PALAMURU UNIVERSITY

CBCS SYLLABUS

(w.e.f. ACADEMIC YEAR 2024-25)

FOR

Master of Science in Zoology

III & IV Semester

Department of Zoology
Palamuru University
Mahabubnagar - 509001
Telangana State

Department of Zoology,Palamuru University

MINUTES OF THE MEETING OF THE BOARD OF STUDIES IN ZOOLOGY
PALAMURU UNIVERSITY; MAHABUBNAGAR

The following members were present

S.No	Name of the member	
1	**Dr. A V Rajashekhar** Professor, Dept of Zoology, Osmania University, Hyderabad	Chairperson
2	**Dr. S. Padmaja** Associate Professor, Dept of Zoology, Osmania University, Hyderabad	Member
3	**Dr. K. Y. Chitra** Assistant Professor, Dept of Zoology, Osmania University, Hyderabad	Member
4	**Dr. Apka Nageswara Rao** Dept of Zoology, Nizam College, Osmania University, Hyderabad	Member
5	**Dr. G. Bhanuprakash Reddy** SCIENTIST 'G: National institute of Nutrition, Hyderabad	Member
6	**Dr. Ravinder Rao** Department of Zoology, MVS Degree and PG College, Palamuru University, Mahabubnagar	Member
7	**Dr. B. Neeta Kumari** Director, Oxeeco Technologies, Hyderabad	Member
8	Head, Department of Zoology, PU	Member

The members met on 11th November 2024 at Department of Zoology, Osmania University and discussed about the syllabus of III and IV semester under CBCS for Post graduation (Zoology) to be implemented from the academic year 2024-25 onwards at all the colleges under jurisdiction of Palamuru University, Mahabubnagar.

It is resolved to unanimously approve the PG (Zoology) Theory and Practical Syllabus for III and IV semesters

1. A. V. Rajshekhar

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Department of Zoology, Palamuru University
Two Year M.Sc. (Zoology) Programme w.e.f. AY 2024–2025 onwards
Proposed Scheme for Choice Based Credit System

Semester III					Semester IV				
	Course	Hrs /Wk	Credits	Marks		Course	Hrs /Wk	Credits	Marks
1	Core (EN) (Zoo_301T)	4	4	100	1	Core (A. Biotech) (Zoo_401T)	4	4	100
2	Paper – II(A.Behaviour) (Zoo_302T)	4	4	100	2	Paper – II(BD) (Zoo_402T)	4	4	100
3	Elective –I (Zoo_303T)	4	4	100	3	Elective –I (Zoo_403T)	4	4	100
4	Elective –II (Zoo_304T)	4	4	100		**Project**	4	4	100
5	Practical (Zoo_301P) Endocrinology &Animal Behavior	3+3= 6 (3 hours practical per week@ paper)	2	100	4	Practical (Zoo_401P) Animal Biotechnology & Biodiversity	3+3= 6 (3 hours practical per week@ paper)	2	100
6	Practical (Zoo_302P) Elective – I &Elective - II	3+3=6 (3 hours practical per week@ paper)	2	100	5	Practical(Zoo_402P) Elective-I & Project work (final presentation and viva)	3+3=6 (3 hours practical per week@ paper)	2	100
	Total	**28**	**20**	**600**		**Total**	**28**	**20**	**600**

Note: The teaching hours for each theory paper not less than 60 hours.
The practical papers combine two theory papers; hence, the teaching hours of each practical (concerned paper) should be conducted separately @ 3 hours per week.
Each practical batch should consist of 15 students

A college can offer any course from the available courses listed under the Electives – I and II for Semester III based on the availability of infrastructure and faculty expertise. The course will be offered only when a minimum of 12 students opts for the said course.

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Two Year M.Sc. (Zoology) Programme w.e.f. AY 2024–2025 onwards

List of Elective Papers (Semester III & IV) for Choice Based Credit System

SEMESTER III		SEMESTER IV	
Elective - I	Elective - II	Elective - I	Project
303: Agricultural Entomology – I (AE – I) **303:** Parasitology – I (PS – I) **303:** Principle of Fisheries – I (PF – I) **303:** Neuroscience – I (NS – I) **303:** Comparative Animal Physiology – I (CAP – I) **303:** [redacted] Applied Zoology -I	**304:** Fish Biology **304:** Sericulture [SER] **304:** Applied Toxicology (AT)	**403:** Agricultural Entomology – II (AE – II) **403:** Parasitology – II (PS – II) **403:** Principle of Fisheries – II (PF – II) **403:** Neuroscience – II (NS – II) **403:** Comparative Animal Physiology – II (CAP – II) **403:** [redacted] -II Applied Zoology -II	Project (Pr)

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INTERNAL EXAM

1. Written test = 20 M
2. Attendance = 10 M
3. Seminar =10 M
4. Assignment = 10 M

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DEPARTMENT OF ZOOLOGY, PALAMURU UNIVERSITY

Scheme of Examination

Semester – III

S.N.	Subject Code	Subject (Title)	Credits	Instruction Hrs/week	Duration of (hrs) Exam.	Max. Marks		Total Marks
	THEORY					Internal Assessment	Semester Exam.	
1.	Zoo_301T	Endocrinology	4	4	3	40	60	100
2.	Zoo_302T	Animal behavior	4	4	3	40	60	100
3.	Zoo_303T	Elective - I	4	4	3	40	60	100
4.	Zoo_304T	Elective - II	4	4	3	40	60	100
	PRACTICALS							
5.	Zoo_301P	Endocrinology &Animal Behavior	2	3+3= 6 (3 hours practical per week@ paper)	4	-	100	100
6.	Zoo_302P	Elective – I &Elective - II	2	3+3= 6 (3 hours practical per week@ paper)	4	-	100	100
Total:			**20**	**28**		**160**	**440**	**600**

Note: The teaching hours for each theory paper not less than 60 hours.

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INTERNAL EXAM (Each Unit)

1. Written test = 20 M
2. Attendance = 10 M
3. Seminar =10 M
4. Assignment = 10 M

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Scheme of Examination

Semester – IV

S.N.	Subject Code	Subject (Title)	Credits	Instruction Hrs/week	Duration of (hrs) Exam.	Max. Marks		Total Marks
	THEORY					Internal Assessment	Semester Exam.	
1.	Zoo_401T	Animal Biotechnology	4	4	3	40	60	100
2.	Zoo_402T	Biodiversity	4	4	3	40	60	100
3.	Zoo_3403T	Elective - I	4	4	3	40	60	100
4.	Project	Project	4	4	-	-	100	100
	PRACTICALS							
5.	Zoo_301P	Animal Biotechnology & Biodiversity	2	3+3= 6 (3 hours practical per week@ paper)	4	-	100	100
6.	Zoo_302P	Elective – I & Project (final presentation and viva)	2	3+3= 6 (3 hours practical per week@ paper)	4	-	100	100
Total:			**20**	**28**		**120**	**480**	**600**

Note: The teaching hours for each theory paper not less than 60 hours.

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Each practical batch should be consist of 15 students.

A college can offer any course from the available courses listed under the Electives – I and II for Semester III and IV based on the availability of infrastructure and faculty expertise. The course will be offered only when a minimum of 12 students opts for the said course.

INTERNAL EXAM (Each Unit)

1. Written test = 20 M
2. Attendance = 10 M
3. Seminar =10 M
4. Assignment = 10 M

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DEPARTMENT OF ZOOLOGY, PALAMURU UNIVERSITY

Scheme of Examination

Semester – IV

S.N.	Subject Code	Subject (Title)	Credits	Instruction Hrs/week	Duration of (hrs) Exam.	Max. Marks		Total Marks
	THEORY					Internal Assessment	Semester Exam.	
1.	Zoo_401T	Animal Biotechnology	4	4	3	40	60	100
2.	Zoo_402T	Biodiversity	4	4	3	40	60	100
3.	Zoo_3403T	Elective - I	4	4	3	40	60	100
4.	Project	Project	4	4	-	-	100	100
	PRACTICALS							
5.	Zoo_301P	Animal Biotechnology & Biodiversity	2	3+3= 6 (3 hours practical per week@ paper)	4	-	100	100
6.	Zoo_302P	Elective – I & Project (final presentation and viva)	2	3+3= 6 (3 hours practical per week@ paper)	4	-	100	100
Total:			**20**	**28**		**120**	**480**	**600**

Credits and marks distribution for Project (Zoo_404pr)

	Credits	Marks
External Assessment		
Research Design, data collection, presentation of data, analysis of results, discussion of results, the outcome of project work, bibliography, and dissertation preparation.	4	100
During practical exams		
Final presentation & Viva	1	50
Total		**150**

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Code Zoo_301

Semester – III
Core paper
Paper I – Endocrinology [EN] (60 hours)

15Hrs

UNIT I – Chemical and Neural Integration

1.1 Scope of endocrinology. Role of endocrines in health diseases

1.2 Concept of neurohumors and neurotransmitters.

1.3 Characteristics of neural and hormonal integration, neuro-endocrine mechanism.

1.4 Hormones as chemical messengers; Regulation of hormone secretions. Negative and Positive feedback mechanisms.

1.5 Concept of internal environment and homeostasis. Regulatory mechanisms.

15Hrs

UNIT II – Endocrine Glands and their Hormones

2.1 Invertebrate endocrine system – Hormones and their functions (Coelenterata and Annelida).

2.2 Invertebrate endocrine system – Hormones and their functions (Arthropoda and Echinodermata).

2.3 Hypothalamus and its secretions.

2.4 Vertebrate endocrine glands – Structure, hormones and functions of pituitary, thyroid, parathyroid and thymus.

2.5 Vertebrate endocrine glands – Structure, hormones and functions of adrenal, pancreas, pineal, gastro-intestinal tract and gonads.

