

Baba Mastnath University (BMU)

Private university in Haryana



**Structure and Syllabus of
B.Sc. Medical (Ist to VIth Semesters) Course
Under CBCS-LOCF**

(Effective from the Academic Session 2022-23)

In phased manner

**Department of Zoology
Baba Mastnath University,
Asthal Bohar, Sector-29, Rohtak-124021,
Haryana (INDIA)**

Programme Outcomes:

1. To impart knowledge about co-existence of different forms of living organisms ranging from unicellular to multicellular animals.
2. The objective is to understand the fundamental chemical principles that govern complex biological systems.
3. Students are able to learn, Mendel's work on transmission trait, Genetic Variations, Mendelian genetics, Linkage, Crossing over and Chromosomal mapping, Mutations, Sex determination.
4. To train the students in a wide range with Applied Zoology to provide future careers.

Programme Specific Outcomes:

1. Students will be able to identify the relationship or synchronization between structure and function at all levels: molecular, cellular, and organismal.
2. They will also be able to describe economic, ecological and medical significance of various animals in human life. This will create a curiosity and awareness among them to explore the animal diversity and take up wild life photography or wild life exploration as a career option.
3. The procedural knowledge about identifying and classifying animals will provide students professional advantages in teaching, research and taxonomist jobs in various government organizations; including Zoological Survey of India and National Parks/Sanctuaries.
4. The students will acquire basic experimental skills in various techniques in the fields of genetics; molecular biology; biotechnology; qualitative and quantitative microscopy; enzymology and analytical biochemistry. These methodologies will provide an extra edge to our students, who wish to undertake higher studies.
5. Students will be able to use the evidence of comparative biology to explain how the theory of evolution offers the only scientific explanation for the unity and diversity of life on earth. They will be able to use specific examples to explicate how descent with modification has shaped animal morphology, physiology, life history, and behavior.

6. The program will also provide a platform for classical genetics in order to understand distribution or inheritance of different traits and diseases among populations.
7. After the completion of this course, students have the option to go for higher studies, i.e., M. Sc. / Integrated MS Ph.D. and then do research work for the welfare of mankind. After higher studies, students can join as scientist or assistant professor or assistant teacher and can even look for professional job oriented courses, such as Indian Civil Services, Indian Forest Service, Indian Police Service etc. Science graduates can go to serve in industries or may opt for establishing their own industrial unit.

Meaning of Terms Used in Course

Core Course (CC):

Every semester consist of core courses. These courses are the core requirement and to be compulsory studied by a student to complete the requirement of programme in a said discipline of study.

Discipline Specific (DS) Course: These courses are the core requirement for ability enhancement and to be compulsory studied by a student to complete the requirement of programme in a said discipline of study.

Discipline Specific Elective (DSE) Course: These may be offered by the main discipline/subject of study. The University/Institute may also offer discipline related Elective courses of interdisciplinary nature (to be offered by main discipline/subject of study)

Skill Enhancement (SE) Course: SEC courses are value-based and/or skill-based and are aimed at providing hands-on-training, competencies, skills, etc. These courses may be chosen from a pool of courses designed to provide value-based and/or skill-based knowledge. It is mandatory as per course curriculum.

Examination Pattern

Theory

- Each theory paper shall be of 40 marks and consist of four units
- Duration of theory exam is 3 hours
- Nine questions shall be set in all
- Question No.1 shall be compulsory. It shall be objective / short question type covering the Entire syllabus.
- The remaining eight questions shall be set with two questions from each unit.
- The candidate shall be required to attempt Question 1 and four more selecting one from each section.

Practical Exam:

- Practical exams shall be held semester wise and at the end of each semester.
- Each practical exam shall be of 3 hours and of 50 Marks.
- Odd semester exam shall be conducted internally and internal examiner shall be appointed by the University/ Department.

- For the even semester evaluation, examination shall be conducted by External +Internal Examiner as approved by the University/ Department.

