



RAJARSHI SHAHU MAHAVIDYALAYA, LATUR
(Autonomous)

(BoS in ZOOLOGY)

CHOICE BASED CREDIT SYSTEM (CBCS)

SEMESTER PATTERN

(W.e.f. Academic Year 2022-23)

SYLLABUS FOR B.Sc.-II (ZOOLOGY)

June-2022-23

Rajarshi Shahu Mahavidyalaya, Latur
Autonomous
Semester Pattern Curriculum
Under Choice Based Credit System
Faculty of Science
Subject: Zoology
B.Sc. S.Y.

Sem.	Course No.	Paper No. & Title	Total Lect./ Week	Marks		Credits
				Internal	External	
Sem-III	CCZ-III-A	Animal Physiology and Immunology	45 3/week	20	30	2
	CCZ-III-B	Genetics	45 3/week	20	30	2
	CCZP-III-A	Lab Course -V	45 3/week	20	30	2
	CCZP-III-B	Lab Course -VI	45 3/week	20	30	2
	SECZ-I	Clinical Hematology	45 3/week	20	30	2
Sem-IV	CCZ-III-A	Biochemistry	45 3/week	20	30	2
	CCZ-III-B	Molecular Biology and Genetic Engineering	45 3/week	20	30	2
	CCZP-III-A	Lab Course -VII	45 3/week	20	30	2
	CCZP-III-B	Lab Course -VIII	45 3/week	20	30	2
	SECZ-II	Microtechniques	45 3/week	20	30	2

B. Sc. II ZOOLOGY (SEM-III)

Course Code: U-ZOO-363

Course: Animal Physiology and Immunology (CCZ-III-A)

Credits: 02

Marks: 50

Lectures: 45

Learning Objectives

L01. To understand the digestion physiology and respiration physiology of animals

L02. Analyze circulation physiology

L03. Apply the conceptual knowledge in excretion physiology and neurophysiology

L04. Describe the concepts and different types of immunity

Course Outcome

After the completion of this course students will be able to:

CO1. Understand the digestion physiology and respiration physiology of animals

CO2. Analyze circulation physiology

CO3. Apply the conceptual knowledge in excretion physiology and neurophysiology

CO4. Describe the concepts and different types of immunity

Unit-I (Digestion Physiology and Respiration physiology)

- Intracellular and Extracellular digestion
- Mechanical process indigestion
- Chemical process of digestion and Absorption of food
- External and Internal respiration
- Respiratory organs of man
- Mechanism of respiration
- O₂ and Co₂ transportation
- Control of respiration and Respiratory quotient

Unit-II (Circulation physiology)

- Open and closed type of circulation
- Circulatory organs (Heart and Blood vessels)
- Typical pattern of circulation
- Composition and function of blood
- Level of blood Cholesterol, urea and sugar.
- Erythropoietin and Its regulation
- Blood pressure, ECG, Heart beat and cardiac cycle.
- Lymphatic system (Lymph, Lymph vessels and Lymph node)

Unit-III (Excretion physiology and Neurophysiology)

- Mode up of Excretion
- Structure of nephron (Uriferous tubule)
- Physiology of Urine formation Composition of urine and Osmoregulation
- Structure of Neuron
- Structure of Synapse and reflex action
- Conduction of nerve impulses and Neurotransmitter

Unit-IV (Muscle physiology, Reproductive Physiology and Immunology)

- Structure and types of muscles
- Ultra structure of skeletal muscle fiber
- Sliding filament theory
- Hormonal control of testicular and ovarian functions, menstrual cycle,
- Types of Immunity) The immune system
- Immune response (Antigen, Antibody, Humeral and cell mediated Immunity)