15Hrs

UNIT III – Chemistry of Hormones and Mechanism of Hormone Action

3.1 Classification of hormones.

3.2 Biosynthesis of release and transport of amino acid derivatives.

3.3 Biosynthesis and transport of peptide and steroid hormones.

3.4 Membrane-bound and intracellular receptors.

3.5 Mechanism of action of amino acid derivatives, peptide and steroid hormones.

15Hrs

UNIT IV - Clinical and Applied Endocrinology

4.1 Obesity – Role of hormones and its metabolic complications – The role of Adipokines Insulin Resistance and Dyslipidemia.

4.2 Hormones in IVF, Pregnancy testing, and Amniocentesis.

4.3 Clinical disorders of male and female gonads.

4.4 Pheromones in applied endocrinology; Hypothalam0- pituitary disorders

4.5 Application of endocrinology in Sericulture and Apiculture.

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PRACTICALS

1 *In situ* demonstration of endocrine glands of the rat.
2 Histology slides of Endocrine glands - Pituitary, Thyroid, Parathyroid, Thymus, Adrenal, Pancreas, Ovary &Testis, and Uterus.
3 Effect of Eye Stalk ablation on Blood Glucose levels in Crabs.
4 Identification of Gonadotrophin in Human urine samples.
5 Effect of thyroxin and thiourea (antithyroid agent) on oxygen consumption in fish.
6 Effect of parathormone on serum calcium levels in Rat.
7 Effect of insulin and adrenalin on blood glucose levels in the Rat.
8 Submission of assignment on:**[To be submitted at the time of Internal Examination – 5 Marks]**

Suggested Books

1 Comparative Endocrinology of Invertebrates by Highman and Hill.
2 Comparative Vertebrate Endocrinology by P.J.Bentley, Cambridge Univ. Press.
3 General and Comparative Endocrinology by E.J.W. Barrington, Oxford Clarendan Press
4 Endocrinology Vol.1-3 by DeGroot L.J.et.al.
5 Text Book of Endocrine Physiology by C.R.Martin, Oxford Univ.Press, New York.
6 Text Book of Endocrinology by Turner and Bangnara (W.B.Sanders).
7 Vertebrate Endocrinology by McHadley.
8 Text Book of Comparative Endocrinology by Gorbman A, and Bern H.A., John Harley and Sous, New York.
9 Essential Endocrinology by JoenLaycock and Peter Loise Oxford Univ. Press.
10 A Text Book of Medical Physiology by ArthrumaC.Guyton.
11 Text Book of Endocrinology by R.H.Williams (W.B.Saunders).

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Code Zoo_302

Semester – III

Core paper

Paper II – Animal Behavior (60 hours)

UNIT I **15Hrs**

1.1 Introduction to animal behaiour and brief history. Diversity and unity in the study of behaviour and complex behaviour.

1.2 Development of behavior: Accommodative and Associate learning.

1.3 Hormones and early development.
Concept of neurohumors and neurotransmitters.

1.4 Neural control of behavior. Stereotyped behavior: Kinesis, taxis, orientation and reflexes.

UNIT II **15Hrs**

2.1 Motivation, decision making on different scales, drive, models of motivation, stress

2.2 Conflict behavior: territorial conflicts, threat display, displacement activities and fighting as conflict behavior.

2.3 Stimuli and communication: Diverse sensory capacities, sign stimuli, stimulus filtering. Communication. Hormones and behaviour: Chemical communication, body coloration,

2.4 Application of pheromones and their biological actions in vertebrates and invertebrates

UNIT III **15Hrs**

3.1 Ecological aspects of behaviour: Habitat selection, food selection, optimal foraging theory, anti-predator defenses.

3.2 Aggression, homing, territoriality, dispersal. Host-parasite relations.

3.3 Courtship and ritual behaviour: Mate selection, male-male selection, female choice and maternal behaviour.

3.4 Genetic basis of behavior. Behavioural genetics: single and multiple gene effect.

UNIT IV **15Hrs**

4.1 Biological rhythms: Circadian and circannual rhythms.

4.2 Origin of migration, types of migration, advantages of migration with suitable examples.
Migratory Behaviour Migration in fishes: Anadromous and catadromous migration
Migration in birds :

4.3 Social organizations in insects (Termites and honey bees) and primates

4.4 Hormone in insect & crustacean metamorphosis.

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Practical

1) To study the geotaxis, phototaxis, chemotaxis and hydrotaxis in different animals
2) To study the response of woodlice to hygrostimuli.
3) Fixed action pattern in spider
4) Habituation in snail.
5) Foraging behaviour in local animals with suitable examples
6) Leaning behaviour in animals
7) Selection of mate in different animal group
8) Observation of nesting behaviour in the birds
9) Observation of parental care in the animals as studied in the theory (pisces: Hippocampus, Arius, Amphibian: Icthyophis, Birds: Myna, Jacana)
10) Observation of migratory in birds
11) Observation of courtship behaviour in birds (sparrows, fowl, Peacock, pigeon).
12) Submission of assignment on: **[To be submitted at the time of Internal Examination – 5 Marks]**

REFERENCE BOOKS:

1. Aubrey Manning and Marian. S. Dawkins. An Introduction to Animal Behaviour. Cambridge University Press, 1995.
2. McFarland. D. The Oxford Companion to Animal Behaviour.
3. McFarland.D. Animal BehaviourPsychology, Ethology and Evolution. Pitman Publications, 1985.
4. Slater.P.J.B. Essentials of Animal Behaviour. Cambridge University Press, 1999.
5. Krebs J.R and Davies, N.B. An Introduction to behavioural Ecology-III (Ed). Blackwell Science Ltd, 1993.

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Code Zoo_303

SEMESTER – III
Elective - I
Paper III: Agricultural Entomology - I [AE –I] (60 hours)

UNIT I – Introduction **15 Hrs**

1.1 Scope and Importance of Agricultural Entomology.

1.2 Insect – outline classification and identification of phytophagous insects.

1.3 General Insect Plan - External Morphology, different types of mouthparts, Antenna, Legs, Wings and External genitalia.

1.4 Insect development; growth, development and metamorphosis.

1.5 Insects and their environment. Habitat & Geographical distribution.

UNIT II – Oilseed pest: Life history, hosts, nature of damage and control measures – I **15 Hrs**

2.1 Aphis craccivora, Achea Janata.

2.2 Agrotis segetum, Acanthiophilus helianthin.

2.3 Athalia lugens, Lipapiserysimi.

2.4 Asphondylia sesame, Dasinuralini.

2.5 Dichocrosispunctiferalis, Euproctislunata.

UNIT III – Commercial crop pests: Life history, hosts, nature of damage and control measures – II **15 Hrs**

3.1 Nilaparvathalugens, Niphotettixnigropictus.

3.2 Chilo partellus, Pectinophoragassypiella.

3.3 Bemesiatobaci, Atherigonasacota.

3.4 Sesamiainferens, Pyrillaperpusilla.

3.5 Helicoverpaarmigera, Spodoptera litura.

UNIT IV – Vegetable & Stored Grains pests: Life history, hosts, nature of damage and control measures – III **15 Hrs**

4.1 Urentissentis, Thysanoplusiaorichalcea, Plutellaxylostella.

4.2 Scirtothrips dorsalis, Euzopheraperticella, Eariasvittella.

4.3 Tanymecus indicus, Exelastisatmosa, Amsactamoorei.

4.4 Major Stored Grain Pests – Khapra beetle, Rice weevil, Rice moth

4.5 Minor Stored Grain Pests - Lesser Grain borer, Indian Meal moth, Saw-toothed beetle

PRACTICALS

1 Collection, Preservation and identifications of insect pests of agricultural and stored products importance.
2 Study of permanent slides of different parts of insects.
3 Preparation of permanent slides of different parts of insects and their stages of the lifecycle.
4 Study of museum specimens of agricultural importance.
5 Rearing of pests of agricultural importance in the laboratory.
6 Dissection of the digestive system of Grasshopper or any suitable pest.
7 Dissection of the reproductive system of Grasshopper or any suitable pest.
8 Dissection of nervous systems of Grasshopper or any suitable pest.
9 Visit to PJSAU, ICRISAT or any Agricultural Institute in Telangana State.
10 Submission of assignment on **[To be submitted at the time of internal Examination – 5 Marks]**

Suggested Books

1 Metcalf, C. L. & Flint, W.P: Destructive and useful insects. Their habits and control, 4th Edition, McGraw Hill, New York.
2 Pradhan. S. Insect pests of Crops. National Book Trust, New Delhi.
3 K. P. Srivastava: A Text Book of Applied Entomology Vol. I & II. Kalyani Publishers, New Delhi.
4 H. S. Pruthi: Text Book of Agricultural Entomology. ICAR Publication ., New Delhi.
5 Alwal, A. S. Agricultural Pests of India and South East Asia, Kalyani Publishers, New Delhi.
6 B. V. David & Kumara Swamy: Elements of Economic Entomology

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SEMESTER – III Az-II

Elective – I: Paper III: [redacted] - I [AZ-I] (60 hours)

Applied Zoology-I (AZ-I)

UNIT I –Vermitechnology **15 Hrs**

1.1 Introduction to Vermitechnology, definition and history, general characters of Annelida, the habitat of earthworm (soil), diversity of earthworms, role of earthworms on ecology

1.2 Biology of earthworm: Anatomy, physiology and reproduction. Role of gases, diet, humidity, temperature, PH, light, and climatic factors on earthworm.

1.3 Small Scale Earthworm farming for home gardens - Earthworm compost for home gardens. Conventional commercial composting - Earthworm composting larger scale Earthworm Farming (Vermiculture), Extraction (harvest), vermicomposting harvest and processing.

1.4 Nutritional Composition of Vermicompost for plants, comparison with other fertilizers Vermiwash collection, composition &use Enemies of Earthworms, Sickness and worm's enemies.

UNIT II – Apiculture: **15 Hrs**

2.1 Scope and its importance. Classification and morphology of honey bees, diversity of and races of honey bees, tribal life and bee hunting. sex seperation, comb building, orientation of comb, communication, collection of propolis and water.

2.2 Entomophily: Bee plants, Relationship between floral design and mouth parts of honey bees. Pollen and nectar collection.

