

Shiksha Mandal's
Bajaj College of Science, Wardha
(An Autonomous College)

P. G. Department of Zoology

Syllabus for M.Sc. Zoology (Semester Pattern)

Choice Based Credit System

As Per NEP

Session 2023-24

Bajaj College of Science, Wardha
(An Autonomous College)
Department of Zoology
Syllabus for M.Sc. Zoology (Semester Pattern)
Semester – II
Choice Based Credit System
As Per NEP

Semester-II

DSC – 5 - Structure and Function of Vertebrates

Unit-I

- 1.1 Origin and ancestry of Chordata.
- 1.2 General organization and affinities of Cephalochordata.
- 1.3 Structure, development and metamorphosis of Amoecoetus.
- 1.4 General characters and affinities of Dipnoi.

Unit-II

- 2.1 Organs and mechanism of respiration in Pisces and Amphibia.
- 2.2 Vertebrate integument and its derivatives.
- 2.3 Appendicular skeleton (Limbs and girdles) in Amphibia, Reptilia, Aves and Mammals.
- 2.4 General body organization and classification in Chelonia.

Unit-III

- 3.1 Evolution of urinogenital organs in vertebrates.
- 3.2 Origin of Birds.
- 3.3 Cetacea: general characters and adaptations.
- 3.4 Comparative anatomy of the brain in vertebrates (teleost, frog, lizard, fowl and rat).

Unit- IV

- 4.1 Autonomous nervous system in vertebrates: structure and functions.
- 4.2 Evolution of heart in vertebrates.
- 4.3 Sense organs in vertebrates.
- 4.4 Evolution of Man.

Biochemistry-II

Semester – II :-

DSC – 6 – Biochemistry of Metabolic processes

UNIT I: Bioenergetics and Metabolism-I

- 1.1 Cell bioenergetics: First and second law of thermodynamic, internal energy, enthalpy, entropy.
- 1.2 Glycolysis: Anaerobic pathway of glucose metabolism, two phases of glycolysis, Gluconeogenesis.
- 1.3 Citric acid cycle: Aerobic pathway of glucose metabolism.
- 1.4 Alternate pathways of carbohydrate metabolism: Pentose phosphate pathway, glyoxylate cycle.

UNIT II: Bioenergetics and Metabolism-II

- 2.1 Lipid metabolism: Beta oxidation of saturated and unsaturated fatty acids.
- 2.2 Oxidation of fatty acids with odd number of carbon atoms, formation of ketone bodies.
- 2.3 Electron transport chain: Mitochondrial organization, Components and reactions of electron transport chain.
- 2.4 Oxidative phosphorylation. Inhibitors of oxidative phosphorylation.

UNIT-III: Bioenergetics and Metabolism III

- 3.1 Metabolism of amino acids: Transamination, Deamination
- 3.2 Biosynthesis of Purine and pyrimidine nucleotides.
- 3.3 Urea cycle, regulation of urea cycle.
- 3.4 Integration between urea cycle and TCA cycle. Metabolic disorders of urea cycle.

UNIT-IV: Hormones and Metabolic disorders

- 4.1 Classes of Hormones: Peptide. Amine and Steroid
- 4.2 Peptide (Insulin and Glucagon) and Steroid hormone (Testosterone): Mode of Action
- 4.3 Vitamins: Types and Significance
- 4.4 Neurohormones (Nitric oxide, Dopamine): Mode of action

M.Sc. Semester-II

DSC – 7 - Practical based on Structure and Function of Vertebrates

1. Study of museum specimens using already available specimens in the museum/

charts/ models/ photographs/ digital alternatives etc.

Classification of vertebrates up to order and comments on the specimens representing all phyla.

2. Anatomical Observations

Anatomical observations, demonstration and detailed explanation of the following with the help of ICT tools/ models/ charts/ photographs etc.

- a) Brain and cranial nerves- Fish/ Rat.
- b) Arterial and venous systems- Fish/Rat
- c) Urinogenital system- Fish/Rat.
- d) Reproductive systems- Fish/Rat.
- e) Internal ear in fish, Weberian ossicles in fish, accessory respiratory organs in fish.

3. Mounting:

Study of Stained Permanent preparation of scales, ampullae of Lorenzini, otolith, striated muscles and cartilage of fish using animal wastes from local recognized fish markets or with the help of already available permanent slides/ ICT tools/ charts/ photographs etc.

