

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY



CIRCULAR NO.SU./B.Sc.CBC & GS/11/2022

It is hereby inform to all concerned that, on the recommendation of Faculty of Science & Technology Meeting dated 24.08.2022, **the Academic Council at its meeting held on 29 August 2022 has accepted the following Syllabi of B.Sc. Degree under the Choice Based Credit & Grading System along with Rules and Regulation** as appended herewith:-

1.	B.Sc.Computer Science (Optional)	Ist and IInd semester
2.	B.Sc.Computer Application (Optional)	Ist and IInd semester
3.	B.Sc.Computer Application (Degree)	Ist and IInd semester
4.	B.Sc.Computer Science (Degree)	Ist and IInd semester
5.	B.Sc.Horticulture (Optional)	Ist to VIth semester
6.	B.Sc.Botany (Optional)	Ist to VIth semester
7.	B.Sc. Agrochemical & fertilizer (Optional)	Ist to VIth semester
8.	B.Sc.Home Science (Optional)	Ist and IInd semester
9.	B.Sc.Automobile Technology (Degree)	Ist and IInd semester
10.	B.Sc.Workshop Technology (Degree)	Ist and IInd semester
11.	B.Sc.Refrigeration and Air Conditioning (Degree)	Ist and IInd semester
12.	B.Sc.Environmental Science (Optional)	Ist and IInd semester
13.	B.Sc.Biotechnology (Degree)	Ist and IInd semester
14.	B.Sc.Biotechnology (Optional)	Ist and IInd semester
15.	B.Sc.Dairy Sci.& Tech (Optional)	Ist and IInd semester
16.	B.Sc.Zoology (Optional)	Ist to VIth semester
17.	B.Sc.Polymer Chemistry (Optional)	Ist and IInd semester
18.	B.Sc.Fisheries Science (Optional)	Ist and IInd semester
19.	B.Sc.Instrumentation Practice (Optional)	Ist semester
20.	B.Sc.Biochemistry (Optional)	Ist and IInd semester
21.	B.Sc.Non Conventional & Conventional Energy (Degree)	Ist and IInd semester

This is effective from the Academic Year 2022-23 and onwards.

All concerned are requested to note the contents of this circular and bring notice to the students, teachers and staff for their information and necessary action.

University Campus,
Aurangabad-431 004.
Ref.No. SU/B.Sc./2022/8428-35
Date:-29.08.2022.

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Deputy Registrar,
Academic Section

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Copy forwarded with compliments to :-

- 1] **The Principal, concerned affiliated College,**
Dr. Babasaheb Ambedkar Marathwada University, Aurangabad.
- 2] **The Director, University Network & Information Centre, UNIC, with a request to upload this Circular on University Website.**

Copy to :-

- 1] The Director, Board of Examinations & Evaluation,
- 2] The Section Officer, [B.Sc. Unit] Examination Branch,
- 3] The Programmer [Computer Unit-1] Examinations,
- 4] The Programmer [Computer Unit-2] Examinations,
- 5] The In-charge, [E-Suvidha Kendra],
Rajarshi Shahu Maharaj Examination Branch,
- 6] The Public Relation Officer,
- 7] The Record Keeper,

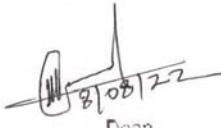
**Dr. Babasaheb Ambedkar Marathwada University,
Aurangabad**



**Syllabus for
B.Sc First Year (Semester I and II)
B.Sc Second Year (Semester III and IV)
UNDER CHOICE BASED CREDIT SYSTEM
Under
FACULTY OF SCIENCE AND TECHNOLOGY**

w.e.f Academic Year.2022-23

Yali
8/8/2022


8/08/22
Dean
Faculty of Science & Technology
Dr. Babasaheb Ambedkar Marathwada
University, Aurangabad

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
Semester Pattern Curriculum under
Choice based Credit System (CBCS)
Faculty of Science and Technology
Department of Zoology
Course Structure and Examination Scheme
B. Sc. First Year (Semester – I)

Class / Semester	Code	Course Title	Credits	Period/week	Examination Scheme			
					Maximum Marks	UA	CA	Minimum Passing
B.Sc. F.Y Semester First	ZOL- 101	Animal Diversity -I Protozoa To Echinodermata	2	(3/week)	50	40	10	20
	ZOL- 102	Cell Biology	2	(3/week)	50	40	10	20
	ZOL- 103	Practical Paper based on Paper 101 & 102	2	(3 /week Batch)	50	50 Annual Exam.	-	20

B. Sc. First Year (Semester –II)

Class / Semester	Code	Course Title	Credits	Period/week	Examination Scheme			
					Maximum Marks	UA	CA	Minimum Passing
B.Sc. F.Y Semester Second	ZOL- 105	Animal Diversity-II (Protochordata to Mammals)	2	(3/week)	50	40	10	20
	ZOL- 106	Genetics	2	(3/week)	50	40	10	20
	ZOL- 107	Practical Paper based on Paper 105& 106	2	(3 /week Batch)	50	50 Annual Exams.	-	20

B. Sc. First Semester
Course Code - ZOL- 101
Zoology Paper: I
ANIMAL DIVERSITY- I
(PROTOZOA TO ECHINODERMATA)
Credits- 02 (1 Credit =16 Clock Hours)
Total No. of Period - 45
Evaluation - External 40, Internal 05

Learning Objective-To know the general characters and classification of non chordates and understand the diversity and complexity of life from Protista to Echinodermata.