2.3 Honey and its chemical composition, medicinal importance.

Economic importance of honey, wax, bee pollination, pollen and Venom

2.4 Beekeeping and management: Beekeeping equipments , beekeeping and its products , Queen rearing, bee nursing, honey and wax extraction. Diseases and pests of Bees: Bacterial, fungal and viral diseases

UNIT III – Poultry: **15 Hrs**

3.1 Introduction to poultry: indigenous and exotic breeds and their economic value

3.2 Breeding techniques of poultry breeds viz. white leghorn, jengle fowl, giriraj, turkey bird and duck and hatcheries of poultry

3.3 Nutrient value and Marketing of poultry products eg. Eggs, meat and poultry waste

3.4 Housing techniques: diseases of poultry (Bacterial, fungal and viral diseases). Project Proposal and Loan Schemes

UNIT IV Dairy **15 Hrs**

4.1 Indigenous and exotic breeds

4.2 Rearing, housing, feed and rationing; Commercial importance of dairy and poultry farming

4.3 Diseases and their management : Bacterial, fungal and viral diseases

4.4 farm management and Marketing. Project Proposal and Loan Schemes

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PRACTICAL

1) Key to identify different types of earthworms.
2) .Study of Life stages & development of earthworms.
3) . Study of Vermiculture, Vermiwash& Vermicompost equipments, devices
4) Preparation vermibeds, maintenance of vermicompost & climatic conditions.
5) . Study of verms diseases & enemies
6) Field trip- Collection of native earthworms & their identification.
7) Study of different types of bees (Queens, Drones and Worker bees).
8) Key to identify different types of honey bees
9) Study of Life stages & development of honey bee
10) Study of different types of honey bee equipments
11) Study of different types of breeds of poultry
12) Key to identify different types of poultry breeds
13) Study of Life stages & development of breeds
14) Study of different types of poultry farms and its equipments
15) Study of different types of breeds.
16) Key to identify different types of breeds
17) Study of Life stages & development of breeds
18) Study of different types of dairy farms and its equipments
19) **Visiting different places/sites related to poultry, apiculture/ dairy farms according to syllabus and submit the report at the end of course**

SUGGESTED READINGS

1. Dhyan Singh Bisht, Apiculture, ICAR Publication.
2. Duncan, F. N. (eds). Beekeeping for profit and pleasure. Agrobios (India) 2004.
3. Dunham RA (2004) Aquaculture and Fisheries Biotechnology – Genetic Approaches. CABI publications, U.K.
4. Hafez ESE (1962) Reproduction in Farm Animals. Lea and Fabiger Publishers.
5. Knobil E and Neill JD (2006) The Physiology of Reproduction. Vol.2. Elsevier Publishers, USA. 5. Prost PJ (1962) Apiculture. Oxford and IBH, New Delhi.
6. Singh S. Beekeeping in India, Indian council of Agricultural Research, New Delhi.

7. Jadhav and Sidiqui. Handbook of poultry production and management. Jaypee publishers, 2010

8. Sarkar, Kundu and Chaki. (2014)Introduction to Economic Zoology. NCBA Publisher

9. Gupta, P. K. Vermicomposting for sustainable Agriculture. Agrobios (India) 2003 Gupta, P. K. Vermicomposting for sustainable Agriculture. Agrobios (India) 2003

10. Kumar, A. (2005) Verms and Vermitechnology, APH Publishing.

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Semester – III
Elective - I
Paper III - Parasitology – I [PS-I] (60 hours)

UNIT I – Morphology, Anatomy and Classification **15 Hrs**

1.1 An overview and classification of Monogenea, Aspidogastrea, Digenea and Cestoda.
1.2 Ultrastructure and function of the tegument.
1.3 Digestive system, feeding and mechanism of digestion.
1.4 Excretory system, paranephridial system and lymphatic system.
1.5 Nervous system and its mechanism; sense organs and its functions.

UNIT II – Reproduction, Ecology and Evolution **15 Hrs**

2.1 Reproductive system, eggshell formation, types of eggs, and morphology of larval forms.
2.2 Population concept, factors regulating population, dispersion concept.
2.3 Origin and evolution of Monogenea, Aspidogastrea, Digenea &Cestoda.
2.4 Helminth's host specificity and its breakdown.
2.5 Host-parasite interactions and their significance; the role of helminths as vectors of microbial infection

UNIT III – Trematode and Cestode Diseases **15 Hrs**

3.1 Trematode and Cestode parasites of humans; Morphology, life cycle, pathogenicity, diagnosis, treatment, and control measures of *Clonorchis sinensis, Fasciolopsisbuski, Hymenolepis nana* and *Echinococcus granulosus.*
3.2 Helminthes of livestock with emphasis on *Fasciola hepatica* and *Moniezia* spp.
3.3 Life cycle and pathogenicity of Trematode parasites - *Dactylogyrus*spp. and*Gyrodactylus*spp.
3.4 Life cycle and pathogenicity *of* Cestode parasites - *Diplostomum*spp.,*Sanguinicola inermis.*
3.5 General account of Trematode and Cestode parasites of wild animals with emphasis on *Dicrocoeliumdendriucum* and *Echinococcus multilocularis.*

UNIT IV – Adult Metabolism, Anthelminthics and Immunology **15 Hrs**

4.1 Carbohydrate metabolism - Glycolysis (FMP-pathway), CO_2 fixation, PK/PEPCK branch point, malate dismutation; role of TCA cycle, Electron Transport chain - oxidation.
4.2 Protein composition and metabolism-Amino acid catabolism, transamination.
4.3 Lipid composition and metabolism-fatty acid metabolism and the role of β oxidation.
4.4 Immunity to schistosomiasis and fascioliasis; evasion of immunity and molecular mimicry.
4.5 Role of arthropods and molluscs in spreading of helminth diseases.

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PRACTICALS

1 Collection, fixation, and staining techniques of permanent whole-mount preparations and identification of Monogeneans, Digeneans, Aspidogastreans and Cestode (Host Fishes, water snakes, birds, sheep, goat and cattle viscera).
2 *Fasciola* smear preparation, staining and study for eggs & concentration.
3 Collection and examination of infective larvae from intermediate hosts, snails, microcrustaceans (*Cyclops, Gammarus* etc., fishes).
4 Effect of light, and temperature on the emergence of cercaria.
5 Estimation of total proteins, carbohydrates and lipids in helminths.
6 Measurement of infection: Prevalence, density, intensity and index of helminth parasites.
7 Submission of assignment on: Classification of Monogenea, Aspidogastrea and Digenea; Classification of cestoda and trematode; Types of eggs and morphology of larval forms of cestode and trematode; Morphology and larval forms of cestode and trematode; Morphology and life cycle of *Fasciola hepatica*; Morphology and life cycle of *Echinococcus multiloculus*; Carbohydrate metabolism in helminths; Protein metabolism in helminths.
[To be submitted at the time of Examination – 5 Marks]

Suggested Books

1 Animal parasitology – J. D. Smyth (Cambridge Univ. Press., 1976).
2 Foundations of parasitology 6 ed. – L. S. Roberts & J. Janovy Jr (McGraw Hill Publ., 2000).
3 Parasitism – A. O. Bush, J.C. Fernandez & J. R. Seed (Cambridge Univ. Press, 2000).
4 Helminthology – Eds. N. Chaudhury & I. Tada (NarosaPublg. House, 1994).
5 Helminthes, Arthropods, & Protozoa of domesticated animals 6 ed. – EJL Soulsby (ELBS, 1976).
6 Introduction to parasitology – B.E. Matthews (Cambridge Univ. Press. 1998).
7 The physiology of Trematodes – JD. Smyth & D. W. Halton (Cambridge Univ. Press, 1983).
8 The physiology and Biochemistry of Cestodes – J.D. Smyth & D.P. MEmanus, (Cambridge Univ. Press, 1989).
9 T.B.Fish Diseases – (Tr.) – D.A. Convoy & R.L. Herman (Narendra Publg. House, 1997).
10 Handbook of Medical Parasitology – V. Zaman & L. H. Keong (K.C. Ang Publishing Pvt. Ltd., 1989).
11 T.B. Medical parasitology – P. Chakraborty (New Central Book Agency, 2004).
12 Ecological Animal Parasitology – C. R. Kennedy (Black well Scientific Publ., 1975).
13 Infectious Diseases of fish – S. Egusa (Oxonian Pvt. Ltd., New Delhi, 1978).
14 A.T.B. of Parasitology 2 ed. – S. S. Kekar & R.S. Kelkar (Bombay popular Prakshan, 1993).

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Semester – III

Elective - I

Paper III - Neuroscience - I [NS–I] (60 hours)

UNIT I – Cellular Neurobiology **15 Hrs**

1.1 Ultrastructure of a neuron, axonal transport and its mechanism.
1.2 Types of neuronal and glial cells, organization of neurons in the brain.
1.3 Organization of CNS and PNS.
1.4 Overview of the functional anatomy of the brain and spinal cord.
1.5 Neuroanatomical and neuroimaging technique.

UNIT II – Neurophysiology **15 Hrs**

2.1 Principles and methods of electrophysiological techniques – voltage and patch-clamp.
2.2 Ion channels and ion pumps.
2.3 Types of biopotentials and mechanism; Action potential and propagation cable conduction.
2.4 Synaptic transmission, molecular and physiological mechanisms, EPSP and IPSP.
2.5 Synaptic receptor – nicotinic and muscarinic Ach receptor.

UNIT III – Molecular Neurobiology **15 Hrs**

3.1 Neurotransmitters and neuromodulators.
3.2 Metabolism and functional significance of neurotransmitters, specific transmitter defined system.
3.3 G-protein coupled receptor mechanisms.
3.4 Neuroendocrine circuits.
3.5 Neuroimmune circuits.