Reference Books

1. A textbook of Animal Physiology – K.A. Goal and K.V. Castro (Rastogi Pub.)
2. A textbook of Practical Physiology – V.G. Remade (P.V.G. PrakashanPune.)
3. Clinical Pathology and Hematology – Nanda Baheti (KanhaiyaPub.)
4. Comparative animal physiology C. LaddProsser.
5. Text book of animal Physiology – A.K. Berry (Emkay Pub.Delhi)
6. Animal Physiology – A. Mariakuttikan N. Arumugum (Sara's Publication)
7. Principles of animal Physiology – WoodD.W
8. Physiology – Guyton and Hall
9. Duby-Immunology (W.H. Freeman)

B. Sc. II ZOOLOGY (SEM-III)

Course Code: U-ZOO-364

Course: Genetics (CCZ-III-B)

Credits: 02

Marks: 50

Lectures: 45

Learning Objectives:

L01. To understand Mendelian genetics and its Modifications

L02. To understand the concept of multiple alleles, linkage and crossing over

L03. To Analyze mechanisms of Sex determination, sex linked inheritance and Gene Mutations

L04. To correlate the disorders linked to a particular sex chromosome.

Course Outcome

After the completion of this course students will be able to:

C01. Understand Mendelian genetics and its Modifications

C02. Understand the concept of multiple alleles, linkage and crossing over

C03. Analyze mechanisms of Sex determination, sex linked inheritance and Gene Mutations

C04. Correlate the disorders linked to a particular sex chromosome

Unit-I (Mendelian genetics and Modifications)

- Mendelism
- monohybrid cross and dihybrid cross
- Interaction of gene (9:3:4, 9:7, 13:3,15:1)
- Incomplete dominance.
- Back cross and testcross.

Unit-II (Multiple Alleles and Multiple Gene)

- Multiple alleles – Eg. Coat colour in Rabbit .and ABO Blood groups in Man.
- Rh factor and Erythroblast sis fetalis in man.
- Multiple genes - Eg. Skin colour in Man.
- Linkage – definition, Types and significance
- Crossing over –Mechanism, Factor affecting on crossing over, and Its Significance

Unit- III (Sex determination, sex linked inheritance and Gene Mutations)

- Chromosomal methods of sex determination.
- Bridge's ratio theory of genic balance.
- Sex linked inheritance in Drosophila.
- Sex linked inheritance in man – colorblindness, haemophilia, Hypertrichosis and baldness.

Unit-IV (Mutation & Human genetics)

- Chromosomal Mutations – Structural and numerical mutations
- Mutagenic agents
- Sickle cell anemia.
- Syndromes – Turner's, Klinefelter's, Down's, Cat – Cry, Patau's, and Edwards.
- Inborn errors of metabolism – Phenylketonuria (PKU), Alkaptonuria, Albinism

Reference Books

1. Gupta, P.K. (1996) "Genetics" Rastogi Publications.
2. Ranga, M.M. "Animal Biotechnology (Agrobios), Published by Agrobios (India).
3. Rastogi, Sharma, V.N. and Anuradha Tandon (1993). "Concepts in Molecular Biology".WileyEastern Ltd. N. Delhi.
4. Smustad, Simmons, Jenkins (1999). "Principles of Genetics" John Wiley and sons. Inc.
5. Genetics – P.K. Gupta (Rastogi pub. Meerut)
6. Genetics – Verma P.S. and Agarwal V.K. (S. Chand pub. Delhi.)
7. Genetics – Winchester (Oxford LBH Pub.)
8. Genetics and Evolution – A.P. Jha (Macmillon India)
9. Concepts of genetics – W.S. Clug (Pearson Education ISBN)
10. Genetics – Strickberger (Prentice – Hall)
11. Principle of genetics – R.H. Tamarin (Tata Mc Graw Hill Pub. India)
12. Concepts of Genetics – R. L. Kotpal (Rastogi Pub.)
13. Genetics and Genetic Engineering – Dr. R.P. Meyyan (Saras Pub.)
14. Foundations of Genetics – Pai A.C. (Mc Graw Hill Pu b.)
15. Molecular Genetics – Gunther, S. Stent, (Macmillon)
16. Principles of Genetcs – Sinnott, Dunn and Dobzansky (Tata McGraw Hill Pub. Delhi).
17. Genetics – M.P. Arora (Himalaya).
18. Genetics and Evolution – N. Armugam (Saras Pub.)