Year	Semester	Course Type	Paper Code	Paper	Title	Marks			Credits
						Exam	IA	Total	
I	I	Core	22-BS-ZOO-101C	I	Animal Diversity of Non Chordates from Protozoa to Aschelminthes	40	10	50	3
		Core	22-BS-ZOO-102C	II	Biochemistry of cell	40	10	50	3
		AEC	22-BS-ZOO-103AEC	III	Environmental Science	40	10	50	2
			22-BS-ZOO-104CL	IV	Practical-1			50	2
	II	Core	22-BS-ZOO-201C	I	Animal Diversity of Non-Chordates from Annelida to Hemichordata	40	10	50	3
		Core	22-BS-ZOO-202C	II	Genetics	40	10	50	3
		22-BS-ZOO-203CL	III	Practical-2			50	2	
II	III	Core	22-BS-ZOO-301C	I	Animal Diversity of Chordates from Protochordata to Pisces	40	10	50	3
		Core	22-BS-ZOO-302C	II	Comparative Anatomy and Physiology	40	10	50	3
			22-BS-ZOO-303CL	III	Practical-3			50	2
	IV	Core	22-BS-ZOO-401C	I	Development Biology	40	10	50	3
		Core	22-BS-ZOO-402C	II	Animal Diversity of Chordates from Amphibia to Mammalia	40	10	50	3
		Discipline Specific Course	22-BS-ZOO 403DSC	III	Aquatic Biology	40	10	50	3
	22-BS-ZOO-404CL	IV	Practical-4			50	2		
III	V	Discipline Specific Elective	22-BS-ZOO 501DSE	I**	Ecology and Evolution	40	10	50	3
		Discipline Specific Elective	22-BS-ZOO 502DSE	I**	Insect Vector and Diseases	40	10	50	3
		Skill Enhancement Course	22-BS-ZOO-503SEC	II	Applied Zoology	40	10	50	2
			22-BS-ZOO 504DSE CL	III	Practical-5			50	2
	VI	Discipline Specific Course	22-BS-ZOO 601DSC	I	Sericulture	40	10	50	3
		Discipline Specific Elective	22-BS-ZOO-602DSE	II**	Immunology	40	10	50	3
		Discipline Specific Elective	22-BS-ZOO-603DSE	II**	Animal Biotechnology	40	10	50	3
		Skill Enhancement Course	22-BS-ZOO-604 SEC	III	Medical Diagnostics	40	10	50	2
			22-BS-ZOO-605 DSE CL	IV	Practical-6			50	2
	Grand Total								1050

NOTE: Students shall choose one discipline specific elective paper out of I** and II** in V and VI Semester; Internal Assessment: Sessional exam + Attendance + Assignment/Test/Presentation/ Any other activity = 10 Marks

DETAILS OF COURSES Core Courses

1. Animal Diversity of Non Chordates from Protozoa to Aschelminthes
2. Biochemistry of cell
3. Animal Diversity of Non Chordates from Annelida to Hemichordata
4. Genetics
5. Animal Diversity of Chordates from Protochordata to Pisces
6. Comparative Anatomy and Physiology
7. Animal Diversity of Chordates from Amphibia to Mammalia
8. Development Biology

Discipline Specific Courses

1. Sericulture
2. Aquatic Biology

Discipline Specific Courses Elective Course- (Any two)

1. Insect Vector And Diseases
2. Ecology and evolution
3. Immunology
4. Animal Biotechnology

Skill Enhancement Courses

1. Medical Diagnostics
2. Applied zoology

Course Title: Animal Diversity of Non-Chordates from Protozoa to Aschelminthes**Course Code: 22-BS-ZOO-101C; Paper: I****Credits: 3; Final Theory Examination: 40; Internal Assessment: 10; Total Marks: 50**

Objective: To understand the classification, general characteristics, body organization and origin of animals belonging to different phylum of Protozoa to Helminthes.

Course outcomes:

CO-1: Students will be able to describe unique characters and recognize life functions of phylum Protozoa, Porifera, Coelenterate and Helminthes

CO-2: Students will be capable to identify the diversity and ecological role of phylum Protozoa, Porifera, Coelenterate and Helminthes.