UNIT IV – Cognitive and Behavior Neurobiology **15 Hrs**

4.1 Biorhythm – Sleep and awake; neuronal – humoral mechanisms.

4.2 Types of learning and memory; cellular and molecular basis of learning and memory; the role of hippocampus and LTP in memory.
4.3 Neuronal basis of feeding.
4.4 Neuronal basis of emotion.
4.5 Cerebral cortex; organization and behaviour.

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PRACTICALS(All experiments involving live animals are for demonstration only)

1 Demonstration of gross anatomical regions of the brain.
2 Isolation of hippocampus, preparation of AchE, staining, the protocol of hippocampal cell culture.
3 Identification of different types of neural and glial cells.
4 Estimation of acetylcholine in different regions of the brain.
5 Estimation of acetylcholinesterase sodium and potassium ATPase activity.
6 Electrophysiological demonstration of biopotentials and conduction velocity.
7 Determination of maze learning and estimation of proteins in the hippocampus.
8 Biochemical differentiation of fast and slow muscles – SDH, LDH activities.
9 Induction of stress and estimation of glycogen, lactate, AChE and Na-K ATPase activities.
10 Submission of assignment **[To be submitted at the time of Examination – 5 Marks]**

Suggested Books

1 Physiology and biophysics – Ruch and Patten.
2 A textbook of muscle physiology – D. A. Jones and J. M. Round.
3 Neurobiology – Gorden M Shepperd.
4 Principles of neural science – E. Kandel and others.
5 Essentials of neural science and behaviour – E. Kandel and others.
6 Behavioural neuroscience – Cottman.
7 From Neuron to Brain – Nichollas, J. G. others.
8 Neuroscience – A. Longstaff .
9 Elements of Molecular Neurobiology – C U M Smith.
10 Physiology of excitable cells – D. J. Aidley.
11 Textbook of medical physiology – Guyton.

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Semester – III
Elective - I
Paper III - Comparative Animal Physiology – I [CAP-I] (60 hours)

UNIT I – Comparative Aspects of Digestion and Nutrition — 15 Hrs

1.1 Scope, principles and validity of comparative approach to physiology.
1.2 Origin of nutritive types - special dietary requirements of some animals, amino acid requirements, and essential vitamins.
1.3 Mechanisms of food intake and feeding mechanisms, comparative physiology of digestive enzymes and regulatory mechanism of digestion.
1.4 Coordination of digestive activities - Visceral autonomic system and gastrointestinal hormones.
1.5 Comparative aspects of carbohydrate pathways - Glycolysis and gluconeogenesis pathways and regulation.

UNIT II – Comparative Aspects of Respiration — 15 Hrs

2.1 Availability of oxygen, uptake of oxygen and factors that influence uptake.
2.2 Oxygen consumption by an intact animal, modifying agents.
2.3 Adaptations to diving and high altitudes.
2.4 Comparative aspects of the transport of oxygen and carbon dioxide; regulation of respiration.
2.5 Respiratory pigments in different phylogenic groups, genes with reference to haemoglobin.

UNIT III – Osmoregulation, Excretion and Thermoregulation — 15 Hrs

3.1 Problem of osmoregulation and biological responses in different environments.
3.2 Comparative aspect of osmoregulation in different animal groups.
3.3 Excretory organs and general mechanisms of excretion in various animal groups.
3.4 Freezing, winter hardening, lethal limits and resistance adaptation; Behavioral and locomotory adaptations; Heat regulation - physical and chemical.
3.5 Temperature regulation in homeotherms; neural mechanism of thermoregulation.

UNIT IV – Deranged Metabolism and Disorders — 15 Hrs

4.1 Effects of colonic bacterial flora (beneficial and harmful effect); lactose intolerance, GERD.
4.2 Liver cirrhosis and its causative agents; fatty liver.
4.3 Chronic obstructive pulmonary disease – Asthma, sleep apnea, and snoring.
4.4 Electrolyte imbalance - Acidosis, alkalosis; Dialysis.
4.5 Heatstroke; thirst and its physiological mechanism.

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PRACTICALS

1 Estimation of levels of lactic acid and free amino acids levels.
2 Effect of Heterosmotic media on blood chlorides in any one animal- crustacean/fish.
3 Effect of acclimatization to hetero osmotic media on SDH, LDH in gills and muscle tissue of crustacean/fish.
4 Effect of starvation on glycogen levels in fish/crab.
5 Effect of starvation on free amino acids in the liver and muscles of fish/crab.
6 Starvation induced changes in aminotransferases in fish/crab.
7 Starvation induced changes in excretory products in fish.
8 Acclimatization to cold and high temp in fish/crab and its effect on oxygen consumption.
9 Effect of the thyroid and antithyroid agents on oxygen consumption in fish.
10 Submission of assignment on: Comparative aspects of carbohydrate pathways; Comparative aspects of metabolic pathways; Respiratory pigments in different phylogenic groups; Nitrogen excretion pattern as in different animal groups; Freezing; Winter hardening; GERD
[To be submitted at the time of Examination – 5 Marks]

Suggested Books

1 Comp. Animal Physiology by Ladd Prosser (Publ. W. B. Saunders, Philadelphia)
2 Comp. Animal Physiology by William Hoar. (Pub. E.E.E. IBH).
3 Animal Physiology – Adaptation and function By F. Reed Hainswoth (Publ. by Addison – Wesley Publ. Company, California).
4 Animal Physiology by Kent Schmidt Nielson (Publ. E.E.E. IBH).
5 Animal Physiology and adaptation by David Gordon.
6 Animal Physiology by Wilson.
7 Concise Medical physiology by Sujit K. Chaudari.
8 Textbook of medical physiology by Arthur Guyton

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Semester – III
Elective - I
Paper III - Principles of Fisheries –I [PF-I] (60 hours)

15 Hrs

UNIT I – Introduction to Fisheries

1.1 History of fisheries; Present scenario of the fisheries sector in India; Blue revolution & food security.
1.2 Classification of fisheries; Resources of fisheries in India and Telangana in particular.
1.3 Fisheries institutes in India and their role in the augmentation of fish production.
1.4 Role of fisheries in the economic development of the nation.
1.5 Fishery economics - Basic concepts in economics; micro versus macro-economics.

15 Hrs

UNIT II – Ecology of Water Bodies

2.1 Ecology of lentic and lotic ecosystems. Aquatic pollution and its impact on fisheries.
2.2 Ecosystem and productivity – Energy flow, Trophodynamics, Ecological pyramids, Ecological productivity.
2.3 Water quality: Physico-chemical parameters of freshwater, brackish water and marine; Ideal conditions of soil and water for fish culture.
2.4 Population dynamics – Population characteristics, Dynamics of the fish population.
2.5 Reservoir, riverine and estuarine fisheries and their management.

15 Hrs

UNIT III – Culture Systems

3.1 Culture systems: open, closed, semi-intensive and intensive culture systems.
3.2 Poultry-cum-fish culture - Analysis of cost-benefit ratio.
3.3 Paddy and Horticulture-cum-fish culture - Analysis of cost-benefit ratio.
3.4 Sewage-fed fish culture - Opportunities and challenges.
3.5 Composite fish culture - Prawn-cum-fish culture.

15 Hrs

UNIT IV – Fish Harvesting Technology and Fish Biotechnology

4.1 Types of Fishing Crafts – Non-mechanized and mechanized crafts.
4.2 Types Fishing Gears – Gear material, gear making, accessories.
4.3 Fish gear preservation methods and maintenance of crafts.
4.4 Cryopreservation of gametes; Fish genomics – chromosomal mapping.
4.5 Fish transgenics for therapeutics; Vaccine development for fish diseases.

PRACTICALS

1 Water analysis and its relation with Aquaculture – pH, Dissolved oxygen, Total alkalinity, Salinity, Calcium, Magnesium, Nitrates, Phosphates, total dissolved solids, Turbidity.
2 Collection and identification of planktons.
3 Collection and identification of benthos.
4 Identification of Fishing gear and craft models.
4 Karyotyping of chromosomes in fishes.
5 Submission of assignment **[To be submitted at the time of Examination – 5 Marks]**

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Suggested Books

1 Water quality criteria for freshwater fish. Albastor, J. S. and Lloyd, R. Buttorvorth Scientific Pub.
2 Fish and Fisheries of India – Jhingran, V. G. Hindustan Publishing Corporation New Delhi.
3 The fishes of India – Francis. Day. Vol. I &II, New Delhi – CSIR.
4 The freshwater fishes of Indian Region – Jayaram, KC. Narendra Publishing house, New Delhi.
5 Prawns and prawn fisheries – Kurian, C.V. and Sebastian, V. O. Hindustan Publishing Corporation.
6 A manual of freshwater aquaculture – Santhanam, R. Sukllnaran. N. Natarajan Oxford and IBH Pub. comp.
7 Freshwater aquaculture – Rath, R. K. Scientific Publishers, Jodhpur.
8 Textbook of fish culture, breeding and cultivation of fish – MareelHuet, Fishing News Books.
9 Aquaculture development, processes and prospects – TVR Pillay Fishing news books.
10 Aquaculture – John, E. Bardach, John H. Ryther, W.O. Mclamey, John Willey and Sons, New York.
11 Fish Ecology – RJ. Wotton, Dalckie, Chapman and Hall, New York.
12 Environmental stress and fish diseases – Wedemeye, G. A. Narendra. Publishing House.
13 Diseases of fishes – C. Vandujn, Narendra Publishing House, New Delhi.
14 Aquaculture Principles and Practices by T. V. R. Pillay.

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Semester – III
Elective-II
Paper IV: Fish Biology [FB] (60 hours)

15Hrs

UNIT I – Introduction and Diversity of Fishes

1.1 Introduction, general characteristics, evolutionary succession and fossil history of fishes.
1.2 The early evolution of fishes; Chondrichthyans fishes - Sharks, Skates and Rays.
1.3 Characterization and classification of: Ostracoderms, Placoderms, Acanthodians, Holocephali, and Elasmobranchs.
1.4 Characterization and classification of Cyclostomes, Sarcopterygii, Dipnoi, and Actinopterygii.
1.5 Integumentary system - Basic structure of the skin, dermal and epidermal pigments, fins, and scales.

