FOURTH SEMESTER:
ZOO. 401: ANIMAL BEHAVIOUR

UNIT I

1. Introduction: Ethology as a branch of biology and animal psychology.
2. Classification of behavioral patterns, analysis of behaviour (ethogram)
3. Reflexes and complex behaviour
4. Perception of the environment: mechanical, electrical, chemical, olfactory, auditory and visual
5. Evolution and ultimate causation: Inheritance behaviour and relationships

UNIT II

6. Motivation: Drive, timing and interaction of drives, physiological basis of motivation, hormones and motivation, aggregation
7. Communication: Chemical, visual, light and audio, evolution of language
8. Ecological aspects of behaviour: Habitat selection, food selection, optimal foraging theory, anti-predator defences, aggression
9. Homing, Behaviour, dispersal, host-parasite relations
10. Biological rhythms: Circadian and circannual rhythms

UNIT III

11. Orientation and navigation, migration of fishes, turtles and birds,
12. Learning and memory: Conditioning, habituation, Insight learning, association learning, reasoning

UNIT IV

14. Social behaviour, aggregations, schooling in fishes, flocking in birds, herding in mammals, group selection, kin selection, altruism, reciprocal altruism, inclusive fitness,
15. Social organization in Insects

UNIT V

17. Neural and hormonal control of behaviour
18. Genetic and environmental components in the development of behaviour
19. Bioluminescence
20. Electric organs and behavior

Suggested Readings:
ZOOI. 402: BIOLOGY OF PARASITISM AND VERTEBRATE IMMUNE SYSTEM

UNIT I
1. Parasitism: Concept, origin, evolution, advantages and disadvantages in the parasitic life
2. Classification of parasites according to habitat, microenvironment and host specificity
3. Modes of parasitic invasion: Passive, mechanical, active, contact, transovarial pathways of entry and sites of habituation
4. Host specificity: Definition, origin, types, structural, physiological & pathological response, tissue, ecological and phylogenetic response
5. Host-parasite system: Effects of parasites on hosts (mechanical, nutritional, destructive, toxic etc.)

UNIT II
6. Host reactions to parasites: Resistance, compatibility and immunity
7. Innate and acquired immunity
8. Cells of immune system and their differentiation
10. Structure and functions of antibodies: Classes and subclasses, gross and fine structure, antibody mediated effector functions

UNIT III
11. Antigen-antibody interactions: Antibody affinity and avidity, gross reactivity, agglutination
12. Major histocompatibility complex in mouse and HLA system in human: MHC haplotypes, class-I and class-II molecules, cellular distribution, peptide binding, expression and diversity, disease susceptibility and MHC/HLA
13. T-cell receptors: Isolation, molecular components and structure, T-cell maturation and thymus, T-cell activation mechanism, T-cell differentiation, cell death and T-cell population

UNIT IV
14. B-cell generation, activation and differentiation: B-cell receptors, selection of immature and self reactive B-cells, B-cell activation and proliferation, T-B- cell interactions, humoral immune response and kinetics
15. Cytokines: Structures and functions, cytokine receptor, cytokines and immune response
16. Complement system: Complement activation & biological consequences
17. Cell-mediated effector functions: Cell adhesion molecules, effector cells and molecules, CTL and NK cells- mechanisms of action, delayed type hypersensitivity

UNIT V
18. Immune response to infectious diseases: Immune response to viral, bacterial, protozoan and other parasitic worms
19. Vaccines: Types of vaccines, active and passive immunization
20. Immunodeficiency disorders: Primary immunodeficiencies, secondary or acquired immunodeficiencies (AIDS)
21. Transplantation: Immunological basis of graft rejection, general and specific immunosuppressive therapy
D. ENTOMOLOGY

Zool. 403 (D): Insect Taxonomy, Ecology & Development

Unit I

1. Insecta: Salient features, scheme of classification
2. Classification of Apterygota with distinctive feature, economic importance and example
   of various orders and their subdivisions
3. Classification of Exopterygota upto orders with distinguishing characters and examples
4. Classification of the Dictyoptera upto families with distinguishing characters, economic
   importance and examples
5. Classification of the Orthoptera upto families with distinguishing characters, economic
   importance and examples

Unit II

6. Classification of the Hemiptera upto families with distinguishing characters, economic
   importance and examples
7. Classification of the Isoptera upto families with distinguishing characters, economic
   importance and examples
8. Classification of the Odonata upto families with distinguishing characters, economic
   importance and examples
9. Classification of the Thysanoptera upto families with distinguishing characters, economic
   importance and examples