Learning Outcome- On completion of the course the students will be able to understand the general organization, diversity and adaptation of Non Chordates. The Student will learn the importance of biodiversity conservation.

- **Protista: - 10**
General characters and classification.
 - A. Animal like Protist E.g. Amoeba, Noctiluca
 - B. Plant like Protist E.g. Diatoms, Stentor
 - C. Fungi like E.g. Water molds, Phytophthora infestans, Yellow slime mold
 - D. Euglena like E.g. Euglena
 - Locomotory organelles and locomotion in Euglena and Amoeba.Reproduction in protozoa; Asexual and Sexual conjugation
- 2. **Porifera :- 04**
 - General characters and classification up to classes
 - Spicule and Gemules in Porifera
 - Canal system in Porifera.
- 3. **Cnidaria:- 03**
 - General characters and classification up to classes
 - Polymorphism in Coelenterates.
- 4. **Platyhelminths : - 04**
 - General characters and classification up to classes
 - *Taenia solium*- Life history, pathogenicity, Parasitic adaptation and control measures
- 5. **Nemathelminthes :- 04**
 - General characters and classification up to classes
 - *Ascaris lumbricoides*: - Life history, Pathogenicity & control measures.

6. **Annelida:** - **03**

- General characters and classification up to classes
- Metamerism in Annelids.

7. **Arthropoda:-05**

- General characters and classification up to classes
- Arthropods Eyes and Vision
- Metamerism in insects

8. **Mollusca:- 03**

- General characters and classification up to classes
- Torsion in Gastropods

9. **Echinodermata:- 04**

- General characters and classification up to classes
- Water vascular system in Star fish (Asterias)
- Tutorial **05**

B. Sc. First Semester
Course Code - ZOL- 102
Zoology Paper: II
Cell Biology
Credits- 02(1 Credit =16 Clock Hours)
Total No. of Period - 45
Evaluation - External 40 Internal 05

Learning Objective- To understand the structure and function of animal cell

Learning Outcome - The student will understand the architecture and functions of cell.

1. Introduction to cell biology- 10

- General structure of Prokaryotic cell
- General structure Eukaryotic cells
- Energy efficiency of small cell
- Cell Cycle
- Mitosis and Meiosis

2. Cell environment- 08

- Chemical bonds, Inorganic - water, salts and ions
- Organic compounds- Proteins, Carbohydrates, Lipids, Nucleic acids, Vitamins.

3.Cell organelles- 12

- Plasma Membrane: - Structure, function and Fluid mosaic model
- Mitochondria: - Structure, function and Electron Transport Chain
- Structure and function of Endoplasmic reticulum, Ribosomes, Golgi Bodies and Lysosomes, Microtubules, microfilaments and centrioles

4. Nucleus:- 04

- Structure and Function of Nucleus
- Structure of DNA and Types of RNA

5. Cancer biology and Ageing:- 06

- Characteristics of cancer cell
- Types of Cancer:-Carcinomas, Sarcomas, Lymphomas, Leukemia etc.
- Introduction to cell ageing
- Effect of radiations on cells (UV radiations, photodynamic sensitization)

- Tutorial 05

B. Sc. First Semester

Credit: 02

Zoo-103

Paper-III PRACTICAL

PROTOZOA TO ECHINODERMATA & Cell Biology

1. **Study of animals belonging to** Protozoa, Porifera, Cnidaria, Ctenophora, Platyhelminthes, Aschelminthes and Annelida with special reference to systematic position up to class level, habit, habitat, characteristic features and economic importance (one example of each class and Local examples are to be given more emphasis) with the help of Museum specimens, models, charts, Microslides, Photographs and Digital sources.

2. **Study of animals belonging to** - Onychophora, Arthropoda, Mollusca, Echinodermata with special reference to systematic position up to class level, habit, habitat, characteristic features and economic importance. (one example of each class and Local examples are to be given more emphasis) with the help of Museum specimens, Models, Charts, Microslides, Photographs and Digital sources.

3. Method of protozoan culture (Any one)

4. Identification of Protozoan's and Coelenterates in pond water sample

5. Temporary mounting of :-

- Gemules and Spicules of sycon
- Obelia colony
- Parapodium of Neries

6. Study of diversity of mouth parts in insect:- Mosquito, Housefly, Honey bee, Cockroach, Butterfly

7. Digestive and Nervous system of Earthworm (Museum specimen/Charts/digital sources)

8. Digestive system of Cockroach (Museum specimen/digital sources)

9. Study of Prokaryotic cells –Grams staining technique

10. Study of Eukaryotic cells using suitable staining technique (Buccal epithelial cells)

11. Study of cytoplasmic movements in paramecium

12. Localization of Mitochondria by Janus Green stain

13. Study of cancer cells through permanent slides

14. Study of cell organelles through electron micrographs/charts

15. Study of Mitosis using suitable material /Meiosis using permanent slides.

Note: Demonstration of animal dissections through Computer Aided

Techniques as per U.G.C Guidelines.