15Hrs

UNIT II – Fishes – Habits and Habitats

2.1 Buoyancy – Dynamic lift and static lift; swim bladder- structure and function.
2.2 Locomotion – Myotomal muscles and caudal fin oscillation mechanisms.
2.3 Feeding mechanisms – Food habits and feeding, fish as predators and prey; Food chains and food webs.
2.4 Osmoregulation and ion balance – Freshwater, brackish water and marine teleosts; kidney and salt balance.
2.5 Fish migration, migratory mechanisms, mating, and parental care.

15Hrs

UNIT III – Fish Biology

3.1 Skeletal system - skull, splanchanocranium, jaw suspension and vertebral column.
3.2 Digestive system – Digestive tract, enzymes and digestion.
3.3 Respiratory mechanism – Respiratory gills and lungs.
3.4 Circulatory system – Heart and accessory pumps.
3.5 Excretory system – Excretory organs and excretion.

15Hrs

UNIT IV – Fish Biology and Embryogenesis

4.1 Nervous system- Central nervous system, brain and peripheral nervous system.
4.2 Sense organs – Olfactory, taste buds, touch receptors, photoreceptors, lateral line and internal ear.
4.3 Endocrine system – Pituitary gland, neurohypophysis, adrenal gland, gonads, and thyroid gland.
4.4 Reproductive system – Male and female reproductive organs; Role of hormones.
4.5 Embryogenesis - Early development and post-embryonic development.

PRACTICALS

1 Morphometric identification of fishes.
2 Meristic characters of fishes.
3 Dissection and preparation of permanent slides of scales.
4 Isolation of pituitary gland.
5 Identification of fish developmental stages - egg, spawn, fry, fingerling and adult.
6 Dissection of Weberian ossicles.
7 Dissection of the digestive system.

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8 Dissection of the reproductive system.
9 Sexual differentiation of fishes.
10 Determination of chlorides in heterosmotic media.
11 Submission of assignment on: Digestive system; Respiratory system; Circulatory system; Excretory system; Nervous system; Endocrine system; Reproductive system; Osmoregulation system
[To be submitted at the time of Examination – 5 Marks]

Suggested Books

1 Textbook of Fish Biology & Indian FisheriesRahul P Parihar
2 A Text-Book of Fish Biology and Fisheries by S S Khanna and H R Singh,
3 Handbook of Fish Biology and Fisheries,(Vol I & II) by Paul J. B. Hart and John D. Reynolds
4 Fish Biology by, C B L Srivastava.
5 Fauna of British India, including Ceylon & Burma – by Francis Day.
6 Indian Fishes and Fisheries – Jhingran.
7 Introduction to Fish Physiology – Dr. Lynwood S. Smith
8 An Introduction to fishes – S. S. Khanna
9 Ichthyology – K.F. Lagler, John F., Bardach, R. R. Miller and D. R. May Passino

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Semester – III
Elective - II
Paper IV – Sericulture [SER] (60 hours)

UNIT I – Introduction **15Hrs**

1.1 Introduction - Sericulture as an agro-industry.
1.2 Mulberry cultivation - Varieties of mulberry and non-mulberry food plants; Agroclimatic conditions for Moriculture; Agricultural practices; Harvesting and Preservation of leaves.
1.3 Diseases of Mulberry and their management - Bacterial diseases, Viral diseases, Fungal diseases.
1.4 Mineral deficiency diseases and their management.
1.5 Insect Pests of Mulberry and their management.

15Hrs

UNIT II – Biology of Silk Worms

2.1 Races of mulberry and non-mulberry silkworms.
2.2 External morphology of *Bombyx mori* - Egg, larva, pupa & adult.
2.3 Internal morphology of *Bombyx mori* - Digestive, respiratory, nervous, excretory and reproductive systems.
2.4 Morphology and anatomy of silk glands.
2.5 Properties and composition of silk.

15Hrs

UNITIII – Silkworm Rearing

3.1 Rearing house and rearing appliances.
3.2 Environmental conditions for silkworm rearing.
3.3 Rearing of early stages (Chawki rearing) and late stages of silkworms.
3.4 Mounting and harvesting of silkworm cocoons.
3.5 Silkworm diseases and pests.

15Hrs

UNIT IV – Harvesting Technology

4.1 Transport of cocoons to the cocoon markets.
4.2 Commercial characters of cocoons, defective cocoons and price fixation.
4.3 Reeling technology – Mulberry and Vanya silk rearing.
4.4 Seed technology – Grainage& DFLs; By-Products: Types and uses.
4.5 Role of biotechnology in sericulture.

PRACTICALS

1 Rearing appliances.
2 Study of the life history of silkworm by rearing.
3 Identification of different types of silkworms - Mulberry, Tasar, Eri and Muga.
4 Identification of defective cocoons.
5 Sex differentiation of larva, pupa and adult silkworms.
6 Preparation of permanent slides of month parts, spiracles and appendages of the larva.
7 Dissection of silk glands of the silkworm larva.
8 Dissection of digestive and nervous systems in the larva.
9 Dissection of reproductive organs in the adults moths.
10 Calculation of Shell Ratio.

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11 Visit to the Cocoon market.
12 Visit to the Reeling Centre and Grainage Units.
13 Submission of assignment **[To be submitted at the time of Examination – 5 Marks]**

Suggested Books

1 FAO Manuals
2 Ullal and Narasimhanna: Hand Book of Practical Sericulture
3 Manjeet Singh Jolly: Appropriate Sericulture Techniques
4 CSB Bulletins of Sericulture
5 Ganga and Sulochana Shetty: An Introduction to Sericulture
6 NCERT Manuals of Sericulture

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Code Zoo_304

M.Sc. Zoology Semester – III
Elective - II
Paper IV - Applied Toxicology [AT] (60 hours)

15 Hrs

UNIT I – Principles of Toxicology

1.1 Definition, scope and importance of toxicology; classification of toxic agents - natural toxins, animal toxins, plant toxins, food toxins, genetic poisons and chemical toxins.

1.2 Dose, dose-effect and dose-response relationship – Acute toxicity, chronic toxicity; toxic kinetics.

1.3 Factors affecting toxicity - species and strains, age, sex, nutritional status, hormone, environmental factors.

1.4 Absorption and distribution of toxicants, portals of entry – Skin, gastrointestinal tract and respiratory system.

1.5 Bio-accumulation, bio-magnification, biotransformation and elimination of xenobiotics.

15 Hrs

UNIT II – Biochemical toxicology

2.1 Mechanism and reactions of toxicants - Covalent bonding, non-covalent bonding and enzymatic reactions.

2.2 Lipid peroxidation – Reactive Oxygen Species (ROS) and Reactive Nitrogen Species (RNS); Mechanism of Reactive Oxygen Species production; Superoxide, hydrogen peroxide and hydroxyl radicals in toxicity of xenobiotics.

2.3 Oxidative Stress – Consequences of oxidative stress; protein and DNA damage.

2.4 Antioxidant defense mechanism – Role of glutathione, superoxide dismutase, metallothionine.

2.5 Xenobiotic induced intracellular and cellular alterations.

15 Hrs

UNIT III – Systemic toxicology

3.1 Basics of organ toxicity - Target organs, organ selectivity and specificity.

3.2 Hepatotoxicity - susceptibility of the liver; Types of liver injury and biochemical mechanism.

3.3 Pulmonary toxicity – Lung injury, systematic lung toxins, lung pathology.

3.4 Renal toxicity – susceptibility of the kidney to toxicants; Chemical induced renal injury.

3.5 Neurotoxicity – Effect of toxic agents on neurons, ion channel neurotoxins; Lesions of neural tissue.

15 Hrs

UNIT IV – Environmental and Occupational Toxicology

4.1 Eco-toxicology of heavy metals – Mechanism of heavy metal toxicity; Case studies of Arsenic, Mercury and Cadmium.

4.2 Environmental problems by organochlorine and organophosphate pesticides; case studies of DDT, endosulfan, parathion and malathion.

4.3 Occupational hazards - physical, chemical, biological and mechanical hazards. Occupational diseases: Pneumoconiosis, silicosis, asbestosis; Prevention of occupational diseases.

4.4 Carcinogenesis – Carcinogen types, mechanisms of carcinogenesis; Skin cancer, lung cancer and leukaemia.

4.5 Legislation and Regulation – Federal government, State government; Legislation and regulation in other countries.

PRACTICALS (All experiments involving live animals are for demonstration only)

1 Determination of LC50/LD50 of selected toxicant (bioassay method).

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2 Determination of LPO activity by TBRAS method.
3 Effect of toxicant on glycogen, glucose and amino acids.
4 Hepato-toxicant effect on Total Bilirubin Content (direct and indirect method).
5 Estimation of SGOT and SGPT as a marker enzyme for hepatotoxicity.
6 Estimation of serum creatinine activity as a marker enzyme for Renal toxicity.
7 Micronuclei test.
8 Estimation of Hemoglobin and RBC in Lead exposed experimental animals.
9 Estimation of AchE activity as a marker of pesticide poisoning.
10 Industrial visit
11 Submission of assignment **[To be submitted at the time of Examination – 5 Marks]**

Suggested Books

1 Principles of ecotoxicology- 3rd edition 2006, C H Walker, S P Hopkin, R N Sibly and D B Peakall (Eds.), Taylor and Francis, New York, NY.
2 Introduction to Environmental toxicology -3rd edition 2003, W.G. Landis and M.H. Yu. Lewis publishers.
3 Text Book of Modern Toxicology 2000 edition, Ernst Hodgson and Patrica Levi, McGraw – Hill Int. ed.
4 Principles of toxicology 2010 edition, Anju Agarwal and Krishna Gopal, IBDC Publishers India.
5 Essentials of Toxicology 2011 edition, Vijay Kumar Matham, New India Publishing Agency, New Delhi, India.
6 Principles of Biochemical Toxicology- Jatimbrell; Taylor and Francis Ltd, London.
7 Basic Environmental Toxicology – Lorris G. Cockerham, Barbara S Shane; CRC Press, London.
8 Handbook of Toxicology – Thomas J Haley, Willan O Berndt; Hemisphere Publishing cooperation.
9 Modern Toxicology (3 Volumes) - P K Gupta and Salunkha; B V Gupta Metropolitan Book Co., Ptv Ltd.
10 Encyclopedia of Toxicology – O P Jasra.