Unit-I

Phylum Protozoa: General characters and classification up to class level; Biodiversity and economic importance of Protozoans; Life cycle and Etiology of *Entamoeba*, *Giardia*; Type study of *Plasmodium*

Unit-II

Phylum Porifera: General characters and classification up to class level; Biodiversity and economic importance; Type study – *Sycon*; Canal system in sponges; Skelton system in sponges

Unit-III

Phylum – Coelentrata: General characters and classification up to class level, Cnidaria and Ctenophora; Biodiversity and economic importance of cnidarians; Type Study – *Obelia*; Corals and coral reefs; Polymorphism in Siphonophores

Unit-IV

Phylum – Platyhelminthes and Aschelminthes: General characters and classification up to class level; Biodiversity and economic importance of flat worms; Type study – *Fasciola hepatica*; Common roundworms and their economic importance

List of Recommended Books

1. B.K. Tikadar. Threatened Animals of India, ZSI Publication, Calcutta.
2. E.O. Wilson. The Diversity of Life (The College Edition), W.W. Northern & Co.
3. Kotpal, R. L. (2012). Modern text book of Zoology: Invertebrates. Rastogi Publications.
4. Parasitic diseases of wildlife and domestic animals by A. Alonso Aguirr
5. The diversity of living organisms, author: Richard Stephen Kent Barnes
6. Verma, P. S. (2001). Invertebrate Zoology (Multicolour Edition). S. Chand Publishing.

Course Title: Biochemistry of Cell; Course Code: 22-BS-ZOO-102C; Paper: II
Credits: 3; Final Theory Examination: 40; Internal Assessment: 10; Total Marks: 50

Objectives:

1. The aim of this paper is to give basic knowledge of biomolecules.
2. To enable the students to know about metabolic pathways occurring within cell.

Course Outcomes:

- CO-1:** The students will understand the structure and function of biomolecules.
CO-2: The students will understand various metabolic pathways occurring within cell.

UNIT- I

Introduction to metabolism: Biochemical reaction, Cell as an open system, Laws of thermodynamics and bioenergetics.
Introduction to enzymes and working of enzymes.

Unit -II

Carbohydrates – Types and structure, Metabolism of Carbohydrates – Glycolysis , Gluconeogenesis, HMP pathway and Krebs cycle.

UNIT-III

Proteins-Types and structure. Amino acid – essential and non essential amino acids. Major pathways of amino acid metabolism. Glucogenic and ketogenic amino acid

UNIT-IV

Lipids- Types, structure and function. Lipid metabolism – Biosynthesis of Lipids and oxidation of Lipids – beta-oxidation pathway

Nucleic Acid – Type and structure. Biosynthesis and degradation of nucleotides.

List of Recommended Books

1. Donald Voet and J.G. Voet, Biochemistry, 3rd edition. John Wiley and Sons (2004).
2. Eric E. Conn, Paul K. Stumpf and others. Outlines of Biochemistry 5/E. John Wiley and Sons. (1995). 3. Jeremy M. Berg, John L. Tymoczko and Lubert Stryer. Biochemistry. 5th edition W.H. Freeman and Company, New York (2006).
3. Lehninger – Principles of Biochemistry & Bartle. Nelson & Cox. 4th edition. W. H Freeman and Company, New York.

Course Title: Environmental Science; Course Code: 22-BS-ZOO-103AEC; Paper: III

Credits: 2; Final Theory Examination: 40; Internal Assessment: 10; Total Marks: 50

Objectives:

To educate the students about the basic environmental phenomena like pollution, ecosystem, biogeochemical cycles and gives the awareness the side effects of pollution to students.

Course Outcomes:

CO1: They will get idea about the impact of anthropogenic activities on the environment and importance of natural resources in life.

CO2: To provide general overview of different types of pollutants and functions of environment and its components.

Unit-I

Environmental pollution: definition of pollution, Types of pollutants, causes and control of air, soil, water and noise pollution,

Unit-II

Energy resources: Renewable and non renewable resources, Food chain and food web, Environmental protection act 1986, Biotic and abiotic factors affecting biodiversity.