Suggested Readings:

1. *Jordan E.L., Verma P. S. (1987) Invertebrate Zoology. S. Chand and Company Pvt. Ltd. New Delhi.*
2. *Kotpal R.L. (2000) Invertebrates. Rastogi Publi. Meerut*
3. *EkambaranathaAyyar, M. Ananthkrishnan, T N. Outlines of Zoology, S. Vishwanathan, Madras*
4. *Prasad S.N. (Reprint 1992) Life of Invertebrates. VikasPublishing House Pvt. Ltd.*
5. *Dhami P.S., Dhami J.K. Invertebrate Zoology. S. Chand and Company Pvt. Ltd. New Delhi.*
6. *Parker A.J., Haswell W. A. A. (2002) Textbook of Zoology Vol. I . Mc millan*
7. *Ganguly B. B., Sinha A.K. and Adhikari S. (2000) Introduction to biology of Animals. New Central Book Agency, Calcutta*
8. *Barnes R.D. (2000) Invertebrate Zoology. Saunders College Publishing*
9. *Karp, G. (2010). Cell and Molecular Biology: Concepts and Experiments. VI Edition. John Wiley and Sons. Inc.*
10. *De Robertis, E.D.P. and De Robertis, E.M.F. (2006). Cell and Molecular Biology. VIII Edition. Lippincott Williams and Wilkins, Philadelphia.*
11. *Cooper, G.M. and Hausman, R.E. (2009). The Cell: A Molecular Approach. V Edition.*
12. *S.V.Nikam and T.T.Shaikh Protozoology 2011, Oxford Publication house ,Jaipur*
13. *Kotpal, R.L. Modern Text Book of Zoology Invertebrates, Rastogi Publication, Meerut.*
14. *Parker &Hashwell, Textbook of Zoology Vol. I (Invertebrates) A.Z.T.B.S. Publishers &Distributors. New Delhi.*
15. *E.L. JORDEN & P.S. VERMA, Invertebrate Zoology, S. Chand & Co. Ltd. New Delhi*
16. *Cytology, Genetics and Evolution – P.K. Gupta (Rastogi Publications, Delhi)*
17. *Cytology and genetics – Dyansagar V. R. (Tata McGraw Hill Pub. 1992 Reprint)*
18. *Manual of Practical Zoology – P. K. G. Nair and K. P. Achar (Himalaya Publication)*

B. Sc. Second Semester
Course Code - ZOL- 104
Zoology Paper: IV
DIVERSITY OF CHORDATA-II
Protochordata to Mammals
Credits- 02(1 Credit =16 Clock Hours)
Total No. of Period - 45
Evaluation - External 40, Internal 05

Learning Objective: To know the general characters and classification of Chordates and Understand the increasing complexity of organization of life from lower to higher chordates.

Learning Outcome: On completion of the course the student should be able to know the General organization of Chordates as a group and know the taxonomy and characteristic features of the various Chordate phyla.

Unit 1: Protochordata	04
General features and Phylogeny of Protochordata	
Unit 1: Agnatha	04
General features of Agnatha, classification and affinities of cyclostomata up to classes	
Unit 2: Introduction to Chordates	06
General features and classification of phylum Chordates upto classes	
Unit 3: Pisces	04
General features, Migration and Parental care in Fishes.	
Unit 4: Amphibia	04
General features and classification up to order, Parental care in Amphibia,	
Unit 5: Reptilia	10
General features and classification up to order; Identification of poisonous and non- poisonous snakes.	
Snake venom, symptoms, effect, and first aid treatment of snakebite.	
Unit 6: Aves	06
General features and classification up to order, volant adaptations in Birds; Migration in birds	
Adaptation in feet of birds.	
Unit 7 : Mammals	05
General features and classification up to order; Origin of Mammals (Prototheria, Metatheria and Eutheria), Adaptive radiation in mammals	

B. Sc. Second Semester
Course Code - ZOL- 105
Zoology Paper: V
GENETICS
Credits- 02 (1 Credit =16 Clock Hours)
Total No. of Period - 38
Evaluation - External 40, Internal 10

Learning Objective: To study the hereditary biology and mechanism involved in hereditary diseases and disorders.

Learning Outcome - The student will understand genetics and heredity.

Unit 1: Mendelian Genetics and its extensions **06**

- Overview of Mendelian genetics; - Epistasis and Hypostasis, multiple gene and multiple alleles

- Sex linked, Sex limited and Sex influence inheritance, Linkage – definition, types and significance

Unit 2: Chromosome structure **06**

- Eukaryotic chromosomes; -Types of Eukaryotic chromosomes (based on centromere position), Eukaryotic & Prokaryotic organization, giant chromosomes.

Unit 3: Gene mutation **05**

-Natural and induced mutation;- Types of gene mutation (base pair substitution and frame shift)

-Types of chromosomal aberrations, spontaneous and induced mutations (chemical mutagen and radiations)

Unit 4: Sex determination: **06**

- Chromosome theory in sex determination;- Genic balance theory of sex determination

-Triploid inter sexes & Gynandromorphs in Drosophila;-Sex linked inheritance: X linked and Y linked

Unit 5: Inheritance of human traits **06**

-Human karyotype; -Pedigree analysis; -Inheritance of human traits: Brown eyes, Polydactyl, Diabetes insipidus, Sickle cell anemia PKU

Unit 6: Human Genetics: **05**

Dizygotic Twins and Monozygotic Twins, Use of human genetics in medical science, Gene Therapy and DNA Fingerprinting

Unit: 7 Population Genetics :- **04**

Gene Pool., Gene Frequency.

Hardy-Weinberg's Law.