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Semester – IV
Core Paper
Paper I: Animal Biotechnology [AB] (60 hours)

15Hrs

UNIT I – Introduction and Animal Improvement

1.1 Introduction to biotechnology- scope, importance and its applications.
1.2 Mammalian reproductive systems and gametogenesis.
1.3 *In vitro* fertilization and embryo transfer; ICSI, sperm sexing.
1.4 Cryopreservation, cryoprotection and gamete banking.
1.5 Biotechnology in the improvement of livestock herds and breeding selected traits.

15Hrs

UNIT II – *In vitro* Culture of Cells and Tissues

2.1 Cell culture - Equipment and materials for cell culture technology, the principle of sterile techniques and cell propagation, primary and established cell line cultures.
2.2 Mammalian cell lines & their characteristics.
2.3 Basic techniques of mammalian cell culture *in vitro*, disaggregating of tissue and primary culture, maintenance of cell culture, cell separation.
2.4 Tissue culture system – cell tissue fragment, organ and embryo cultures, merits and demerits.
2.5 Scaling-up of animal cell culture, cell synchronization, cell cloning, micromanipulation, cell transformation.

15Hrs

UNIT III –Production of Recombinant Organisms and Transgenic Animals

3.1 Cloning of mammals.
3.2 Transgenic animals; creation of transgenic mice, retroviral vector method, Microinjection, embryonic stem cell method – short gun, electroporation, lipofection, microinjection.
3.3 Production of other transgenic animals – cattle, sheep, pigs and fish.
3.4 Large scale culture and production from genetically engineered animal cell culture.
3.5 Large scale culture and production from recombinant microorganisms –Downstream processing.

15Hrs

UNIT IV – Application of Biotechnology

4.1 Medical biotechnology – Application of RFLP in forensic science, hybridoma technology and production monoclonal antibodies.
4.2 Environmental Biotechnology - Bioassay, biosensors in ecotoxicological screening; Bioleaching of metals by microorganisms; Bioabsorption of metals by bacteria.
4.3 Insecticide development – biopesticides; *Bacillus thuringiensis* – mode of action of toxin, toxin gene isolation and engineering of *B. thuringiensis*.
4.4 Biotechnology of aquaculture - sex reversal in fish and sterile fish culture.
4.5 Use of animals as bioreactors; Knock out model systems and their utility.

PRACTICALS

1 Preparation of culture media: a) Bacteria and/or b) animal cells.
2 Methods of cultivating a) Bacteria and/or b) animal cells.
3 Isolation and characterization of microbes useful in fermentation.
4 Staining Techniques for microbes:
a) Gram's staining; b) Spore & Capsule staining.

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c) Acid-fast stain; d) Fungal stains

5 Determination of microbial growth curve.

6 Antibiotic sensitivity test.

7 Yield estimation in fermentations products:
a) *Aspergillus niger*-citric acid; b) *Lactobacillus* – Lactic acid from curd; and
c) *Saccharomyces cervisiae* (Yeast) Alcohol

8 Microbial evaluation of stored foods from plant/animal origin for contaminants/toxins.

9 Visit to Quality Control Labs.

10 Submission of assignment **[To be submitted at the time of Examination – 5 Marks]**

Suggested Books

1 Culture of Animal Cells. R. Ian Freshney, Wiley Liss.
2 Animal Cell culture – Practical Approach – Ed. John R W Masters, Oxford.
3 Animal Cell Biotechnology, 1990 – Speir, RE and Griffith, JB, Academic Press.
4 Molecular Biotechnology – Glick &Pasternock.
5 Gene manipulation – Old & Primrose.
6 Biotechnology – S. Mitra.

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Semester – IV Core paper

Paper II – Biodiversity (60 hours)

UNIT I – introduction to Biodiversity **15 Hrs**

1.1 Biodiversity: Concepts, Definition. Values of biodiversity: Consumptive use and Productive use ; Social, Ethical, Aesthetic, Option & Environment service values.

1.2 Genetic diversity: Nature and origin of genetic variations; Measurement of genetic Diversity.

1.3 Species diversity: History and origin of species diversity; Species diversity indices ; Measures of diversity – Alpha, Beta & Gamma diversity.

1.4 Ecosystem diversity: Classification and nature of ecosystems (in brief); Ecosystem diversity of India (in brief), Agro- biodiversity: Origin and evolution of cultivated species diversity; Vaviloviancenters ; Diversity in domesticated animal species.

UNIT II – Status of biodiversity **15 Hrs**

2.1 Biodiversity at global, national and local levels.

2.2 Hot spots of biodiversity; India as a mega diversity nation. Endemism and endemic species.

2.3 Threats to biodiversity: Deforestation & habitat destruction, Hunting & Overexploitation; Introduction of exotic species, Pollution. Endangered, Vulnerable, Rare and Threatened species..

2.4 Conservation of Biodiversity: Objectives and action plans; Strategies – In-situ and Ex- situ conservation; Peoples movement, Role of educational Institutions and NGO's, Biodiversity Awareness programmes

2.5 Biodiversity and Biotechnology: Role of Biotechnology in: Assessment of biodiversity and bioresources.

UNIT III – Biodiversity and law **15 Hrs**

3.1 Biodiversity legislation: Legal aspects with special reference to India; CITES; Trade related Intellectual Property Rights..

3.2 Biodiversity conventions: Earth Summit and other conventions; Convention on Biological Diversity.

3.3 Biodiversity conservation; Utilization of Biodiversity/Bioresources. GMO's and their impact on biodiversity.

3.4 Neuroendocrine circuits.

3.5 Neuroimmune circuits.

UNIT IV – Biodiversity Management: **15 Hrs**

4.1 Organizations associated with biodiversity management – IUCN, UNEP, UNESCO, WWF, FAD,WCMC –their role and contributions.

4.2 Bioprospecting; Biopiracy; Biosafety.

4.3 Intellectual property rights and patents.

4.4 Future strategies for biodiversity conservation in India.

4.5 Cerebral cortex; organization and behaviour.

Practical

1. Study the faunal diversity of state and country, provide relevant information
2. Prepare a report on conservation projects of biodiversity or wild life fauna in India
3. Prepare report on Biosphere reserves in India

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4. Prepare a report on national parks and sanctuaries in India with reference to the biodiversity
5. Prepare report on endanger, rare, vulnerable animals of India
6. Determination of species diversity by Shannon-Weiner Index
7. Determination of species diversity by Simpson's index
8. Critical studies on endangered, endemic, vulnerable, exotic species of India.
9. Field visits will be integral part of the Practical. Visits to nearby Zoo, Forest, seashore, Nursery, Aquaria or a wildlife sanctuary, Natural history Museum and any other relevant site must be arranged. submission of a report
10. Submission of assignment on: **[To be submitted at the time of Internal Examination – 5 Marks]**

REFERENCE BOOKS:

1. Dasmann. F Raymond. Wildlife Biology. Wiley Eastern Ltd. India. 1982.

2. Encyclopedia of Nature and Science. Vols 1-18. Bay Books Pvt.Ltd. Sydney, 1974.

3. Burnie. D. (Ed). Animal: the Definitive Visual Guide to the Worlds Wildlife. D.K.Publications, 2001. 4. B.B.Hosetti, 2005: Glimpses in Biodiversity, Daya Publishing House, Delhi.

5. B.B.Hosetti, 2008: concepts in wildlife management, Daya Publishing House, Delhi.

6. K.C.Agrwal, 2006. Concepts in biodiversity, Narendra Publishers Meerut

7. B.B.Hosetti, 2008: Wild life management in India, Pointer Publishers, Jaipur ,

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Semester – IV

Elective - I

Paper III – Agricultural Entomology – II [AE – II] (60 hours)

UNIT I – Introduction **15 Hrs**

1.1 Introduction – Antiquity of pest problem.

1.2 Reasons for insects turning into pest, reasons for pest outbreaks.

1.3 Economic injury level; Economic threshold level.

1.4 Climatic factors and natural barriers.

1.5 Pest monitoring and methods of survey.

UNIT II – Insect Pest Control Methods – I **15 Hrs**

2.1 IPM - Definition, necessity of IPM; Tools of IPM, Ecology versus IPM.

2.2 Cultural control methods.

2.3 Physical control and Mechanical control methods.

2.4 Biological control methods.

2.5 Genetic control methods.

UNIT III – Insect Pest Coztrol Methods – II **15 Hrs**

3.1 Chemical control – Inorganic pesticides, Organic pesticides, Organochlorides, Organophosphates and Carbamates.

3.2 Synthetic pyrethroids – Classification and their applications.

3.3 Synergists, Repellants, Baits, Toxicants, Antifeedants, Attractants, Chemosterilants.

3.4 Pesticide formulations – Dust, Sprays, Emulsions, Aerosols, Fumigants, Seed dressers or Seed treatment chemicals etc.