4. Microtomy, Histology and Skeleton

- a. Fixation, embedding, sectioning and staining of the internal organs of vertebrates (Source of tissue: Animal wastes from local recognized slaughter houses/ poultry farms/ fish markets etc.)
- b. Study of slides of internal organs of vertebrates with the help of already available permanent slides/ ICT tools/ models/ charts/ photographs etc.
- c. Axial and appendicular skeleton of fowl and rabbit using already available skeleton/ ICT tools/ models/ charts/ photographs etc.

Distribution of Marks

Internal Assessment (Practical)

Sr. No	Evaluation type	Marks
1	Lab based assignments, Projects, Survey, Case study, etc.	15
2	Internal Viva	15
3	Practical Record	20
Total Marks		50

End Semester Exam (External)

1. Anatomical observations of fish/rat	10
2. Stained permanent preparation:	10
3. Identification and comment on the spots (1-5)	10
4. Submission of stained permanent slides	05
5. Histological staining of endocrine gland	10
6. Viva-voce	05

Total Marks 50

M.Sc. - Semester-II

DSC - 8 – Practical Based on Biochemistry of Metabolic Process

- Separation of amino acids by two-dimensional TLC.
- Separation of amino acids by descending\ascending paper chromatography.
- Estimation of glycine by Sorenson's formol titration.
- Paper electrophoresis of serum proteins
- Gel electrophoresis of serum proteins
- Separation of proteins by SDS-PAGE and Native PAGE
- Demonstration of Western Blot
- Isolation of DNA and RNA from various samples.
- Extraction and estimation of DNA from coconut endosperm
- Separation of DNA by Agarose Gel Electrophoresis.
- Estimation of vitamin-C in lemon and oranges.
- Estimation of Urease

M.Sc. - Semester-II

DSC - 8 – Practical Based on Biochemistry of Metabolic processes

Distribution of Marks

Internal Assessment (Practical)

Sr. No	Evaluation type	Marks
1	Lab based assignments, Projects, Survey, Case study, etc.	15
2	Internal Viva	15
3	Practical Record	20
Total Marks		50

End Semester Exam (External)

1. Histochemical demonstration of DNA/RNA protein / carbohydrate/lipids/enzymes	10
2. Estimation of sugar/protein/DNA/RNA/ qualitative analysis of saliva/bile	10
3. Biochemistry experiment I	10
4. Biochemistry experiment II	10
5. Submission of stained permanent slides	05
7. Viva voce	05

Total Marks	50

Semester-II

DSE 2 – Elective – I - Molecular Biology and Biotechnology

Unit-I

- 1.1 Cot $\frac{1}{2}$ and Rot $\frac{1}{2}$ values, organelle genome, DNA structure, forms of DNA.
- 1.2 DNA replication – molecular mechanisms of prokaryotic and eukaryotic DNA replication, regulation of replication.
- 1.3 DNA damage and repair – types of DNA damages, excision repair system.
- 1.4 Mismatch repair, recombination repair, double strand break repair, and transcription coupled repair.

Unit-II

- 2.1 Transcription- prokaryotic and eukaryotic transcription, RNA polymerases, transcriptional unit, initiation, elongation, termination, transcriptional factors.
- 2.2 Regulation of transcription – Operon, positive and negative control, attenuation phage strategies, anti-termination, response elements and inducible elements.
- 2.3 Translation - prokaryotic and eukaryotic translation, genetic code, altered code in elongation, termination factors, fidelity of translation, post translational modifications.
- 2.4 Mobile DNA elements – transposable elements, IS elements, P elements, retroviruses, retrotansposons.

Unit-III

- 3.1 Antisense and ribozyme technology – initiation of splicing, polyadenylation, molecular mechanisms of antisense molecules, miRNA, siRNA, gene silencing.
- 3.2 Isolation and sequencing of DNA, gene amplification, PCR, RAPD, RFLP, Maxam-Gilbert, Sanger's dideoxy methods.
- 3.3 Splicing and Cloning – Cloning vectors for recombinant DNA technology- plasmids, cosmids, phagemids, YACS, gene replacement, restriction enzymes.
- 3.4 Hybridization techniques – Southern- Northern hybridization, microarray.

Unit-IV

- 4.1 Medical biotechnology- Application of restriction fragment length polymorphism (RFLP) in forensic science, disease prognosis and genetic counseling.
- 4.2 Agricultural biotechnology- biofertilizers, bioinsecticides, biogas.
- 4.3 Immunobiotechnology-Hybridoma technology and monoclonal antibodies.
- 4.4 Industrial and Environmental biotechnology-microbial production of fermentation products, enzymes, antibiotics, single Cell proteins and biosensors.