**B. Sc. Second Semester
Course Code - ZOL- 106
Zoology Paper: VI**

DIVERSITY OF CHORDATA-II

Based on Protochordata to Mammals&Genetics

PRACTICALS

Credits 02

1. **Protochordata:** Study of specimens: *Balanoglossus, Herdmania, Branchiostoma, Salpa, Doliolum, Oikopleura, Botryllus*
2. **Agnatha:** Study of specimens: *Petromyzon, Myxine*
3. **Fishes:** Study of specimens: *Scoliodon, Sphyrna, Pristis, Torpedo, Chimaera, Mystus, Heteropneustes, Labeo, Exocoetus, Echeneis, Anguilla, Hippocampus, Tetradon/ Diodon, Anabas, Cyannoglossus.*
4. **Amphibia:** Study of specimens: *Ichthyophis/Ureotyphlus, Necturus, Bufo, Hyla, Alytes, Salamandra*
5. **Reptilia:** Study of specimens: *Chelone, Trionyx, Hemidactylus, Varanus, Uromastix, Chamaeleon, Ophiosaurus, Draco, Bungarus, Vipera, Naja, Hydrophis, Zamenis, Crocodylus.* Key for Identification of poisonous and non-poisonous snakes
6. **Aves:** Study of six common birds from different orders. Types of beaks and claws
7. **Mammalia:** *Sorex, Bat (Insectivorous and Frugivorous), Funambulus, Loris, Herpestes, Erinaceus.*
8. Visit to Zoological survey of India/ Museum/National Park.
9. Observation of common mutants of drosophila
10. Determination of human blood groups A, B, AB, and O, Rh factor.
11. Major and minor problems in genetics
12. Study of preparation of Normal Karyotype of human.

13. Karyotypic study of Down's syndrome, Turner's syndrome,

14. Klinefelter's syndrome with the help of photograph.

14. Detection of Barr body from epithelial cell.

15. Problems on sex linked inheritance.

16.. Study of gene frequency and mutants of man

➤ Attached and free ear lobe.

➤ Colour of eye.

➤ Rolling of tongue.

➤ Blood group frequency.

17. Human pedigree analysis- various symbols used.

18. Study of permanent slide of sickle cell anemia

Reference Books:

1. Young, J. Z. (2004). *The Life of Vertebrates. III Edition. Oxford university press.*
2. Pough H. *Vertebrate life, VIII Edition, Pearson International.*
3. Darlington P.J. *The Geographical Distribution of Animals, R.E. Krieger Pub Co.*
4. *Strickberger s Evolution. IV Edition. Jones and Bartlett*
5. A life of Vertebrate – K.Z.Young, ELBS Oxford University Press.
6. Modern Text Book of Zoology Vertebrate – R.L.Kotpal, Rastogi Publication Meerut.
7. A Text Book of Chordate Zoology – R.C.Dalela –Jaiprakashnath Publication Meerut.
8. Chordate Zoology – E.L.Jordan and P.S.Verma, S.Chand and Company New Delhi.
9. Kotpal R L (2009): *Modern textbook of Zoology Vertebrates*, Rastogi Publication .
10. Lal S.S. (1996): *Textbook of Practical Zoology Vertebrates*, Rastogi Publications
11. *Manual of Practical Zoology – P. K. G. Nair and K. P. Achar (Himalaya Publication)*

REFERENCES BOOKS

1. Genetics – P.K. Gupta (Rastogi Pub. Meerut)
2. Genetics – Verma P.S. and Agarwal V.K. (S. Chand Pub. Delhi.)
3. Cytology, Genetics and Evolution – P.K. Gupta (Rastogi Pub. Delhi)
4. Elementary Genetics – Single tone
5. Genetics – Winchester (Oxford LBH Pub.)
6. Genetics and Evolution – A.P. Jha (Macmillon India)
7. Concepts of Genetics – W.S. Clug (Pearson Education ISBN)
8. Genetics – Strickberger (Prentice – Hall)
9. Principle of Genetics – R.H. Tamarin (Tata Mc Graw Hill Pub. India)
10. Concepts of Genetics – R. L. Kotpal (Rastogi Pub.)
11. Foundations of Genetics – Pai A.C. (Mc Graw Hill Pub.)
12. *Manual of Practical Zoology – P. K. G. Nair and K. P. Achar (Himalaya Publication)*

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
Semester Pattern Curriculum under
Choice based Credit System (CBCS)
Faculty of Science and Technology
Department of Zoology
Course Structure and Examination Scheme
B. Sc. Second Year (Semester –III)

Class / Semester	Code	Course Title	Credits	Period/week	Examination Scheme			
					Maximum Marks	UA	CA	Minimum Passing
B.Sc. S.Y Semester Third	ZOL- 201	Developmental Biology in Vertebrates	2	(3/week)	50	40	10	20
	ZOL- 202	Biochemistry and Endocrinology	2	(3/week)	50	40	10	20
	ZOL- 203	Practical Paper based on Paper 201	2	(3 /week Batch)	50	50 Annual Exams.	-	20
	ZOL-204	Practical Paper based on Paper 202	2	(3 /week Batch)	50	50 Annual Exams.		
Skill Enhancement Course (SEC) (Any One)	ZOL-SEC-205	Hematology (Theory)	1	(1/Week)	50	2	50/20	
	ZOL-SEC-206	Urinology (Theory)	1	(1/Week)	50			
	ZOL-SEC-207	Hematology (Practical)	1	(1/Week)	50			
	ZOL-SEC-208	Urinology (Practical)	1	(1/Week)	50			