3.5 Pesticide application methods and Safety parameters in pesticides application.

UNIT IV – Pesticide Resistance and Advances in IPM **15 Hrs**

4.1 Chitin Synthesis Inhibitors; Insect growth regulators; Pheromones.

4.2 Pesticide resistance – Definition and types of resistance; Mechanism of resistance, Genetics of resistance.

4.3 Regulatory methods – Insecticides and Plant Quarantine Acts.

4.4 Modern trends in pesticide research; Biotechnological advances in IPM.

4.5 Pesticide applications and their adverse consequences on environment; Concepts of organic farming.

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PRACTICALS

1. Collection, Identification and Preservation of insect pests of agricultural, medical and veterinary importance.
2. Usage of light traps for insect collection.
3. Usage of pheromone traps for insect collection.
4. Bird perches and their utility.
5. Preparation of natural extractions botanicals
6. Bioassay of insecticides using different methods of exposure.
7. Calculation of LD50 using probit analysis.
8. Study of antifeedant activity in *Spodoptera* or any suitable pest.
9. Culturing of NPV.
10. Submission of assignment **[To be submitted at the time of internal Examination – 5 Marks]**

Suggested Books

1. Introduction to General and Applied Entomology by V.B. Awasthi.
2. Integrated pest management principles and practices by Abrol D.P, CABI publications.
3. Integrated pest management principles and applications vol. 1 by Singh, CBS publication.
4. Applied Entomology by P.G. Fenemore and Alka Prakash.
5. Biodiversity and insect pests management S. Ignacimuthu, S. Jayaraj.
6. Integrated pest management principles and applications Amerika Singh, O.P. Sharma, D.K. Garg.
7. Handbook of Integrated pest management by ICAR.
8. Pest management principles and practices by Rajesh Ravi.
9. Theory and practices of Integrated pest management by A.K. Dhawan & Ramesh Arora.
10. A textbook of Applied Entomology, Vol. I & II. by K.P. Srivastava.

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SEMESTER – IV

Elective - II

Paper III: [redacted] - II [redacted] (60 hours)

UNIT I – Pearl culture **15 Hrs**

1.1 Introduction to pearl culture. Global and national status of pearl culture, History of pearl culture ,Significance of pearl culture. Biology of Pearl oyster: Pearl-producing molluscs. Morphology and anatomy of Pearl oyster, the Life cycle of pearl oyster

1.2 Pearl oyster culture Techniques of pearl oyster culture (Fresh water and Marine water) for artificial production of pearls. Pearl culture techniques -Rafts, long lines, Pearls oyster baskets, under water platforms, mother oyster culture/Collection of oysters, rearing of oysters, Environmental parameters.

1.3 Selection of Oyster, Graft tissue preparation, Nucleus insertion, Conditioning for surgery, Post- operative culture, harvesting of pearl, clearing of pearl.

1.4 Diseases and Predators of Pearl oysters' Present status, prospects and problems of pearl industry in India.

UNIT II – Lac culture **15 Hrs**

2.1 Introduction to Lac culture, . Global and national status of Lac culture. History of Lac culture ,Significance of Lac culture. Lac Insect Taxonomy and diversity. DISTRIBUTION and life cycle of Lac insect.

2.2 Host plants, strains of lac insects. Lac cultivation: Local practice , Improved practice, Propagation of lac insect, Inoculation period , Harvesting of lac

2.3 Composition of Lac: Stick lac, Seed lac, Shellac, Hand made process, Heat process, Solvent processes

2.4 Lac Products And Their Use: Lac dye, Lac wax, Shellac , Bleached shellac, Dewaxed bleached shellac , Aleuritic acid (Shellac Aleuritic Powder)
Lac Pests and potential OF India in Lac production

UNIT III – Goat forming **15 Hrs**

3.1 Introduction to Goat Farming: Brief history about goat farming in Telangana as well as in India. Identify different breeds of Goat for Goat Farming. Indigenous goat breeds and Exotic breeds of goats in India. Characteristics and productive features of various breeds of goats of regional and national

3.2 Goat Accommodation: Structure goat housing focusing on waste management. fodder cultivation & feeding for goats maintaining constituents of livestock feed component

3.3 Breeding Management for Goats: Natural and artificial Breeding of Goats
Health and Disease Management of Goats (Bacterial, viral and fungal)

3.4 Production and Marketing linkage in Goat farm. Entrepreneurship, Project Proposal and Loan Schemes

UNIT IV Aquarium Fish Keeping **15 Hrs**

4.1 The potential scope of aquarium Fish Industry as a cottage Industry, Exotic and endemic species of aquarium Fishes,

4.2 Common characters and sexual dimorphism of fresh water and marine aquarium fishes such as Guppy, Molly, Sword tail, Gold fish, Angel fish, Blue morph, Anemone fish and Butterfly fish.

4.3 Food and feeding of aquarium fishes, Use of live fish feed organisms, Preparation and composition of formulated fish feeds.

4.4 Live fish transport, Fish handling, packing and forwarding techniques, General aquarium maintenance, budget for setting up an aquarium fish farm as a cottage

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industry

PRACTICAL

1. Study of different pearl producing Moluscas
2. Study of Designed pearl culture techniques, bleaching, collection of pearls, cleaning of pearls
3. Study of Lac culture practices and host plants
4. Study of Lac insects morphology
5. Study of Lac products and its significance
6. Identification of Identify different breeds of Goat (Indigenous breeds and Exotic breeds)
7. Disease of Goats (Bacterial, viral and fungal)
8. Natural and artificial Breeding of Goats
9. Study of Exotic and endemic species of aquarium Fishes
10. **Visiting different places related to syllabus and submit the report at the end of course**

SUGGESTING READINGS

1. Srivastava CBL (2006) Fishery Science and Indian Fisheries. KitabMahal publications, India.
2. Gina Sandford (2003) Aquarium Owner's Manual, Dorling Kindersley; 2Rev Ed edition
3. Klaus PaysanKlaus Paysan Guide to Aquarium Fishes, Publisher ; Times Books
4. Anshuman D. Dholakia · 2016: Ornamental Fish Culture and Aquarium Management
5. Breeding and Culture of Freshwater Ornamental Fish: By Archana Sinha, Pramod Kumar Pandey · 2023
6. Freshwater Aquariums Basic Aquarium Setup and Maintenance By David Alderton · 2012
7. Commercial Goat Farming in India- Guide An Entrepreneur Manual to Successful Goat Production and Marketing in India By Mohan Chand Rajbar · 2019
8. LIVESTOCK PRODUCTION MANAGEMENT BY GHOSH, NILOTPAL · 2019
9. A TEXTBOOK OF ANIMAL HUSBANDRY BY G. C. BANERJEE · 2018
10. GOAT, SHEEP AND PIG (PRODUCTION AND MANAGEMENT) BY JAGDISH PRASAD · 2007

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Semester – IV
Elective - I
Paper III: Parasitology – II [PS-II]

15Hrs

UNIT I – Protozoology

1.1 Protozoan ecology, nutrition; population structure and kinetics.
1.2 Metabolic pathways in protozoa – carbohydrate, protein and lipids.
1.3 Antimetabolites analogues, inhibitors and transport phenomenon in protozoa.
1.4 Enzyme secretions and activity; nucleic acids composition and its synthesis.
1.5 Respiration in protozoa; nutritional requirements and nitrogen excretion.

15Hrs

UNIT II – General Account and Taxonomy of Nematodes

2.1 History, scope and significance of nematodes.
2.2 Classification of nematodes up to family level with examples.
2.3 Functional anatomy – Structure of cuticle and cuticular modifications, Body wall, musculature and pseudocoelom.
2.4 Digestive system with special reference to oesophageal modifications and associated glands.
2.5 Excretory system, nervous system and sense organs of nematodes.

15Hrs

UNIT III – Morphology, Development, Life Cycles and Pathology

3.1 Reproductive system, types of eggs, embryology and development.
3.2 Life cycles, pathology, treatment of the gastrointestinal nematodes; tissue nematodes, epidemiology and geographical distributions of i) *Strongyloidesstercoralis*, ii) *Ancylostoma duodenale*, iii) *Dracunculus medinensis*, iv) *Wuchereriabancrofti, Iv) Brugiamalayi* and vi) *Trichinella spiralis*; Visceral larva migrans, dermatitis and pulmonary bronchitis.
3.3 Origin and evolution of animal nematode parasites and host interaction.
3.4 General account of entomophilic Nematodes – characteristics and classification.
3.5 General account of phytonematodes; Life history and pathology of *Hirschmanniella* and *Meloidogyne.*

15Hrs

UNIT IV – Acanthocephala

4.1 Medical Acanthocephalans - General account, morphology, life cycle, clinical symptom, pathogenicity, diagnosis, prophylaxis and treatment of the diseases caused by *Macracanthorhynchushirudinaceous*and *Moniliformis*.
4.2 The role of vectors in spreading of diseases in humans.
4.3 Host-parasite relationships and their immunological reactions.
4.4 Innate and acquired immune resistance.
4.5 Antihelminthic drug action and drug resistance.

PRACTICALS

1 Collection of nematode parasites and acanthocephalan parasites, fixation, preparation of permanent slides and their identification.
2 Hosts – cockroaches (invertebrate), fish (carps & catfishes), birds (fowl), and mammals (sheep and cattle).
3 Identification of nematode eggs and larval stages.

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4 Blood smear preparation for the identification of *Plasmodium* spp.
5 Qualitative and quantitative estimation of carbohydrates, proteins and lipids in normal, infected tissues and parasites.
6 Ecology of parasites and biostatistical calculations of incidence, intensity, density and index of infection of nematode parasites.
7 Submission of assignment on: **[To be submitted at the time of Examination – 5 Marks]**

Suggested Books

1 Principles of nematology – by Chitwood B.G. and Chitwood M.B.
2 Nematode parasites of domestic animals and of man – by Levine Norman D Burgess publishing Co.
3 The natural history of Nematodes by Pionar G.O., Prentice-Hall, New Jersey.
4 The organization of nematodes by Croll N.A., Academic press.
5 The physiology of nematodes by Lee D. L. & At. Kinson, Columbia University Press, New York.
6 Agricultural Helminthology – Filipjev I. N.
7 General Parasitology by Cheng T.C.
8 Introduction to animal parasitology by J. D. Smith.
9 Entomophilic nematodes and their role as biological control of pest insects by George Poiner, Pub. INC Engle wood Cliffs, New Jersey.
10 Parasitology by Noble & Noble.
11 Parasitology by K. D. Chatterjee.
12 Parasitology by Chandler.
13 Human Helminthology - by Faust.
14 Medical Zoology by Sobti.