Semester-II

DSE – 2 - Elective II- Basic Endocrinology of Invertebrate & Vertebrate

Unit-I

- 1.1 Hormones and functions in Coelenterata and Helminths.
- 1.2 Neurosecretory system in Annelida: structure, hormones and functions.
- 1.3 Neuroendocrine system in Mollusca: structure, hormones and functions.
- 1.4 Hormones and functions in Echinodermata.

Unit-II

- 2.1 Neuroendocrine system in crustacean; structure and hormones.
- 2.2 Endocrine control of metamorphosis, reproduction and colour change mechanisms in crustacea.
- 2.3 Cephalic neuroendocrine system in insects: structure and hormones.
- 2.4 Endocrine control of metamorphosis and reproduction in insects.

Unit-III

- 3.1 Pineal organ: structure, hormones and functions.
- 3.2 Hypothalamo hypophysial system: structure, hypothalamic nuclei, hormones and function.
- 3.3 Pituitary: cell types, hormones and functions.
- 3.4 Thyroid: Structure, hormones and function.

Unit-IV

- 4.1 Parathyroid ultimobranchial glands: Structure, hormones and regulatory mechanisms.
- 4.2 Gastro-entero-pancreatic endocrine system: endocrine pancreas and gastro intestinal tract: endocrine cells, hormones and functions.
- 4.3 Adrenal gland: structure, hormones and functions in vertebrates.
- 4.4 Gonadal hormones in vertebrates and their hormonal actions, feedback mechanisms.

OJT or FP or CS – Apprenticeship or Field project or Case study

List of Books for reference

M.Sc. - Semester-II

Structure and function of Vertebrates

1. Alexander R.N., The Chordata, Cambridge University Press London.
2. Barrington EJW, The Biology of Hemichordates and Protochordates, Oliver and Boid Edinberg.
3. Bourne G.H., The structure and function of nervous tissue Academic press New York.
4. Kingslay J.S, Outlines of Comparative anatomy of vertebrates, Central Book Depot, Allahabad.
5. Honyelli A.R. The Chordates Cambridge University Press, London
6. Smith H.S. Evolution of Chordate structure, Hold Rinehart and Winton Inc. New York
7. Walter H.A. and Sayles L.D. Biology of Vertebrates Macmillan and co. New York
8. Romer A.S. Vertebrate body W.P. Sanders co., Philadelphia.
9. Young J.Z. Life of Vertebrates Oxford University Press, London.
10. Young J.Z. Life of Mammals Oxford University Press, London.
11. Colbert E.H. Evolution of Vertebrates John Wiley and sons Inc. New York.
12. Kent C.J. Comparative anatomy of Vertebrates.
13. Waterman A.J. Chordate Structure and Functions Macmillan Co. New York.
14. Montagna W. Comparative anatomy clarendon press, Oxford
15. Weichert C.K. Preach W. Elements of Chordates anatomy McGraw-Hill book co., New York.
16. Lovettrup S. The phylogeny of Vertebrates John Wiley and sons Inc., London.
17. Joysey K.A. and Kemp T.S. Vertebrate Evolution Oliver and Boyd, Edinberg.
18. Romer A.S. Vertebrate Paleontology University of Chicago Press, Chicago.
19. Newman Phylum Chordata.
20. Goodrich E.S. Structure and development of vertebrates. Dover publications Inc., New York
21. Hardisty M.W. and Potter I.C. Biology of Lampreys Academic Press New York
22. T.B. of Zoology Parker and Haswell W.A. Macmillan co. Ltd. London
23. The Biology of Amphibia Noble G.K. Dover Publication Inc New York

Biochemistry of metabolic processes

1. Lehninger-Principles of biochemistry.
2. Donald Voet and Judith Voet- Biochemistry.
3. Harper -Biochemistry.
4. Jeremy M. Berg, John L. Tymoczko, Lubert Stryer- Biochemistry.
5. U. Satyanarayana, U. Chakrapani -Biochemistry.