B. Sc. Second Year (Semester –IV)

Class / Semester	Code	Course Title	Credits	Period/week	Examination Scheme			
					Maximum Marks	UA	CA	Minimum Passing
B.Sc. S.Y Semester Third	ZOL- 209	Ecology	2	(3/week)	50	40	10	20
	ZOL- 210	Evolution	2	(3/week)	50	40	10	20
	ZOL- 211	Practical Paper based on Paper 209	2	(3 /week Batch)	50	50 Annual Exams.	-	20
	ZOL-212	Practical Paper based on Paper 210	2	(3/week Batch)	50	50 Annual Exams.		
Skill Enhancement Course (SEC) Any One	ZOL-SEC-213	Micro technique (Theory)	1	(1/Week)	50	2	50/20	
	ZOL-SEC-214	Apiculture (Theory)	1	(1/Week)	50			
	ZOL-SEC-215	Micro technique (Practical)	1	(1/Week)	50			
	ZOL-SEC-216	Apiculture (Practical)	1	(1/Week)	50			

B. Sc. Third Semester

Zoology Paper: ZOL-201

DEVELOPMENTAL BIOLOGY OF VERTEBRATES

Credits- 02 (1 Credit =16 Clock Hours)

Total No. of Period - 38

Evaluation - External 40, Internal 10

Learning objective: To provide a comprehensive understanding of the concepts of early animal development.

To develop a critical appreciation of methodologies specifically used to study the process of embryonic development in animals.

Learning Outcome: Students should be able to know the basic embryonic development and Evaluate the applications development biology to understand the basis of life

Unit 1:- Fertilization:

Mechanism of Fertilization, Monospermic and polyspermic fertilization **05**
Significance of Fertilization.

Unit 2: Cleavage:

07

Definition, Salient features of cleavage, Types of cleavage, Pattern of Cleavage, Blastulation and Gastrulation in Mammals, Significance of Blastulation and Gastrulation

Unit 3: Gametogenesis: 08

Spermatogenesis- Formation of spermatids, Spermiogenesis; Ultra structure Control of spermatogenesis and oogenesis in mammals, Physico- Chemical Nature of Yolk ; Types of egg; Function of Yolk; Functions of Ovarian tissues during growth phase.

Unit 4: Fate maps, Gastrulation and Tubulation 12

Fate Maps- Construction of fate maps by natural marking, Construction of fate maps by artificial marking; Gastrulation- General process involved in Gastrulation; Morphogenetic movements – Epibolic morphogenetic movements, Embolic morphogenetic movements; Tubulation; Neurogenesis; and Mesogenesis.

Unit 5: Embryonic Adaptation

06

Development of Foetal Membrane in Mammals; Placentation in Mammals- Development of placenta, Allanto-chorionic villi; Classification of mammals placenta, Functions of Placenta.

SUGGESTED READINGS

Gilbert, S. F. (2006). *Developmental Biology*, VIII Edition, Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts, USA.

Balinsky, B.I. (2008). *An introduction to Embryology*, International Thomson C. Press.

Carlson, Bruce M (1996). *Patten's Foundations of Embryology*, McGraw Hill, Inc
Sastry & Shukul (2012) *Developmental Biology*, Rastogi Publication, Meerut India.

B. Sc. Third Semester

Zoology Paper: ZOL- 202 BIOCHEMISTRY AND ENDOCRINOLOGY

Credits- 02 (1 Credit =16 Clock Hours)

Total No. of Period - 38

Evaluation - External 40, Internal 10

Learning Objectives: 1. To understand the structure and role of biomolecules in biological system. 2. To understand and identify the structures and functions of the endocrine system

Learning Outcome: 1. Student will learn the fundamentals of biochemical process and their applications. 2) To understand the structure, identify and understand the endocrine function and pathology.

A-BIOCHEMISTRY

1. Carbohydrates :- 06

Monosaccharide's, Disaccharides, Polysaccharides and Oligosaccharides

Metabolism: - Glucogenesis, Gluconeogenesis, Glycolysis, TCA. & oxidative phosphorylation.

2. Enzymes:- 02

Factor affecting enzyme activity and Mechanism of enzyme action

3. Proteins :- 06

Classification -simple, conjugated and derived proteins,

Structure of proteins: - Primary, secondary, tertiary and quaternary.

Metabolism: - Deamination and transamination.

Structure of amino acid & peptide bond formation

Immunoglobulin's-biological significance

4. Lipids: 06

Types of Lipid & Biological role

Metabolism: B-Oxidation and cholesterol biosynthesis

ii) Ketosis, Ketogenesis and Ketolysis.

5. Vitamins: - Sources and deficiency 02

B) ENDOCRINOLOGY:

1. Endocrine system of vertebrates: - 02

Significance of endocrine and neuro - endocrine system.

2. **Pituitary gland:** - Morphology & histological structure, Hormones and their function. **03**
3. **Thyroid gland:** - Morphology & histological structure, Hormones and their function. **02**
4. **Adrenal gland:** - Morphology & histological structure, Hormones and their function. **02**
5. **Pancreas:** - Islets of Langerhans- Histological structure **02**
Hormones and their function.
6. **Testis and Ovaries-**Morphology & histological structure, Hormones and their function**04**
7. **Pineal Gland-** Structure, Hormones and their functions**01**

SUGGESTED READINGS

- J.L. Jain –Biochemistry S.Chand Publication, Meerut
- Lehninger- Biochemistry, Kalyani Publications
- Stryer-Biochemistry, W.H Freeman and Co., New York
- Granner and Rodwell - Harper's Illustrated Biochemistry, Murray, (27th Ed.), McGraw Hill, New York, USA
- Rangnatha Rao K-Text Book of Biochemistry, Prentice-Hall of India
- C.B.Powar- Biochemistry – (Himalaya Pub.)
- Das.-Biochemistry
- Nelson and Cox - Principles of Biochemistry. Lehninger. 2nd Ed. CBS publishers.
- R.H. Williams, Textbook of Endocrinology, W.B. Saunders
- E.J.W. Barrington, General and Comparative Endocrinology, Oxford, Clarendon Press.