B. Sc. II ZOOLOGY (SEM-III)

Course Code: U-ZOO-365

Lab. Course: Animal Physiology and Immunology (CCZP-III-A)

Credits: 02

Marks: 50

Lectures: 45

Learning Objectives

L01.To understand the different physiological process of animals

L02. To describe functional status of organ

L03. To do analysis complete blood count, blood grouping, blood films, and differential count.

L04. To understand the respiratory status of animals

Course Outcome

After the completion of this course students will be able to:

C01.Uunderstand the different physiological process of animals

C02. Describe functional status of organ

C03. Do analysis complete blood count, blood grouping, blood films, and differential count.

C04. Understand the respiratory status of animals

Practicals:

1. Qualitative detection of digestive enzymes (protease, Amylase and Lipase) in cockroach/ Crab.
2. Detection of human salivary amylase.
3. Estimation of oxygen consumption in fish/ Crab or any other suitable aquatic animal.
4. R.B.C. Counting.
5. W.B.C. counting.
6. Differential leukocyte count of blood.
7. . Measurement of blood pressure by sphygmomanometer.
8. Estimation of Haemoglobin.
9. Estimation of urine / serum creatinine from blood
10. Estimation of urine / serum urea by diacetyl monoxime method
11. Colorimetric estimation of blood/serum cholesterol.
12. ESR of blood.
13. Determination of clotting time of blood by capillary tube method.
14. Estimation of glucose by Benedict quantitative method.
15. Determination of bilirubin in serum
16. Qualitative detection of Nitrogenous waste products (Ammonia, Urea and Uric acid)
17. Preparation of Haematin crystals.
18. Types of Neuron (Unipolar,Bipolar, and Multipolar Neuron)
19. Antibody and antigen reaction

B. Sc. II ZOOLOGY (SEM-III)

Course Code: U-ZOO-366

Lab. Course: Genetics (CCZP-III-B)

Credits: 02

Marks: 50

Lectures: 45

Learning Objectives:

L01. To gain the knowledge of Mendel's laws to understand the process and patterns of inheritance

L02. To understand and apply the concept of multiple alleles, linkage and crossing over

L03. To understand mechanisms of sex determination

L04. To understand the Human pedigree analysis and symbols to trace the ancestral history of an organism

Course Outcome

After the completion of this course students will be able to:

C01. Gain the knowledge of Mendel's laws to understand the process and patterns of inheritance

C02. Understand and apply the concept of multiple alleles, linkage and crossing over

C03. Understand mechanisms of sex determination

C04. Understand the Human pedigree analysis and symbols to trace the ancestral history of an organism

Practical:

1. Problems based on monohybrid and dihybrid cross (Explain with the help of plastic beads.)
2. Problems on modification in ratio due to interaction of genes- complementary factors, supplementary factors, inhibitory factors, duplicate genes (explain with the help of plastic beads).
3. Problems on blood group inheritance in man.
4. Problems based on sex linked inheritance
5. Culture of Drosophila and observation of genetic characters in Drosophila (eye & wings)
6. Preparation of temporary slides of salivary gland chromosomes from chironomous larva.
7. Study of slide of sickle cell anemia.
8. Study of chromosomes abnormalities in man, Down's syndrome, Klinefelter's Syndrome, and Turner Syndrome with the help of Photograph / Charts /Karyotype.
9. Drosophila culture techniques.
10. Study of phenotypic characters in Drosophila (Body colour, Wing pattern and Eye colour).
11. Buccal smear - Identification of BarrBody
12. Human Pedigree Analysis (Various Symbols used and Problems)

B. Sc. II ZOOLOGY (SEM-III)

Course Code: U-ZOO-334-H

Course: Clinical Hematology (SECZ-I)

Credits: 02

Marks: 50

Lectures: 45

Learning Objective:

L01. To perform staining and counting technique for identification of different type of blood cells.