Molecular Biology and Biotechnology

1. Harper's Review of Biochemistry, Prentice Hall.
2. Principles of Biochemistry by Lehninger and Nelson, CBS publications and Distributors.
3. The Biochemistry "Students companion" by Allen J. Scism, Prentice Hall.
4. Fundamentals of Biochemistry by Jain J. L., S. Chand Publication.
5. Principles of Biochemistry by Zubay J. L., WM. C. Brown Publishers.
6. Principles of Biochemistry by Horton, Prentice Hall.
7. Concept of Biochemistry by Boyer R., Coel publication co.
8. Harper's Biochemistry eds. Murray, R. K. P. and Granner, D. K. Prentice Hall.
9. Biochemistry by Mathews C. K. and Van Holde K. E., Benjamin C. publishing Co.
10. Biochemistry by Garrett R. H. and Grisham C. M., Saunders College publication.
11. Cell and Molecular Biology by De Robertis- E. D. P., I. S. E. publication.
12. Molecular Biology by Turner P. C. and Mc Lennan , Viva Books Pvt. Ltd.
13. Advanced Molecular Biology by Twyman R. M., Viva Books Pvt. Ltd.
14. Molecular Biology by Freifelder D., narosa publication House.
15. Gene VI by Benjamin Lewis, Oxford press.
16. Gene VIII by Benjamin Lewis, Oxford press.
17. Molecular biology of Gene by Watson J. D. et. al., Benjamin publication.
18. Molecular cell Biology by Darnell J. Scientific American Books USA.
19. Molecular Biology of the Cell by Alberts B., Bray D. Lewis J., garland publishing Inc.
20. Genetics Vol. I and II by Pawar C. B., Himalaya publication.
21. Essentials of Molecular Biology by Freifelder D., narosa publication House.
22. Molecular Cell Biology by Laodish H., Berk A., Zipursky S. L., Matsudaira P., Baltimore D. and Darnell J., W. H. Freeman and Co.
23. The Cell: Molecular Approach by Cooper G. M.
24. Molecular Biology by Upadhyay A and Upadhyay K. Himalaya publication.

Basic Endocrinology for Invertebrate & Vertebrate

1. General & Comparative Endocrinology: E.J.W., Barrington, Oxford, Clarendon Press.
2. Text Book of Endocrinology: R.H. Williams, W.B. Saunders.
3. Endocrine Physiology: C.R. Martin, Oxford University Press.
4. Comparative Endocrinology: A Gorbman et al, John Wiley & Sons.
5. Medical Physiology: W.F. Ganong (1981): 10th Edn. Lange Medical Publications.
6. Principles of Anatomy and Physiology: Tortora Grabowski, 9th Edn., John Willey & Sons.
7. Reproductive Physiology of Vertebrates: Van Tienhoven, A. (1983): 2nd Edn. Cornell Univ. Press, New York.
8. The Pituitary Gland: Imura, H. (1994), 2nd Edn., Comprehensive Endocrinology Revised Series Raven, New York.
9. Comparative Vertebrate Endocrinology: Bentley, P.J. (1976) Cambridge University Press, Cambridge.
10. General & Comparative Endocrinology: E.J.W., Barrington, Oxford, Clarendon Press.
11. Text Book of Endocrinology: R.H. Williams, W.B. Saunders.
12. Comparative Vertebrate Endocrinological: Bentley, P.J. (1976) Cambridge University Press, Cambridge.
13. Invertebrate endocrinology: D. B. Tembhare, Himalaya publishing House (2012) 23

BAJAJ COLLEGE OF SCIENCE, WARDHA
(An Autonomous College)
Master of Science (M.Sc.) Semester-II (C.B.C.S.) (Zoology) Examination
Marking Scheme of Question Paper

Paper Code:_____ Paper Name: Zoology

Time: 3 hours

Max. Marks: 60

- NOTE: (1) All questions are compulsory.
(2) There are total five (5) questions in the question paper.
(3) Each question carries twelve marks.

UNIT	Question No.	Sub-questions	Marks
UNIT I	Que. 1	A. B. OR C. D.	6 Marks 6 Marks OR 6 Marks 6 Marks
UNIT II	Que. 2	A. B. OR C. D.	6 Marks 6 Marks OR 6 Marks 6 Marks
UNIT III	Que. 3	A. B. OR C. D.	6 Marks 6 Marks OR 6 Marks 6 Marks
UNIT IV	Que. 4	A. B. OR C. D.	6 Marks 6 Marks OR 6 Marks 6 Marks
	Que. 5	Solve any four	3× 4 = 12 Marks
UNIT I		(a) (b)	3 Mark 3 Mark
UNIT II		(c) (d)	3 Mark 3 Mark
UNIT III		(e) (f)	3 Mark 3 Mark
UNIT IV		(g) (h)	3 Mark 3 Mark

(* - The CO i.e. course outcome mapping and BTKL i.e. Blomm's Taxonomy knowledge level should be given by paper setters. All the question papers kept in Department and library records should be in above format. The Co mapping and BTKL need not be mentioned in question papers distributed to students during exam.)