Unit III

10. Classification of Endopterygota upto orders with distinctive features and examples
11. Classification of the Lepidoptera upto families with distinguishing characters, economic
    importance and examples
12. Classification of the Diptera upto families with distinguishing characters, economic
    importance and examples
13. Classification of the Hymenoptera upto families with distinguishing characters, economic
    importance and examples
14. Classification of the Coleoptera upto families with distinguishing characters, economic
    importance and examples

Unit IV

15. Social organization in termites
16. Social organization in honey bees
17. Influence of climatic factors on insect populations
18. Adaptations of insects to their surroundings (aquatic, terrestrial and parasitic)
19. Phytophagy in insects, insect - host plant relationship

Unit V

20. Structure of insect eggs, development of upto formation of gamma bands
21. Development and fate of embryonic membranes
22. Metamorphosis in insects
23. Types of insect larvae and pupae
24. Insect diapause
Zool. 404 (A): Applied Entomology

Unit I

1. Beneficial insects
2. Apiculture and beekeeping
3. Tea Culture
4. Sericulture

Unit II

5. Role of insects in plant pollination
6. Insects pests: Classification and categories of pests, origin and emergence of pests, pest out breaks and pest resurgence
7. Structure, life history, significance, nature of damage and control methods of
8. Following pests of sugarcane: (a) Scirpophaga (b) Chilozea (c) Pyrilla (d) Aleurolobus
9. Structure, life history, significance, nature of damage and control methods of following cotton pests: (a) Sylepta (b) Eriis (c) Pectinaphora (d) Dysdercu

Unit III

10. Structure, life history, significance, nature of damage and control measures of following oil seed pests: (a) mustard aphid (b) saw fly (c) castor semi-looper
11. Structure, life history, significance, nature of damage and control measures of following stored grain pests: (a) Sitophilus (b) Trogoderma (c) Rhizopertha (d) Tribolium (e) Bruchus (f) Sitotraga (g) Ephesia
12. Structure, life history, significance, nature of damage and control measures of following general pests: (a) grasshoppers & locusts (b) termites (d) aphids (c) hairy caterpillars
13. Household pests (cockroaches, crickets, ants, wasps, alferfish, cloth's moth, carpet beetle, furniture beetle, book lice, cigarettes beetles and their control

Unit IV

14. Role of insect as vectors of human diseases
15. Mosquitoes as pests of public health importance and their control
17. Live-stocks pests and their control
18. Different measures of insect pest control

Unit V

19. Detailed information and classification of insecticides and their mode of action
20. Merits and demerits of chemical insecticides and development of against them
21. Biological pest control
22. Integrated pest management
23. Account of the following: (a) Catalysts and synergists of insecticides (b) Systemic insecticides (c) Antifeedants (d) Attractants and repellents (e) Aerosols (f) Biopesticides (g) Microbial insecticides (h) Male sterility techniques (i) IGRs, third & fourth generation pesticides (j) Chitin synthesis inhibitors
C. ENDOCRINOLOGY

ZOOI 403 (C): MALE REPRODUCTIVE ENDOCRINOLOGY

UNIT I
1. Differentiation of the testes and male genital ducts
2. Histology of testes, epididymis, vasdeferens and seminal vesicles
3. Ultrastructure of testes
4. Structure and ultrastructure of mammalian sperm

UNIT II
5. Blood – testis barrier
6. Hormonal regulation and Spermatogenic function of the testis
7. Structure and functional significance of Sertoli cells
8. Structure and functional role of Leydig cells

UNIT III
9. Metabolism and biosynthesis of androgens
10. Biochemistry of semen
11. Maturation, transport and fate of spermatozoa in epididymis
12. Capacitation of spermatozoa

UNIT IV
13. Endocrine physiology of epididymis and seminal vesicles
14. Structure and function of coagulating glands, prostatic complex, Couter's gland and paraprostatal gland
15. Inhibin and activin
16. Sperm motility

UNIT V
17. Contraception through male
18. Effects of environmental factors on testicular function
19. Biological aspects of vasectomy
20. Male infertility
UNIT I

1. Differentiation of the ovary and female genital ducts
2. Histology of ovary, uterus, cervix and vagina
3. Ultrastructure of ovum
4. Estrous cycle in mammals

UNIT II

5. Menstrual cycle in primates
6. Endocrine control of structure and function of mammalian oviduct
7. Oviducal fluid composition and physiology
8. Puberty and its hormonal control

UNIT III

9. Implantation and its hormonal regulation
10. Pregnancy and its hormonal regulation
11. Hormonal regulation of parturition
12. Lactation and its regulation