L02. To collect blood sample by different methods.

L03. To separate different components of blood

L04. To analyze Hb from blood samples and diagnosis of various blood diseases like anemia

Course Outcomes:

After completion of this course students should be able to:

C01. Perform staining and counting technique for identification of different type of blood cells.

C02. Collect blood sample by different methods.

C03. Separate different components of blood

C04. Analyze Hb from blood samples and diagnosis of various blood diseases like anemia

UNIT-I: The components of blood

- Plasma, Red blood cells, White blood cells, Platelets
- Criteria for sample collection
- Collection of capillary blood (Peripheral Blood) blood by skin punctures
- Collection of venous blood by Venipuncture,
- Collection of arterial blood,
- **Practical:**
- Collection Blood by Skin puncture and Venipuncture.
- Separation of Blood components Plasma, Serum and Corpuscles

UNIT-II: Haemoglobin

- Structure and function of Haemoglobin
- Types of anemia
- **Anemia** Causes, Effect and Control , Diagnosis of anemia
- **Practical**
- Estimation of Haemoglobin

UNIT-III: Haemopoiesis

- Erythropoietin and leucopoiesis
- **Practical:**
- Complete Blood Count (CBC)
- RBC Counting
- WBC Counting
- Platelet count and Hamatocrit

UNIT-IV: Blood Coagulation Mechanism

- Blood Clotting,
- Mechanism of Clotting : Extrinsic and Intrinsic Mechanism
- Blood cholesterols and Urea and Creatine
- **Practical:**
- Clotting Time of blood and Bleeding time of blood

Reference Books:

1. Medical Laboratory Technology - Ramnik Sood
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. Chatterjee

B. Sc. II ZOOLOGY (SEM-III)

Course Code: U-ZOO-463

Course: Biochemistry (CCZ-IV-A)

Credits: 02

Marks: 50

Lectures: 45

Learning Objectives:

L01. To understand classification, structural properties and biological functions of carbohydrates

L02. To understand classification, structural properties and biological functions of vitamins

L03. To explain classification of enzymes

L04. To demonstrate steps in biochemical processes

Course Outcome:

After the completion of this course students will be able to:

C01. Understand classification, structural properties and biological functions of carbohydrates

C02. Understand classification, structural properties and biological functions of vitamins

C03. Explain classification of enzymes

C04. Demonstrate steps in biochemical processes

Unit-I (Classification, Structural properties and biological functions)

- Introduction of Biochemistry
- Carbohydrates and lipids
- Proteins and Amino acids and peptides,

Unit-II (Classification, Structural properties and biological functions)

- Vitamins (Discovery, types and their functional Significance.)
- Fat soluble (A, D, E, K, Q and U)
- Water soluble (B-complex family and Ascorbic Acid)
- Antioxidants

Unit-III (Enzymology)

- Nomenclature of enzyme and chemistry of enzymes
- Classification, properties of enzyme
- Mechanism and factor affecting on enzyme action
- Enzyme inhibition and Biological function of enzymes
- Coenzymes

Unit-VI (Metabolism)

- EMP, HMP pathway, Krebs cycle, Glycogenesis, Gluconeogenesis, Glycogenolysis.)
- Beta oxidation pathway, Ketogenesis, ketolysis, ketosis
- Oxidation of amino acids. Urea cycle, Transamination Deamination
- Biochemistry of Hormones

Reference Books:

- Lehninger's Principles of Biochemistry
- Fundamentals of Biochemistry-J.L. Jain, Sanjay Jain, Nitin Jain, S. Chand &Company.
- Biomolecules-C.Kannan, MJP Publishers, Chennai-5.
- Laboratory manual in Biochemistry-Jayaraman.
- Biochemical methods -S.Sadasivan and Manickam.
- Introduction to Practical Biochemistry-David T.Plumme

B. Sc. II ZOOLOGY (SEM-III)

Course Code: U-ZOO-464

Course: Molecular Biology and Genetic Engineering (CCZ-IV-B)

Credits: 02

Marks: 50

Lectures: 45

Learning Objectives:

L01. To use biological tools for research purposes.