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Code Zoo_403

Semester – IV
Elective - I
Paper III: Principles of Fisheries - II [PF-II]

15Hrs

UNIT I – Introduction to Aquaculture

1.1 Definition, history, present status and future prospects of aquaculture.
1.2 Criteria for selection of fish species for culture.
1.3 Advanced techniques in seed production - Induced breeding methods in Fishes and Prawns.
1.4 Types of hatcheries: construction and management of hatcheries, and seed transportation methods.
1.5 Fishermen Cooperative societies – structures and functions.

15Hrs

UNIT II – Biology of Cultivable Fishes, Prawns and Crabs

2.1 India Major carps – *Catlacatla*, *Labeorohita* and *Cirrhinusmrigala*.
2.2 Exotic Major carps – *Hypophthalmichthys molitrix*, *Ctenopharyngodonidella* and *Cyprinus carpio*.
2.3 Air-breathing fishes - *Channa punctatus, Channa marulius, Clariausbatrachus*.
2.4 Cultivable prawns –*Macrobrachiumrosenbergii*, *Macrobrachiummalcolmsonii*.
2.5 Cultivable crabs - *Barytelphusacunicularis.*

15Hrs

UNIT III – Fish Pond Management

3.1 Site selection, design and construction of Aquafarms.
3.2 Pre-stocking pond management – Aquatic weeds, predatory insects and their control.
3.3 Nursery pond management – pond fertilization.
3.4 Stocking and Rearing pond Management, Natural fish food organisms, supplementary feeding.
3.5 Brood pond Management – Monosex culture.

15Hrs

UNIT IV – Disease Management & Post-harvest Technology

4.1 Infectious diseases of fishes, their prevention and control measures.
4.2 Infectious diseases of prawns, their prevention and control measures.
4.3 Non-infectious diseases of fishes and their preventive measures.
4.4 Processing and preservation of fishes and prawns.
4.5 By-products and value added-byproducts of fishes and prawns.

PRACTICAL

1 Identification of fishes through general characters and morphometry and meristic characters.
2 Identification of prawns through general characters and morphometry.
3 Identification of fish and prawn through developmental stages.
4 Symptomatic identification of diseased fishes and prawns.
5 Analysis and identification of planktons – Phytoplanktons and Zooplanktons.
6 Identification of benthos as fish feed.
7 Separation of pituitary gland from fish.
8 Demonstration of induced breeding technology in common carp.
9 Submission of assignment **[To be submitted at the time of Examination – 5 Marks]**

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Suggested Books

1 Water quality criteria for freshwater fish. Albastor, J. S. and Lloyd, R. Buttorvorth Scientific. London.
2 Fish and Fisheries of India – Jhingran, V. G. Hindustan Publishing Corporation New Delhi.
3 The fishes of India – Francis. Day. Vol. I & II New Delhi – CSIR.
4 The freshwater fishes of Indian Region – Jayaram, KC. Narendra Publishing house, New Delhi.
5 Prawns and prawn fisheries – Kurian, C.V. and Sebastian, V. O. Hindustan Publishing Corporation.
6 A manual of freshwater aquaculture – Santhanam, R. Sukllnaran. N. Natarajan Oxford and IBH Pub. Comp.
7 Freshwater aquaculture – Rath, R. K. Scientific Publishers, Jodhpur.
8 Textbook of fish culture, breeding and cultivation of fish – Mareel Huet, Fishing News Books.
9 Aquaculture – John, E. Bardach, John H. Ryther, W.O. Mclamey, John Willey and Sons, New York.
10 Fish Ecology – RJ. Wotton, Dalckie, Chapman and Hall, New York.
11 Prevention and control of fish & prawn diseases, 2nd edition. By K. P. Biswas
12 Diseases of fishes – C. Vandujn, Narendra Publishing House, New Delhi.
13 Aquaculture Principles and Practices by T. V. R. Pillay
14 A textbook of fish, fisheries and technology by K. P. Biswas.
15 Fisheries and Aquaculture by Ravishankar Piska.

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Semester – IV
Elective - I
Paper III: Neuroscience - II [NS-II]

UNIT I – Sensory System **15Hrs**

1.1 Types of receptors, basic mechanisms of sensory transduction; sensory circuit and sensory pathways.
1.2 Neurobiology of chemoreception – taste and smell.
1.3 Neurobiology of somatic sense.
1.4 Neurophysiology of hearing.
1.5 Neurophysiology of vision.

UNIT II – Sensory and Motor System **15Hrs**

2.1 Pain and its mechanism - Physiological and neurohumoral.
2.2 Muscle sense – receptors, muscle spindle and GTO.
2.3 Neurobiology of Autonomic function; Motor hierarchies.
2.4 Reflex, reflex pathways and coordination of reflexes.
2.5 Mechanism of locomotion and movement.

UNIT III – Developmental Neurobiology **15Hrs**

3.1 Induction and patterning of nervous system.
3.2 Generation and survival of nerve cells, neurotrophic factors.
3.3 Guidance of axons to their targets, synaptogenesis and developmental plasticity.
3.4 Neural connection and their reactions to injury.
3.5 Regeneration, reinnervation, sprouting; neural specificity; Remodeling of neural circuitry.

15Hrs

UNIT IV – Applied Neurobiology

4.1 Concept of stress; physiological basis of stress and its disorders.
4.2 Role of muscles in sports, slow and fast muscles in exercise and its metabolism.
4.3 Diseases of motor units - neuropathies and myopathies.
4.4 Neuronal disorders – Parkinson's, Alzheimer's, psychosomatic disorders.
4.5 Behavioral disorders, drug abuse and dependence.

PRACTICALS (All experiments involving live animals are for demonstration only)

1 Tail flick test for measurement of pain.
2 Spinal reflexes in decerebrated animal.
3 Preparation of neuromuscular system for electrophysiological recording.
4 Biochemical differentiation of fast and slow muscles – SDH, LDH activities, glycogen and lactate content in altered neurobiological conditions.
5 Effect of ankle sprain on muscle metabolism.
6 Determination of contractile properties of muscle in pathological condition.
7 Determination of conduction velocity in nerve.
8 Induction of stress and estimation of on glycogen, lactate, AChE and Na-K ATPase activities.
9 Experimental studies on atrophy, hypertrophy of muscles and nerve degeneration as well as regeneration.

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10 Rotarod test for motor coordination.
11 Submission of assignment on: **[To be submitted at the time of Examination – 5 Marks]**

Suggested Books

1 Physiology and biophysics – Ruch and Patten
2 A text book of muscle physiology – D. A. Jones and J. M. Round
3 Neurobiology – Gorden M Shepperd
4 Principles of neural science – E. Kandel and others
5 Essentials of neural science and behaviour – E. Kandel and others
6 Behavioral neuroscience – Cottman
7 From Neuron to Brain – Nichollas, J. G. others
8 Neuroscience – A. Longstaff
9 Elements of Molecular Neurobiology – C U M Smith
10 Physiology of excitable cells – D. J. Aidley
11 Textbook of Medical Physiology – Guyton

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Semester – IV
Elective - I
Paper III: Comparative Animal Physiology - II [CAP-II]

15Hrs

UNIT I – Responses of Animals to Their Environment

1.1 General receptor characteristics, receptor potentials and sensory coding.
1.2 Adaptations in organ systems for reception – Chemo-, thermo-, mechano-, and electro- receptors.
1.3 Central nervous system - Insect to vertebrate comparison.
1.4 Integration for effective behavior - spinal reflex; Learning and memory and its genetic basis.
1.5 Stress biology and related disorders.

15Hrs

UNIT II – Effectors and Responses

2.1 Gland effectors for secretion - mechanism of target tissue activation and mechanism of secretion.
2.2 Types of muscle fibers slow, fast and asynchronous flight muscle.
2.3 Mechanism and chemistry of muscle fiber contraction.
2.4 Accessory movements – skeletal levers, elastic movements.
2.5 Effectors for movement – Cyclosis, amoeboid, ciliary, flagellar movements, and control of movement.

15Hrs

UNIT III – Circulation of Body Fluids

3.1 Major types of body fluids – fluid compartments.
3.2 Classification of circulatory mechanisms.
3.3 Types of vertebrate hearts, heart rate, regulation and cardiac output, chemical and nervous control of heart rate.
3.4 Invertebrate hearts – annelids, scorpion, insect, crustacean, molluscan, and tunicate hearts.
3.5 Regulation of vertebrate circulatory systems.

15Hrs

UNIT IV – Control of Reproduction & Adaptations to Environment

4.1 *r* -selected and *k*- selected reproductive patterns; timing with respect to environmental variables, photo periods.
4.2 Hormonal control of insect growth and reproduction.
4.3 Hormones and development; sexual behaviour in vertebrates; pregnancy and parental care.
4.4 Influence of environmental factors on chromatophore systems.
4.5 Biological rhythms circadian - circumlunar and circannual rhythm.

PRACTICALS (All experiments involving live animals are for demonstration only)

1 Maze behaviour studies in rat.
2 Metabolic distinction of slow and fast muscles.
3 Kymographic studies of muscle properties.
4 Effect of temperature on heart beat of crab.
5 Effect of AchE and adrenaline on heartbeat in crab.
6 Effect of estrogen on serum calcium levels of rat.
7 Pregnancy testing by using HCG kit.
8 Dissection of nervous system of cockroach and crab, and their comparison.

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9 Dissection of male and female reproductive systems of cockroach and crab, and their comparison.
10 Submission of assignment **[To be submitted at the time of Examination – 5 Marks]**

Suggested Books

1 Comp. Animal Physiology by Ladd Prosser (Publ. W. B. Saunders, Philadelphia).
2 Comp. Animal Physiology by William Hoar, (Pub. E.E.E. IBH).
3 Animal Physiology – Adaptation and function., By F. Reed Hainsworth (Publ. by Addison-Wesley Publ. company, California).
4 Animal Physiology by Kent Schmidt Nielson (Publ. E.E.E. IBH).
5 Animal Physiology and adaptation by David Gordon.
6 Animal Physiology by Wilson.

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