St. Aloysius College (Autonomous), Jabalpur

Department of Zoology

M.Sc. ZOOLOGY - IV Semester

Choice Based Credit System (CBCS)

Scheme of Examination (w.e.f. Session 2023-24)

Course No.	Course Title	Credits	Marks	
			Max. Marks	Min.Marks For Passing
CORE COURSES				
ZC-401.	Animal Behaviour and Neurophysiology	4	40	14
ZC - 402.	Gamete Biology, Development and Differentiation	4	40	14
ELECTIVE COURSE - (Any 01)				
ZE -403	• Pure and Applied fisheries • Molecular Endocrinology and Vertebrates Immune System	4	40	14
ZD - 404	**DISSERTATION**			
	Abstract Review of literature Methodology Analysis and interpretation Presentation Viva	4	05 05 05 10 10 15 50	18
INTERNAL ASSESSMENT				
ZI -405	CCE-Written test (Based on ZC -401, 402 & ZE -403) (Each test of 10 marks)	0	30	12 (04 in each Test)
ZI -406	Internship Project	4	50	18
ZI -407	Comprehensive • Viva-Voce • Report	1	50	18
PRACTICALS				
ZP -408	Practical- I Based on Course ZC -401 & ZC-402	2	50	18
ZP -409	Practical- II Based on Course ZE - 403	2	50	18
SKILL BASED COURSE				
ZS-410	Skill Based Course	1	10	4
Total Credits & Total Marks		**26**	**410**	**148**

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CORE COURSE

Paper I- Animal Behaviour and Neurophysiology Max.M.-40

Unit-I	1.Introduction: - Ethology as a branch of biology. - Animal psychology, classification of behavioral patterns, analysis of behavior (ethogram) 2. Reflexes and complex behaviour. 3. Perception of the environment wsr mechanical, electrical, chemical, olfactory, auditory and visual receptors . 4. Evolution of proximate and ultimate causation wsr inheritance of behavior and relationships.
Unit-2	1. Neural and hormonal control of behaviour. 2. Genetic and environmental components in the development of behaviour. 3. Motivation: Drive,timing and interaction of drives, physiological basis of motivation, Hormones and motivation. 4. Types of Communication: Chemical, visual, light, audio communication and sonotaxonomy wsr bird call. 5. Evolution of language (primates). 6 Bioluminescence and Colouration in fishes
Unit -3	1.Ecological aspects of behaviour: Habitat selection, food selection, Optimal foraging theory, anti-predator defenses, homing territoriality, dispersal, host parasite relations. 2.Biological rhythms: Circadian and circannual rhythms, orientation and navigation, migration of fishes, turtles and birds. 3.Learning and memory: Association learning wsr conditioning, habituation, insight learning and reasoning 4.Memory –Basic concept and types

Unit-4	1.Reproductive behaviour.Evolution of sex and reproductive strategies,mating systems,courtship,sexual selection., Parental care in fishes . 2.Social behaviour. Aggregations,Schooling in fishes,Flocking in birds,Herding in mammals, Group selection, 3. Kin selection. 4. Social organization in insects and primates.
Unit-5	1. Human Ethology -Ethological concept and human behavior. -Concept of sign stimuli. -Concept of imprinting. -Kinships of human social systems -Human Pheromones. 2. Territorial behavior. 3. Aggressive behavior. 4. Altruism

Suggested Readings-

1.Eibl-Eibesfeldt, I.Ethlogy.The biology of Behaviour.Holt, Rineheart & Winston, NewYork.

2.Gould, J.L. The mechanismand Evolution of Behaviour.

3.Kerbs.J.R.and N.B.davies:Behaviourable Ecology.Blackwell,Oxford, U.K.

4.Hinde, R.A. Animnal Behaviour: A Synthesis of Ethology and Comparative Psychology. McGrawHill, NewYork.

5.Alcock, J. AnimalBehaviour :An Evolutionary approach.Sinauer Assoc.Sunderland, Massachsets,USA.

6.Bradbury, J.W. and S.L. Vehrencamp. Principles of Animal Communication.Sinauer Assoc.Sunderland,Massachsets,USA.