B.Sc. III Semester
Paper:ZOL- 203
DEVELOPMENTAL BIOLOGY OF VERTEBRATES
(PRACTICAL)

1. Study of Whole mount of different types of Sperm(Slide)
2. Types of Egg and cleavage pattern (Slides/ LCD Projector)
3. Study of different stages of frogdevelopment.(Models/Specimen)
4. Study of types of placenta in Mammals (Slides/LCD Projector)
5. Study of Blastula, Gastrula, Morula in Frog (Slides/LCD)
6. Study of whole mount of 24 Hrs, 33 Hrs., 48 Hrs., 72 hrs., 96 Hrs. Chick embryo (Slide)
7. Slide preparation and mounting of Chick Embryo from the Incubated Egg

B.Sc. III Semester
Paper: ZOL- 204
BIOCHEMISTRY AND ENDOCRINOLOGY
(PRACTICAL)

1. Preparation of solutions of given percentage, normality and molarity.
2. **Study of analytical instrument principle and applications.**
 - pH meter,
 - Colorimeter,
 - Centrifuge
 - Electrophoresis
3. Factors affecting enzymes activity temperature and pH.
4. Detection of amino acid by paper chromatography.
5. **Qualitative test for organic compound.**
 - Carbohydrate.
 - Protein.
 - Fats.
6. Quantitative estimation of protein from animal tissue using Lawry's method.
7. Study of biochemical Qualitative and Quantitative test for Urine
8. Determination of Hemoglobin from given blood sample
7. **Study of permanent histological slides of endocrine glands.**
 - T.S. of Pituitary gland,
 - T.S. of Thyroid gland,
 - T.S. of Adrenal Gland,
 - T.S. of Islets of Langarhans.
 - T.S. of Testis
 - T.S. of Ovaries

Skill Enhancement Course (SEC)

Learning Objectives:

1. The subject aims to provide a broad multidisciplinary course in zoology.
2. To promote training in practical and conceptual skills in biology.
3. To equip students with adequate practical knowledge that will enable them be self reliant and biomedical, agro-aqua cultural, environmental and human development industries.
4. To equip students with adequate research techniques that will enable them towards the perfection for national and global economics.

Learning Outcome:

At the end of course, student should be –

1. Able to analyze, study and report on material learned.
2. Able to assess the scope of animal biology and select appropriate area for further study.
3. Able to integrate related topic from separate parts of the course

**PROPOSED SKILLS IN ZOOLOGY FOR B.SC. II YEAR
CHOICE BASED CREDIT SYSTEM (CBCS)
SEMESTER PATTERN
SEMB.Sc. Second Year, Semester – III
SEC – I : Skills for 01 Credits
w. e. f. Academic Year 2022-23
(02 Periods, 01 Theory Per week: Max. Marks: 50)**

**Skill Enhancement Course
ZOL-SEC-205: HAEMATOLOGY(Theory)**

UNIT – I

1. Introduction - Definition, Components, Cells – Structure and Functions of cells, Lymph. Collection of Blood- Collection of blood by skin puncture, Collection of blood by Venipuncture, Collection of arterial blood.

UNIT – II

2. Anticoagulants - Definition, Action of E. D. T. A., Oxalates, double oxalates, fluorides, acidcitrate, detxtrose-trisodium citrate, heparin.
- Effect of anticoagulants on blood cell morphology.

3. Haemoglobin - Normal structure and various haemoglobin, Determination of haemoglobin by various methods.

UNIT – III

4. Study of Blood Cell Count - Total WBC Count, Total RBC Count, Platelets Count, Absolute Eosinophil Count, Reticulocyte Count.

UNIT – IV

5. Study of Blood Smear for differential WBC Count - Preparation and Staining of smears, Counting Methods, Morphology of White cells, Types of White Cells, Abnormalities in morphology of blood cells and related diseases.

CHOICE BASED CREDIT SYSTEM (CBCS)
SEMESTER PATTERN
B.Sc. Second Year, Semester – III
SEC – I : Skills for 01 Credits
w. e. f. Academic Year 2022-23
(02 Periods, 01 Theory Per week: Max. Marks: 50)

Skill Enhancement Course
ZOL-SEC-206: URINOLOGY(Theory)

UNIT - I

1. Definition, Structure and Functions of Urinary System, Physiology of Mechanism of Urine formation.

UNIT - II

2. Constituents and composition of Urine

i) Normal constituents and abnormal constituents of Urine- i) Qualitative tests for sugar, albumin, ketone bodies, bile salts and bile pigments..

UNIT - III

3. Renal Function Tests

i. Definition, importance of tests like urea, creatinine, uric acid, proteins

ii. Importance of Dialysis

UNIT - IV

4. Collection and preservation of Urine Sample

i. Physical and Chemical Examinations of abnormal constituents.

ii. Microscopic Examination of urine

iii. Preparation of Urine Report

iv. Urinometer.