Unit-III

Biodiversity: Status, monitoring and documentation, Types of biodiversity, Global warming, Ozone depletion, Biodiversity conservation strategies, Photochemical smog, Biodiversity hot spot.

Unit-IV

Solid waste management: Causes, effects and control measures of urban and industrial wastes, Role of an individual in prevention of pollution, Pollution case studies, Disaster management: floods, earthquake, cyclone and landslides

List of Recommended Books

1. Cunningham and Saigo: Environmental Science (5th Ed., McGraw Hill, 1999).
2. Odum and Baret: Fundamentals of Ecology (EWP, 2005).
3. Odum: Fundamentals of Ecology (Saunders, 1971).
4. Primark: A Primer of Conservation Biology (2nd Ed., Sinauer, 2004).
5. Hosetti, B. B. (2006). Prospects and perspective of solid waste management. New Age International.

Laboratory Course: Practical-1; Course Code: 22-BS-ZOO-104CL

Paper: IV; Credits: 2; Total Marks: 50

List of Practicals:

1. Classification up to orders with ecological note and economic importance of the following animals: Parazoa (Porifera): *Sycon*, *Grantia*, *Euplectella*, *Hyalonema*, *Spongilla*, *Euspongia*
2. Classification up to orders with ecological note and economic importance of the following animals: Coelenterata: *Porpita*, *Valella*, *Physalia*, *Aurelia*, *Rhizostoma*, *Metridium*, *Millipora*, *Alcyonium*, *Tubipora*, *Zoanthus*, *Madrepora*, *Favia*, *Fungia*, and *Astrea*. Permanent prepared slides: *Hydra* (W.M.), *Hydra* with buds, *Obelia* (colony and medusa), *Sertularia*, *Plumularia*, *Tubularia*, *Bougainvillea*, *Aurelia* (sense organs and stages of life history).
3. Classification up to orders with ecological note and economic importance of the following animals: Platyhelminthes: *Dugesia*, *Fasciola*, *Taenia*, *Echinocoecus*. Permanent prepared slides: *Miracidium*, *Sporocyst*, *Redia*, *Cercaria*, *Scolex* and *Proglottids of Taenia* (mature and gravid).
4. Classification up to orders with ecological note and economic importance of the following animals: Aschelminthes: *Ascaris* (male and female), *Trichinella*, *Ancylostoma*, *Meloidogyne*
5. Determination of standing crop energy status in a grassland area and construction of 'number' and 'biomass (wet weight) pyramids
6. Estimation of DNA
7. Estimation of Glucose
8. Estimation of Proteins
9. Estimation of RNA
10. Measurement of chlorophyll content per unit area of a grass field.
11. Starch – amylase activity
12. To determine the salinity of the soil.
13. To study aerial adaptation in animals.
14. To study aquatic adaptation in animals.
15. To study desert adaptations in animals.
16. To study inter specific relationships.
17. To study the biotic components of an ecosystem.

Course Title: Animal Diversity of Non-Chordates from Annelida to Hemichordata**Course Code: 22-BS-ZOO-201C; Paper: I****Credits: 3; Final Theory Examination: 40; Internal Assessment: 10; Total Marks: 50**

Objective: To make students understand the general characteristics of animal kingdom, body organization, systematic position and origin belonging to phylum Annelida up to Hemichordata.

Course Outcomes:

CO-1: Students will be able to describe unique characters and recognize life functions of phylum Annelida up to Hemichordata.

CO-2: Students will be capable to identify the diversity and ecological role of phylum Annelida up to Hemichordata.

Unit-I

Phylum – Annelida: General characters and classification up to class level; Biodiversity and economic importance of Annelida; Type study – *Pheretima* (Earthworm); Metamerism in Annelida

Unit-II

Phylum – Arthropoda: General characters and classification up to class level; Biodiversity and economic importance of insects (insect vectors, lac insects, honey bee, insect pest) & crustaceans; Type study – *Periplanata*/Cockroach; Evolutionary significance of *Peripatus*

Unit-III

Phylum - Mollusca: General characters and classification up to class level; Biodiversity and economic importance; Type study – *Pila*; Torsion and detorsion in gastropoda