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CORE COURSE

Paper-II - Gamete Biology, Development and Differentiation **M.M-40**

Unit-1	1. Differentiation of gonads in mammals and its genetic basis. 2. Spermatogenesis: Morphological basis in rodents. 3. Gamete specific gene expression and genomics 4. Biochemistry of Semen: Semen composition and formation, assessment of sperm function. 5. Fertilization: Pre fertilization events biochemistry of fertilization post fertilization events.
Unit-2	1. Ovarian follicular growth and differentiation: morphology, endocrinology, molecular biology of oogenesis 2. Vitellogenesis in Amphibia. 3. Hormonal regulation of ovulation and ovum transport in mammals. 4. Multiple ovulation and embryo transfer technology wsr in vitro oocyte maturation, superovulation and elementary idea of IVF.
Unit-3	1. Hormonal regulation of pregnancy and parturition. 2. Hormonal regulation of development of mammary gland and lactation. 3. Endocrinology and Physiology of placenta. 4. Cryopreservation of Gametes and Embryo. 5 Teratological effects of Xenobiotic on gametes. 7. Melanogenesis.
Unit-4	1. Cell commitment and differentiation. 2 Germ cell determinants and germ cell migration. 3 Early development of fish upto gastrulation 4 Types of morphogenetic movements in Frog. 5 Concept of totipotency and pleuropotency. 6 Competence and Induction, primary and secondary inducers. 7 Primary neurulation.

Unit-5	1.	Stem cell concept: Potency definition of stem cells, Embryonic and adult stem cell.
	2.	Adult stem cell niches.
	3.	Mesenchymal stem cells.
	4.	Epidermal stem cell culture.
	5.	Connective tissue cell family
	6.	Haemopoietic stem cells: Blood cells formation,
	7.	Stem cell disorders.

SuggestedReading:

1. Long J.A.EvanH.M.1922: The oestrous cycle in the Rat and its associated phenomenon.
2. Nalbandou.A.C.–Reproductive physiology
3. PrakashA.S.1965-66Marshall's,Physiology Reproduction(3Vol.)
4. Gilbert,S.F.Developmenal Biology,SinauerAssociated Inc.Massachulsetts.
5. EthanBier,the cold Spring.The cold spring Harbor laboratory Press,NewYork.
6. BalinskyB.I.Introduction to Embryology sanders,Phliedelphia.
7. Berril N.J.and Karp.G.Development Biology.McGrawHill NewYork.
8. Davidson.E.H.Gene Activity During Early Development.Academic Press,New York.

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ELECTIVE COURSE

Paper III: Pure and Applied fisheries

Max M.: 40

Unit-1	1.	Origin and outline of evolution of fishes
	2.	Classification of fishes as proposed by Berg
	3.	Structure of fish integument, development of placoid scale and types of Scales.
	4.	Growth studies wsr Age determination in fishes.
	5.	Elementary idea of morphometric and meristic characters of fishes.
	6.	Locomotion in fishes
Unit-2	1.	Alimentary canal and digestion in Elasmobranch [Scoliodon] and teleost fish [Clarias].
	2.	Accessory respiratory organs wsr in Clarias, Anabas and Heteropneustes.
	3.	Air bladder, Weberian ossicles and their functions.
	4.	Structure of heart and arrangement of blood vessels in gills.
	5.	Excretion and Osmoregulation.
Unit-3	1.	Nervous system of fishes.
	2.	Venomous fishes.
	3.	Deep sea adaptations in fishes.
	4.	Hill stream adaptations in fishes.
	5.	Migration in fishes
	6.	Sexual cycle and fecundity of fishes
Unit-4	1.	Collection of fish seed from natural resources.
	2.	Dry and Wet Bundh breeding of carps.
	3.	Method of Hypophysation .
	4.	Importance of genetic engineering in fishes with examples.
	5.	Quarantine measures- Fish quarantine procedure.
	6.	Basic varieties of fish feed.
Unit-5	1.	Management of Hatcheries, Nurseries and Rearing Pond.
	2.	Management of stocking ponds.
	3.	Common aquatic weeds and control.
	4.	Methods of fish preservation.
	5.	By product of fishes.
	6.	Transport of live fish & fish seeds.
	7.	Marketing of fishes in India.