Skill Enhancement Course
Practical Based on ZOL-SEC-205
ZOL-SEC-207 HAEMATOLOGY

1. Collection of blood by Venipuncture and arterial blood.
2. Determination of haemoglobin from given blood sample, Clotting and bleeding time of blood.
3. Determination of Total Count of RBC, WBC.
4. Determination of differential WBC Count by blood Smear

Skill Enhancement Course
Practical Based on ZOL-SEC-206
ZOL-SEC-208 URINOLOGY

1. Study of normal and abnormal constituents of Urine.
2. Biochemical Qualitative and Quantitative tests for urine
3. Study of Microscopic Examination of urine.
4. Qualitative tests for sugar and albumin,

REFERENCE BOOKS: (HAEMATOLOGY)

1. Medical Laboratory Technology - RamnikSood
2. Medical Lab Technology Vol. I, II & III – Kanai Mukherjee
3. Hand Book of Medical Technology - Mrs. Chitra
4. Medical Laboratory Technology – A. Ananthanarayan
5. Manual for Laboratory Technician of Primary Health by Minister of Health
6. Human Physiology Vol. I & II – C. C. Chatterji

REFERENCE BOOKS (URINOLOGY)

7. Medical Laboratory Technology - RamnikSood
8. Medical Lab Technology Vol. I, II & III – Kanai Mukherjee
9. Hand Book of Medical Technology- Mrs. Chitra
10. Medical Laboratory Technology – A. Ananthanarayan
11. Manual for Laboratory Techniiian of Primary Health by Minister of Health
12. Human Physiology Vol. I & II – C. C. Chatterjee

B.Sc. IV Semester
Course Code - ZOL- 209
PAPER:
Ecology

UNIT-I

1. **Ecology:** Definition, Introduction and Scope of Ecology **02**
2. **Introduction to Ecosystem:** **13**
 - 2.1 **Abiotic Components-** Temperature, Light and Water
 - 2.2 **Biotic Components-** Producer, Consumer and Decomposers
 - 2.3 **Types of ecosystem-** Marine ecosystem, Pond ecosystem, Forest ecosystem and Desert ecosystem
 - 2.4 Food chain, Food web, Energy of flow and Ecological pyramids
 - 2.5 Structure of community, Ecological niche, Ecotone and edge effect
 - 2.6 Community succession and climax
3. **Biogeochemical cycles:** **05**
 - 3.1 **Gaseous cycle-** Oxygen cycle
 - 3.2 **Sedimentary cycle-** Sulphur cycle
4. **Sphere of Earth:** **05**
 - 4.1 Atmosphere
 - 4.2 Lithosphere
 - 4.3 Hydrosphere
 - 4.4 Biosphere

UNIT-II

1. **Population Ecology:** **07**
 - 1.1 Density, Natality, Mortality, Dispersion and Age distribution
 - 1.2 Population growth form and Regulation
 - 1.3 Population equilibrium and Fluctuation
2. **Biotic Interactions:** **04**
 - 2.1 Competition
 - 2.2 Predation
 - 2.3 Commensalism
 - 2.4 Mutualism
 - 2.5 Parasitism

B.Sc. IV Semester

Course Code - ZOL- 210

**PAPER:
Evolution**

Unit-I 07

1) Concept of Evolution

2) Theories of organic evolution:

- i) Lamarck's theory
- ii) Darwin's theory
- iii) Modern synthetic theory-Neo-Darwinism
- iv) Germplasm theory

Unit-II 08

1. Evidences of Organic Evolution:

- i) Anatomical evidences
- ii) Embryological evidences
- iii) Paleontological evidences
- iv) Adaptations:-Aquatic, Terrestrial, Fossorial, Volant and Desert

Unit-III 07

1. Basic patterns of Evolution:

- i) Microevolution- concept, silent features & Mechanism with example
- ii) Macroevolution- concept, silent features & Mechanism with example
- iii) Mega evolution- concept, silent features & Mechanism with example

Unit-IV

06

1. Species and Speciation:

- i) Morphological, Genetic, Biological concept of Species
- ii) Concept and Mechanism of Speciation
- iii) Allopatric, Sympatric and Parapatric Speciation

Unit-V 07

1. Elemental forces of Evolution

- i) Mutation-Concept and role in Evolution
- ii) Recombination- Concept and role in Evolution
- iii) Natural selection- Concept and role in Evolution
- iv) Isolation- Concept and role in Evolution
- v) Genetic Drift Concept and role in Evolution

B.Sc. IV Semester
Course Code - ZOL- 211
PAPER:
Ecology
Practical

1. Estimation of Dissolved oxygen from given water sample.
2. Estimation of Water Alkalinity from given water sample.
3. Estimation of population density by quadrat method.
5. Study of microscopic fauna of freshwater ecosystem (from pond).
6. Estimation of water holding capacity of given soil sample.
7. Estimation of Salinity/Chlorinity from water sample.
8. **Preparation of permanent slides of the following:**
 - a) Spirogyra b) Volvox c) Oedogonium d) Daphnia e) Cyclops f) Mysis
10. Visit to Ecosystem: Marine/Fresh water/Desert Ecosystem

Recommended Reference Books:

1. Colvinvaux, P. A. (1993). Introduction to Ecology. II Edition. Wiley, John and Sons, Inc.
2. Krebs, C. J. (2001). Ecology: The Experimental Analysis of Distribution and Abundance, 6th Edition, ©2009, Pearson
3. Odum, E.P., (2008). Fundamentals of Ecology. Indian Edition. Brooks/Cole
4. Robert Leo Smith Ecology and field biology Harper and Row publisher
5. Ricklefs, R.E., (2000). Ecology. V Edition. Chiron Press
6. Sharma P.D. (2002) Ecology and Environment, Himalaya Publication
7. Verma and Agarwal- Principal of Ecology
8. Dutta- Fundamentals of Ecology
9. Clarke, G.L. Elements of Ecology