UNIT IV

13. Placenta: Fine structure and types
14. Placental hormones and their significance
15. Corpus luteum and its functional significance
16. Prostaglandins and their role in reproduction

UNIT V

17. Physiological role of ovarian steroidal hormones
18. Chemistry and functions of human chorionic gonadotropin
19. Delayed implantation and its mechanism
20. Control of fertility in females

Suggested Readings:
Bentley, P.J. Comparative Vertebrate Endocrinology. Cambridge University Press,
Cambridge, U.K.
Hacket, M.E. Endocrinology.
CELL BIOLOGY

ZOOL 403 (B): NEUROBIOLOGY, AGEING & IMMUNOLOGY

UNIT I

1. Voltage gated channels in electrically excitable membrane
2. C-AMP and calcium as second messengers and their role in cellular regulatory mechanism
3. Protein phosphorylation and synapsin I in relation to neuronal regulation
4. Chemical synaptic transmission: Neurotransmitters and role of synaptic vesicles in nerve transmission

UNIT II

5. Chromatophores: Types, Structure Composition and functional signification
6. Autonomic neural Regulation of melanophores and color change
7. Intracellular motility: Axonal transport
8. Intracellular motility: Bi-directional movements of pigment in chromatophores

UNIT III

9. Aging: Theories of aging and current concepts
10. Apoptosis and cell death: Current concept and significance
11. Age associated neurodegenerative diseases: Alzheimer’s and Parkinson’s diseases

UNIT IV

13. Cells and tissues in immune system: General organization and functions
14. Innate and adaptive immunity
15. Antibody: Structure and Function
16. Antibody Diversity
   (a) Rearrangement in immunoglobulin genes
   (b) Recombination in immunoglobulin genes
17. Major histocompatibility (MHC) molecules

UNIT IV

18. Cell Mediated Immune Responses
19. Allergy
20. Auto Immunity
21. AIDS
ZOOI. 404 (B): CHROMOSOMES, GENES & GENETIC ENGINEERING

UNIT I

1. Molecular Organization of eukaryotic chromosome: Structure of nucleosome particles and higher order compaction of mitotic chromosomes; chromatin remodelling
2. Specialized chromosomes: Structural organization and functional significance of polytene chromosomes
3. DNA methylation and DNAase: I Hypersensitivity in relation to gene activity and chromatin organization
4. Organization and significance of heterochromatin

UNIT II

5. Structural organization of eukaryotic genes: Interrupted genes and overlapping genes
6. Gene families: Organization, evolution and significance
7. Transposable genetic elements of prokaryotes and eukaryotes
8. Gene mutations and molecular mechanisms of repair mechanisms

UNIT III

9. Organization of eukaryotic transcriptional machinery: promoter, enhancer, RNA polymerases, activators and repressors
10. Transcription factor: DNA binding domains and activation domains, Types of DBD (zinc finger steroid receptors, homeo domains, Helix loop, Helix and Leucine Zipper)
11. Eukaryotic transcription and eukaryotic transcriptional control
12. Environmental modulation of gene activity (stress response); stress genes and stress proteins

UNIT IV

13. Genetic basis of thalassemia, muscular dystrophy and cystic fibrosis
14. DNA rearrangement: Amplification during development with special responses to,
   (a) Ciliate protozoa
   (b) Drosophila Chorion gene
   (c) Xenopus 5S RNA genes
15. Drosophila development I: (a) Cleavage and (b) Gastrulation
16. Drosophila development II: Origin of anterior and posterior polarity (maternal effect genes and segmentation genes)

UNIT V

17. Drosophila Development II: Origin of dorsal and ventral polarity
18. Basic idea of homeotic selector genes and homeotic mutations
19. Basic idea of organization of homeoboxes
20. Evolutionary significance of homeoboxes

Suggested Readings:

COURSES FOR SPECIAL (ELECTIVE) GROUPS:

A. AQUATIC BIOLOGY AND AQUACULTURE

Zool. 403 (A) FISHERIES AND PISCICULTURE

UNIT I

1. Classification of commercially important fish fishes and shell fishes and their significance
2. Fishes and shell fishes of Madhya Pradesh
3. Reservoir and lake fisheries (with emphasis on Tighra reservoir)
4. Riverine fisheries
5. Estuarine and brackish water fisheries

UNIT II

6. Marine fisheries of India
7. Environmental factors (a biotic and abiotic) in relation to life of fishes
8. Exotic fishes, larvalid fishes and their significance
9. Common parasites of fishes, fish diseases, their control and treatment
10. Economic importance of fishes and their by-products