Suggested Readings:

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

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ELECTIVE COURSE

Paper III: Molecular Endocrinology and Vertebrates Immune System

Max M. : 40

Unit-1	1. Chemical nature of hormones. 2. Mechanism of hormone action. 3. Regulation of T_3& T_4 hormone concentration in blood 4. Hormonal Control of Gene Expression wsr Glucocorticoid 5. Eicosanoids and their hormone action.
Unit-2	1. Bioassay of Androgen wsr androgen doping 2. Hormonal regulation of energy metabolism. 3. Hormone receptor antagonist and antihormone therapy 4. Hypothalamic nuclei and their physiological function. 5. Extraction of Gonadotropin from urine
Unit-3	1. Tissues of Immune system- Primary lymphoid organs (Thymus),Secondary lymphoid organs (Spleen). 2. Immune cells wsr lymphocytes ,macrophages and natural killer cells 3. Antigen processing and presentation 4. B-cell and T-cell receptor 5. B-cell and T-cell activation.
Unit-4	1. Structure and types of Immunoglobulin 2. Gene model for Immunoglobulin gene structure wsr Two Gene Model of Dreyer and Bennett 3. Autoimmune diseases wsr autoimmune haemolyticanaemia 4. Antibody dependent cytotoxic reaction. 5. Delayed type cell mediated hypersensitivity type IV reaction.
Unit-5	1. Immunodiagnostics with special reference to – a) Immunostaining wsr Immunohistochemistry b) Immunoblotting / western blot c) Immunochromatography. 2. Immunization .

Suggested Readings:

1. Principles of Anatomy and *Physiology*, Gerard J. *Tortora*,
2. Benjamin Lewim – Genes VII/ VIII, oxford University press.
3. Lodishetal- Molecular Cell Biology.
4. Zarrow, M.X., Yochin J.M. and Machrthy, J.L. – ExperimentalEndocrinology.
5. Chatterji C.C.- Human Physiology (Vol- II).
6. Bentley, P.J. – Comparative Vertebrate endocrinology.
7. Hadley Mac. E.- Endocrinology.
8. Chinoy, N.J. Rao, M.V., Desarai, K.J. and High land, H.N. – Essential techniques in reproductively physiology and Endocrinology.
9. Norris, D.O. – Vertebrate Endocrinology.
10. Kuby, Immunology, W.H. Freeman, U.S.A.
11. W. Paul. Fundamentals of Immunology.
12. I.M. Roitt. Essential Immunology, ElBS Edition.
13. David Randall:Animal Physiology (Eckert's)
14. D.P. Anderson: Text Book of Fish Immunology.
15. Joshi & Osamo : Immunology & Serology
16. David Male: Advanced Immunology

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Practical-I

(Based on Core Courses: Paper I & II)

M.M.:50

1. **Exercise on Animal behavior**

   a) Taxes – Hydrotaxis, Chemotaxis, Geotaxis, Phototaxis
   b) Reflexes
   c) Social behavior
   d) Learning behavior- Trial and error learning using step maze

2. **Developmental Biology**

   a) Study of embryological slides [Frog & chick]
   b) Preparation of permanent chick mount
   c) Study of different stages of spermatogenesis (slides of meiosis)
   d) Semen analysis –sperm count and sperm motility

Scheme for Practical Examination

1.	Exercise based on animal behavior	20
2.	Exercise based on developmental biology	15
3.	Practical record / Collection	10
4.	Viva Voce	05
	Total	**50 Marks**

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Practical-II

(Based on Elective Course: Paper III)

1. Western Blotting.
2. Widal screening test.
3. Detailed histological structure of Major Lymphoid Organs like spleen, thymus, Bone marrow, lymph nodes and Peyer's patches.
4. Demonstration of antigen and antibody reaction through simple experiments
   a. Agglutination
   b. Immunodiffusion
   c. Immunoelectrophoresis
5. ELISA
6. Viva Voce
7. Practical record & Survey of diseases recorded in local hospitals

Scheme for Practical Examination

M:M 50

Time: 5 hour

1. Western Blotting.	10
2. Immunodiffusion	06
3. Widal screening test.	05
1. ELISA/ Immunoelectrophoresis	06
2. Spotting based of slides of Major Lymphoid Organs.	08
3. Viva Voice.	05
7. Practical record & Survey of diseases recorded in local hospitals	10
Total	**50**

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Practical-II

(Based on Elective Course : Paper III)

1. Major dissection Nervous system of Scoliodon and Digestive system of Clarias
2. Minor Dissection-Accessory respiratory organs /Reproductive system of Clarias /Heteropneustes
3. Age determination of teleost fish with the help of scales
4. Identification of fish (10 fishes)
5.Spotting of museum Specimen ,slides and bones of fishes.

Scheme for Practical Examination

Time: 5 hour	**M:M 50**
1. Major dissection.	10
2. Minor dissection	06
3. Age determination of fish with the help of scales.	05
4. Identification of fish.	06
5. Spotting of museum specimen, slides and bones.	08
6. Viva Voce.	05
7.Practical record & survey of local fish market	10
Total	**50**