B.Sc. IV Semester
Course Code - ZOL- 212
PAPER: XIV
Evolution
Practical

1. **Study of evidences by using photograph/charts and models**
 - a) Analogous and Homologous organs
 - b) Connecting link (*Peripatus and Archaeopteryx*)
 - c) Embryological evidences
2. **Study of adaptations** (Museum Specimens).
3. **Study on patterns of speciation with the help of Charts/Models/Pictures**
 - a) Allopatric Speciation
 - b) Sympatric Speciation
4. **Study of successive stages of evolution with the help of Charts/models**
 - a) Horse
 - b) Human

Recommended Reference Books:

1. Evolution – Moody
2. Evolution – Gopalkrishnan
3. Organic Evolution – M.P. Arora (Himalaya Pub. House)
4. Evolution – M.W. Strickberger (CB Publishers)
5. Organic Evolution – N. Armugam (Saras Pub.)
6. Evolution- Surjeet Publication, Delhi
7. Jha,A.P. Genes & Evolution, John Publication, New Delhi
8. P.K. Gupta-Ecology, Genetics and Evolution
9. Tomer and Singh-Organic evolution, Rastogi Publication, Meerut

CHOICE BASED CREDIT SYSTEM (CBCS)
SEMESTER PATTERN
B.Sc. Second Year, Semester – IV
SECZ – II : Skills for 01 Credits
w. e. f. Academic Year 2022-23
(02 Periods, 01 Theory Per week: Max. Marks : 50)

Skill Enhancement Course
ZOL-SEC-213:Microtechnique

UNIT - I

1. Introduction – Definition of Histotechnology
2. Methods of examination of tissues and cells, Collection and labeling of specimens,
Methods of preparation and examination of tissues (fresh and fixed tissue)

UNIT - II

3. Fixation of tissue - Definition, Criteria for an ideal fixative, types (Simple and Compound),
Properties of Simple and Compounds fixatives (Microanatomical, cytological, histochemical)

UNIT - III

4. Tissue processing - Manual and automatic tissue processing, Different embedding media,
Steps of tissue processing (Dehydration, Clearing, Impregnation).
5. Embedding- Methods of Embedding, Embedding medium, names of medium and moulds,
Automatic Tissue Processes (Structure and Working, Advantages and Disadvantages).

UNIT - IV

6. Section Cutting - Types of Microtome, Rotary Microtome -Parts and their functions,
Microtome Knives- Types, Care and Maintenance Techniques of sharpening; Technique of
Section Cutting, Preparation of Adhesive Mixture, Mounting.
7. Staining - Definition and Significance of Staining, Stain and Staining Types, Theory of
Staining, Methods of Staining.

CHOICE BASED CREDIT SYSTEM (CBCS)
SEMESTER PATTERN
B.Sc. Second Year, Semester – IV
SECZ – II: Skills for 01 Credits
w. e. f. Academic Year June 2022-23
(02 Periods, 01 Theory Per week: Max. Marks: 50)

Skill Enhancement Course
ZOL- SEC-214: APICULTURE

UNIT – I : BIOLOGY OF BEES

1. History, Classification and Biology of Honeybees.
2. Social Organization of Honey bees.

UNIT – II : REARING OF HONEY BEES

3. Artificial Bee Rearing (Apiary), Believes – Newton and Langstroth, Bee Pasturage, Selection of Bee Species for apiculture, Bee keeping equipment, Methods of extraction of honey (Indigenous and Modern).

UNIT – III : DISEASES AND ENEMIES

4. Bee diseases and enemies, Control and preventive measures.

UNIT – IV : ECONOMY OF BEES AND ENTREPRENEURSHIP

5. Products of Apiculture industry and its uses (Honey, Bee wax, Propolis, Pollen etc.).
6. Bee keeping industry – Recent efforts, Modern methods in employing artificial believes for Cross pollination in horticulture gardens.

Skill Enhancement Course
Practical Based on ZOL-SEC- 213: Microtechnique

Credit: 01
ZOL-SEC-214 Microtechnique

1. Isolation and collection of tissue, fixing and block preparation.
2. Tissue processing of prepared blocks.
3. Technique of Section Cutting, fixing, alcohol grading, staining and preparation of permanent slide.
4. Methods of preparation and examination of tissues (fresh and fixed tissue)

REFERENCE BOOKS:

1. Histochemical Techniques – J. D. Bancrot.
2. Handbook of Histopathological and Histochemical Techniques - C.F.A. Culling.
3. Histological and Histochemical Methods 4th Edition – John Kiernan

Skill Enhancement Course
Practical Based on ZOL- SEC-214: APICULTURE

Credit: 01
ZOL-SEC-215:APICULTURE

1. Visit to the Apiculture centers, Collect practical information of artificial Bee Hives and its mechanism.
2. Collection of natural bee hives, wax, honey etc.
3. Methods of extraction of honey (Indigenous and Modern).

REFERENCE BOOKS:

1. Apiculture - Prost, P. J. (1962), Oxford and IBH, New Delhi.
2. Apiculture - Bisht D. S., ICAR Publications.
3. Bee Keeping in India - Indian Council of Agricultural Research, New Delhi.