L02. To describe the importance of Molecular Biology and Genetic Engineering

L03. To use vectors in cloning techniques and rDNA technology

L04. To explain the steps in animal cloning

Course Outcomes:

After the completion of this course students will be able to:

CO1. Use biological tools for research purposes.

CO1. Describe the importance of Molecular Biology and Genetic Engineering

CO3. Use vectors in cloning techniques and rDNA technology

CO4. Explain the steps in animal cloning

Unit-I (Structure and function of Nucleic acid)

- Introduction to Molecular Biology
- Deoxyribonucleic acid (Structure, properties, function, and type of DNA)
- Ribonucleic acid (Structure and types)
- Replication and Genetic codes

Unit-II (Protein synthesis and structure of gene)

- Protein synthesis
- Gene concept and molecular structure of gene
- Types of gene and Discontinuous genes (Exons and Introns)
- Gene Expression in prokaryotes (Lac operon) eukaryotes
- One gene one enzyme hypothesis and one polypeptide hypothesis

Unit-III (Genetic engineering)

- Introduction to genetic engineering-Mendel's to Molecules
- Tools; - a} Enzymes: - i. lysing ii.Ligases
- iii Nucleases: Exonucleases, Endonucleases., Restriction Endonucleases enzymes
- iv. Synthetase : DNA polymerase, Reserve transcriptase
- b} Vectors: Cloning vectors [plasmid -pBR322,Bacteriophage-Lambda phage, Viruses-SV40, Cosmids vectors] and Expression vectors {Shuttle vector }
- Techniques: - a] Southern, Northern and Western blotting b] PCR (Polymerase chain reaction)
- DNA Sequencing (Sanger)

Unit-IV (Cloning)

- Gene cloning
- Linking of desired gene with vector DNA
- Introduction of recombinant DNA into host Cell
- Identification of recombinant DNA
- c-DNA libraries and Genomic libraries
- Transgenesis and Transgenic animals [Transgenic cattle, sheep, pig and fish]
- Animal Cloning and Cloned animals-Dolly
- DNA Fingerprinting

Reference Books:

1. Molecular Biology –David Freifelder –Narosa Publishing House, New Delhi.
2. Cell Biology, Genetics, Molecular Biology, Evolution & Ecology –Verma, Agarwal – S. Chand & Co.
3. Molecular & Cell Biology –Bhamrah –Anmol Publ. Pvt. Ltd., New Delhi.
4. Molecular Biology of the Cell –Alberts, Bray, Lewis, Raff, Roberts, Watson – Garland Publishers, New York.
5. Molecular Biology of the gene –J. D. Watson, NH Hopkins, Roberts, Stertz, Weiner-Freeman.
6. in Biotechnology.Editors-Balasubramanian, Bryee, Dharmalingam, Green, Jayraman – Sangam Books
7. Molecular Biology of the Gene –Watson, Hopkins, Roberts, Steitz, Weiner – Benjamin Cummings Publishing Co.
8. Molecular Cell Biology –Baltimore, Zipursky, Matsudaria, Darnel –W. H. Freeman & Co., New York.
9. Outlines of Biochemistry –Conn & Stumpf.
10. Principles of Biochemistry –White, Handler, Smith –McGraw Hill Publ. 11.Cell & Molecular Biology –Phillip Sheller –Wiley Publ.