UNIT III

11. Cultivable species of inland fishes and principle of their selection
12. Predatory fishes and their importance in fish culture
13. Plankton and their importance in fish culture
14. Fish ponds and their hydrobiological requirements,
15. Principles of genetics, hybridization and sex determination in fish

UNIT IV

16. Transgenic fish, formation and importance
17. Traditional verses modern fish culture practices
18. Paddy cum fish culture and its significance
19. Sewage fish culture and its importance
20. Fish net, gears and method of fishing

UNIT V

21. Fish preservation technology and packaging
22. Marketing of fishes and role of co-operative societies
23. Fisheries and rural development
24. Fisheries legislation
25. Fisheries development in Madhya Pradesh
UNIT I

1. Identification of stages of life histories of important cultivable fishes and prawn
2. Natural breeding, bundh breeding and induced breeding of carps through hypophysation and drugs
3. Planning and designing of freshwater fish farms
4. Management of rearing, nursery and stocking ponds

UNIT II

5. Transport of live fish and fish seed
6. Planning and management of brackish-water fish farms
7. Nutritional requirements of fish and artificial diet
8. Freshwater aquaculture, prospects and management
9. Methods of aquaculture: Pen culture, cage culture, bottom and off bottom culture

UNIT III

10. Integrated fish farming in India: Agriculture-cum-fishery, trapa-cum-fishery, poultry-cum-fishery, piggery-cum-fishery, poultry-piggery-fishery
11. Economical aspect of fish culture management
12. Freshwater prawn culture practice in India
13. Brackish water prawn culture development in India

UNIT IV

14. Prospects and development of mariculture: Pearl culture, mussel culture and oyster culture
15. Frog culture: Species, breeding, culture and polyculture with fish
16. Culture of freshwater macrophytes (Azolla) and algae (Spirulina)
17. Prospects and development of turtle fishery

UNIT V

18. Breeding and rearing of crocodiles, crocodile industry: Indian and international perspective
19. Production of Jayanti culture of fresh water oyster for pearls, and sea weed culture
20. Whaling industry: Sustainable utilization
21. Major aquatic resources: Export and economic status in India

Suggested Readings:

Nikolsky, G.V. The Ecology of Fishes. Academic Press.
Srivastava, C.B.L. Fishery science and fisheries Kitab Mahal.
UNIT I

1. Outline classification of fishes as proposed by Berg
2. Classification of Elasmobranchii
3. Classification of Crossopterygii
4. Classification of Actinopterygii

UNIT II

5. Systematic survey of fish with particular reference to inland fishes of M.P.
6. Exotic fishes and their importance
7. Larvicidal fishes and their importance in public health
8. Predatory fishes and their significance in fish culture

UNIT III

9. Working and maintenance of fish aquarium
10. Fish nets and gears and methods of fishing
11. Fish diseases, symptoms and treatment
12. Common weeds of fish ponds and their control
13. Fish parasites and their control

UNIT IV

14. Physico-chemical characteristics of fish pond
15. Biological characteristics of fish pond
16. Culturable species of fishes of inland water and basis of their selection
17. Plankton and their significance in fish culture

UNIT V

18. Primary productivity of fish ponds and its significance
19. Aquatic macrophytes and culture of Azolla
20. Aquatic algae and culture of Spirulina
21. Sea weeds and their significance
ZOOI. 404 (E): PISCICULTURE AND ECONOMIC IMPORTANCE OF FISHES

UNIT I

1. Collection of fish seed from natural resources
2. Dry bundh breeding of carps
3. Wet bundh breeding of carps
4. Hypophyseal and breeding of Indian major carps
5. Drugs useful in induced breeding of fish

UNIT II

6. Types of ponds required for fish culture farms
7. Management of hatcheries, nurseries and rearing ponds
8. Management of stocking ponds
9. Composite fish culture
10. Integrated fish culture in India

UNIT III

11. Fresh water and brackish water Prawn culture in India
12. Pearl Oysters and pearl culture in India
13. Edible Oysters and Oyster culture in India
14. Methods of fish preservation
15. Marketing of fish in India

UNIT IV

16. Economic importance and by-products of fishes
17. Shark liver oil industry in India
18. Transport of live fish and fish seed
19. Fisheries and prawn resources of M.P.

UNIT V

20. Riverine fisheries in India
21. Coastal fisheries in India
22. Offshore and deep sea fisheries in India
23. Role of fisheries in rural development
24. Fishery co-operative societies and their role in development of fisheries