaculture*. ICAR.
8. Jhingran VG. 2007. *Fish and Fisheries of India.* Hindustan Publishing Corporation, India.
9. Jhingran VG & Pullin RSV. 1985. *Hatchery Manual for the Common, Chinese and Indian Major Carps*. ICLARM, Philippines.
10. Kumar D. 1996. *Aquaculture Extension Services Review: India.* FAO Fisheries CircularNo. 906, Rome.
11. Lavens P & Sorgeloos P. 1996. *Manual on the Production and Use of Live Food for Aquaculture.* FAO Fisheries Tech. Paper 361, FAO.
12. MPEDA. 1993. *Handbook on Aqua Farming - Live Feed. Micro Algal Culture.* MPEDA Publication
13. New MB. 1987. *Feed and Feeding of Fish and Shrimp. A Manual on the Preparation and Preservation of Compound Feeds for Shrimp and Fish in Aquaculture.* FAO – ADCP/REP/87/26
14. Pandian TJ, Strüssmann CA & Marian MP. 2005. *Fish Genetics and Aquaculture Biotechnology*. Science Publ. 15.Pilley, TVR & Dill, WMA. 1979. *Advances in Aquaculture*. Fishing News Books, Ltd. England.
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17. Ray GL. 2006. *Extension, Communication and Management*. 6th Ed. Kalyani Publ. Delhi.
18. ReddyPVGK, AyyappanS, ThampyDM & Gopalakrishna 2005.*Text Book of Fish Genetics and Biotechnol.* ICAR
19. Reichenbach KH. 1965. *Fish Pathology.* TFH (Gt. Britain) Ltd, England.
20. Shang YC. 1990. *Aquaculture Economic Analysis - An Introduction.* World Aquaculture Society, USA.
21. Singh B. 2006. *Marine Biotechnology and Aquculture* Development. Daya Publ. House 22.Stickney RR. 1979. *Principles of Warm waterAquaculture*. John-Willey & sons Inc.
22. Swain P, Sahoo PK & Ayyappan S. 2005. *Fish and Shellfish Immunology: An Introduction*. Narendra Publ.
23. Thomas PC, Rath SC & Mohapatra KD.2003.Breeding and Seed Production of Finfish and Shellfish. Daya Publ.

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ZOOLOGY- SEMESTER-VI

ZOOLOGY - Cluster Elective Paper: VIII-B-2 (2021-2022)

AQUACULTURE MANAGEMENT PRACTICAL – II (Course Code: ZCE21317P)

Periods :24 Max.Marks : 50

Nutrition

1. Identification and study of Live food organisms – Any five
2. Formulation and preparation of a balanced fish feed
3. Estimation of Proximate composition of aquaculture feeds – Proteins, carbohydrates, lipids,moisture, ash content.
4. Gut content analysis to study artificial and natural food intake.

Post harvest Technology

1. Evaluation of fish/ fishery products for organoleptic, chemical and microbial quality.
2. Preparation of dried, cured and fermented fish products, examination of salt, protein, moisture indried / cured products, examination of spoilage of dried / cured fish products, marinades, pickles, sauce.
3. Preparation of isinglass, collagen and chitosan from shrimp and crab shell. ?
4. Developing flow charts and exercises in identification of hazards – preparation of hazardanalysis worksheet, plan form and corrective action procedures in processing of fish.

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ZOOLOGY SYLLABUS FOR VI SEMESTER 2021-2022

Zoology Elective Paper: VIII-B-3

POST HARVEST TECHNOLOGY **(Course Code: ZCE21318)**

Periods : 60 **Max.Marks : 100**

Unit – I

Handling and Principles of fish Preservation

1. Handling of fresh fish, storage and transport of fresh fish, post mortem changes (rigor mortis and spoilage), spoilage in marine fish and freshwater fish.
2. Principles of preservation– cleaning, lowering of temperature, rising of temperature, denudation, use of salt, use of fish preservatives, exposure to low radiation of gamma rays.

Unit – II

Methods of fish Preservation

1. Traditional methods - sun drying, salt curing, pickling and smoking.
2. Advanced methods – chilling or icing, refrigerated sea water, freezing, canning Irradiation and Accelerated Freeze drying (AFD).

Unit – III

Processing and preservation of fish and fish by-products

1. Fish products – fish minced meat, fish meal, fish oil, fish liquid (ensilage), Fishprotein concentrate, fish chowder, fish cake, fish sauce, fish salads,Fish powder, pet food from trash fish, fish manure.
2. Fish by-products – fish glue, ising glass, chitosan, pearl essence, shark fins, fish leather and fish maws.
3. *Seaweed Products*
    1. Preparation of agar, algin and carrageen.
    2. Use of seaweeds as food for human consumption, disease treatment and preparation of therapeutic drugs.

Unit – IV

1. Sanitation and Quality control

Sanitation in processing plants - Environmental hygiene and Personal hygiene in processing plants.

1. Quality Control of fish and fishery products – pre-processing control, control during processing and control after processing.
2. Regulatory affairs in industries

Unit – V

1. Quality Assurance, Management and Certification

1. Seafood Quality Assurance and Systems: Good Manufacturing Practices (GMPs); Good Laboratory Practices (GLPs); Standard Operating Procedures (SOPs); Concept of Hazard Analysis and Critical Control Points (HACCP) in seafood safety.
2. National and International standards – ISO 9000: 2000 Series of Quality Assurance System, *Codex Alimentarius*.

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2. Bond, et al. 1971. *Fish Inspection and Quality Control.* Fishing News Books, England.

3 Clucas IJ. 1981. *Fish Handling, Preservation and Processing in the Tropics*. Parts I, II. FAO.

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5. Govindan, TK.1985. *Fish Processing Technology*, Oxford-IBH.
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7. Huss HH, Jakobsen M & Liston J. 1991. *Quality Assurance in the Fish Industry.* Elsevier.
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A.S.D.GOVERNMENT DEGREE COLLEGE FOR WOMEN (A), KAKINADA

(Re-Accredited NAAC with "B" Grade)

KAKINADA, EAST GODAVARI, A.P, 533002.

ZOOLOGY PRACTICAL SYLLABUS VI SEMESTER 2021-2022

ZOOLOGY ELECTIVE PAPER: VIII-B Post Harvest Technology

PRACTICAL: III (Course Code: ZCE21318P)

Periods: 24 **Max.Marks: 50**

Project Work

1. Visit to a fish breeding centre / fish farms and submit a project report
   or
2. Visit to a feed manufacturing unit and submit a project report
   or
3. Visit to a shrimp hatchery / shrimp farms and submit a project report
   or
4. Visit to a shrimp processing unit and submit a project report