B. Sc. II ZOOLOGY (SEM-III)

Course Code: U-ZOO-463

Lab Course: Biochemistry (CCZP-V-A)

Credits: 02

Marks: 50

Lectures: 45

Learning Outcomes:

- L01. To understand the qualitative and quantitative analytical skill of biomolecules
- L02. To apply skills of titrimetric practicals for the analysis of various biomolecules
- L03. To do the colorimetric, Iodometric analysis of biomolecules.
- L04. To perform the experiments like effect of temperature on enzyme action

Course Outcomes:

After the completion of this course students will be able to:

- C01. Understand the qualitative and quantitative analytical skill of biomolecules
- C02. Apply skills of titrimetric practicals for the analysis of various biomolecules
- C03. Do the colorimetric, Iodometric analysis of biomolecules.
- C04. Perform the experiments like effect of temperature on enzyme action

Practicals:

1. Estimation of amino acids by formal titration.
2. Estimation of ascorbic acid by titrimetric method using 2, 6-dichlorophenol indophenols.
3. Estimation of Antioxidant by, 2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging assay
4. Estimation of reducing sugar from biological fluids by Benedict's titrimetric method.
5. Qualitative estimation of protein, Lipid and carbohydrates
6. 6... Estimation of Protein by Biuret method/Bradford method/Lawry.
7. Estimation of amino acids by ninhydrin method
8. Isolation of glycogen from liver source and its estimation by anthrone method
9. Estimation of Lipids by Vanillin
10. Extraction of DNA by Phenol and Chloroform Method
11. Effect of temperature on enzyme action
12. Effect of pH on enzyme action
13. Effect of temperature on enzyme action
14. Effect of temperature on enzyme action

B. Sc. II ZOOLOGY (SEM-III)

Course Code: U-ZOO-464

Lab. Course: Molecular Biology and Genetic Engineering (CCZ-VI-B)

Credits: 02

Marks: 50

Lectures: 45

Learning Outcomes:

L01. To understand the blotting technique.

L02. To use the agarose gel electrophoresis for DNA molecular size determination

L03. To estimate the DNA and RNA.

L04. To understand the vectors in cloning techniques and rDNA technology.

Course Outcomes:

After the completion of this course students will be able to:

C01. Understand the blotting technique.

C02. Use the agarose gel electrophoresis for DNA molecular size determination

C03. Estimate the DNA and RNA.

C04. Understand the vectors in cloning techniques and rDNA technology.

Practicals:

1. Extraction of genomic DNA from Blood.
2. Estimation of Protein by Polyacrylamide Gel Electrophoresis
3. Estimation of DNA by Agarose gel electrophoresis
4. Estimation of RNA by Agarose gel electrophoresis
5. Demonstration DNA amplification by RT-PCR
6. Digestion of DNA with Restriction Enzymes
7. Demonstration Western Blotting
8. Demonstration of Southern / western blotting.
9. Estimation of DNA by DPA
10. Estimation of RNA by Orcinol reagent.
11. Extraction of proteins from tissues

RAJARSHI SHAHU MAHAVIDYALAYA, (AUTONOMOUS), LATUR.

B. Sc. II ZOOLOGY (SEM-IV)

Course Title : Microtechniques (SECZ-II)

Course Code: U-ZOO-434-M

Total Teaching

hours: 45

Marks: 50

Learning Objective:

L01. To perform preparation of paraffin block of different tissues

L02. To perform fixation of tissues

L03. To perform sectioning and staining.

L04. To understand section cutting and staining

Learning Outcomes:

After completion of this course students should be able to:

C01. Perform preparation of paraffin block of different tissues

C02. Perform fixation of tissues

C03. Perform sectioning and staining.

C04. Understand the section cutting and staining

Unit-I (Introduction to Microtechniques)

- Introduction – Definition of Histotechnology
- 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 (Tissues Fixation)

- Fixation of tissue - Definition, Criteria for an ideal fixative, types (Simple and Compound), Properties of Simple and Compounds fixatives (Micro anatomical, cytological and histochemical)
- Practical – Isolation and collection of tissue, fixing and block preparation.

Unit –III (Tissue Processing and Embedding)

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

Unit-IV (Section Cutting and Staining)

- 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.
- Staining - Definition and Significance of Staining, Stain and Staining Types, Theory of Staining, Methods of Staining.
- Practical – Section Cutting, fixing, alcohol grading, staining and preparation of permanent slide.

Reference Books:

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