Unit-IV

Phylum – Echinodermata: General characters and classification up to class level; biodiversity and economic importance of echinoderms; Type study – *Asterias* (Sea Star)

Phylum Hemichordata: General Characters of Hemichordates with a suitable example

List of Recommended Books

1. B.K. Tikadar. Threatened Animals of India, ZSI Publication, Calcutta.
2. E.O. Wilson. The Diversity of Life (The College Edition), W.W. Northern & Co.
3. Parasitic diseases of wildlife and domestic animals by A. Alonso Aguirr
4. The diversity of living organisms, author: Richard Stephen Kent Barnes
5. Verma, P. S. (2001). Invertebrate Zoology (Multicolour Edition). S. Chand Publishing.
6. Kotpal, R. L. (2012). Modern text book of Zoology: Invertebrates. Rastogi Publications.

Course Title: Genetics; Course Code: 22-BS-ZOO-202C; Paper: II

Credits: 3; Final Theory Examination: 40; Internal Assessment: 10; Total Marks: 50

Objectives:

1. The aim of this paper is to give basic knowledge about the principles of Genetics
2. To enable the students to know about Mendelian and Non Mendelian Work

Course Outcomes:

CO1: The students will understand the contribution of Mendel in field of Genetics

CO2: The students will understand about various human genetic diseases.

UNIT- I

Introduction to Genetics (basic concepts & terms), Mendelian Genetics- Monohybrid cross, Dihybrid cross, Test cross & Back cross, Mendelian laws, Law of dominance, law of independent assortment. Concept of allele, Difference between phenotype and genotype.

UNIT-II

Concepts of Incomplete dominance, Co-dominance. Genetics of ABO Blood groups (multiple allele), Epistasis and Chromosomal mutation- variations in number & structure.

UNIT-III

Chromosomal theory of inheritance, Behavior of chromosomes during mitosis and meiosis. Genetics of Drosophila eye color. Concept of Linkage and Crossing over (Holiday model of DNA recombination)

UNIT-IV

Sex determination & Sex chromosome, Extrachromosomal inheritance. Genetic Diseases in Human (Turner syndrome, Klinefelter syndrome, Hemophilia, Sickle cell anemia, Cystic fibrosis, Thalassemia, Huntington's disease, Duchenne muscular dystrophy etc)

List of Recommended Books

1. Harry Nickla, Concepts of genetics, 1983
2. Robert J. Brooker, Concepts of genetics, 2011
3. William S. Klug, Concepts of genetics, 2019

Laboratory Course: Practical-2; Course Code: 22-BS-ZOO-203CL; Paper: III**Credits: 2; Total Marks: 50**

Objective: To have practical knowledge about identification and understanding of the classification of invertebrates phylum of Protozoa up to Echinodermata

Course Outcome:

CO-1: Students will be capable of identifying the characters and classification of invertebrates' species.

CO-2: Students will be able to realize and explain ecological and economic importance of different invertebrate species

List of Practicals:

1. Classification up to orders with ecological note and economic importance of the following animals: Annelida:
Pheretima, Heteronereis, Polynoe, Aphrodite, Chaetopterus, Arenicola, Tubifex and Pontobdella
2. Classification up to orders with ecological note and economic importance of the following animals: Arthropoda:
Peripatus, Palaemon (Prawn), Lobster, Cancer (crab), Sacculina, Eupagurus (hermit crab), Lepas, Balanus, Cyclops, Daphnia, Lepisma, Periplaneta (cockroach), Schistocerca (locust), Poeciloceris (ak-hopper), Gryllus (cricket), Mantis (praying mantis), Cicada, Forticula (earwig), Dragon fly, termite queen, bug, moth, beetle, Polistes (wasp), Apis (honey bee), Bombyx (silk moth), Cimex (beg bug), Pediculus (body louse), Millipede, Scolopendra (centipede), Palamnaeus (scorpion), Aranea (spider), Limulus (king crab)
3. Classification up to orders with ecological note and economic importance of the following animals: Mollusca:
Mytilus, Ostrea, Cardium, Pholas, Solen (razor / Fish), Pecten, Holiotis, Patella, Aplysia, Doris, Limax, Loligo, Sepia, Octopus, Nautilus (complete and T.S.), Chiton and Dentalium
4. Classification up to orders with ecological note and economic importance of the following animals: Echinodermata: *Asterias, Echinus, Cucumaia, Ophiothrix, Antedon and Asterophyton*
5. Classification up to orders with ecological note and economic importance of the following animals: Hemichordata: *Balanoglossus*
6. Study of the following permanent slides: L.S. and T.S. *Sycon*; gemmules, spicules and spongin fibres of *Sycon*, canal system of sponges
7. Study of the following permanent slides: T.S. *Fasciola* (different regions)
8. Study of the following permanent slides: T.S. *Ascaris* (male and female)
9. Study of the following permanent slides: T.S. *Pheretima* (pharyngeal and typhlosolar regions), Setae, septal nephridia and spermathecae of *Pheretima*.
10. Study of the following permanent slides: Trachea and mouthparts of cockroach.
11. Study of the following permanent slides: T.S. Star fish (arm).
12. Computer, simulated study/ model of:
 - a. *Earthworm*: Digestive, reproductive and nervous systems
 - b. *Pila*: Pallial complex, digestive and nervous system
 - c. Demonstration of internal anatomy of cockroach: Digestive, reproductive and nervous systems
13. Karyotyping of human chromosomes
14. Monohybrid and dihybrid cross
15. Human phenotypic characters
16. Mitosis and meiosis slides

Course Title: Animal Diversity of Chordates from Protochordata to Pisces; Course Code: 22-BS-ZOO-301C

Paper: I; Credits: 3; Final Theory Examination: 40; Internal Assessment – 10; Total Marks: 50

Objective: To make students understand the basic characters of chordates, origin and ancestry of chordates from protochordates and about the general characters, scale and fin pattern in class Pisces.

Course Outcomes:

CO-1: Through this core course the students will be capable of identifying different protochordate and will be capable of imparting conceptual knowledge of protochordates, their adaptations and associations in relation to their environment.

CO-2: Will be able to understand the basic concepts of evolutionary relationship among protochordates and fishes.

Unit-I

Functional morphology of the types included with special emphasis on the adaptations to their modes of life and environment. General characters and classification of all phyla up to orders with examples emphasizing their biodiversity, economic importance and conservation measures where required.

Chordates: Salient features of chordates; Principles of classification; Origin and Evolutionary tree of chordates.

Unit-II

Protochordates: Systematic position, distribution, ecology, morphology and affinities of protochordates

Urochordata: *Herdmania* – type Study

Cephalochordata: *Amphioxus* – type study

Unit-III

Agnatha: General characters; Cyclostomata: General characters and classification up to class level. Ecological significance of cyclostomes; Petromyzon: Structural & functional morphology type study

Unit-IV

Pisces: General characters and classification up to classes with examples emphasizing their biodiversity, Scales and fins, Type study of *Labeo rohita*

List of Recommended Books

1. B.K. Tikadar. Threatened Animals of India, ZSI Publication, Calcutta.
2. E.O. Wilson. The Diversity of Life (The College Edition), W.W. Northern & Co.
3. Kotpal, R. L. (2010). Modern text book of zoology: vertebrates. Rastogi Publications.
4. Parasitic diseases of wildlife and domestic animals by A. Alonso Aguirr
5. The diversity of living organisms, author: Richard Stephen Kent Barnes

Course Title: Comparative Anatomy and Physiology; Course Code: 22-BS-ZOO-302C; Paper: II

Credits: 3; Final Theory Examination: 40; Internal Assessment – 10; Total Marks: 50

Objectives:

1. This course aims to provide the undergraduate students a thorough knowledge of physiological, structural details and comparative account of the different organ systems of the body from lower to higher vertebrates, and protochordates, thus enabling them to appreciate the incredible vertebrate diversity.
2. The course furnishes an understanding of evolutionary basis of morphological and anatomical differences as well as similarities that occur among vertebrates.

Course Outcomes: Upon completion of the course, students should be able to:

CO1: Explain comparative account of the different vertebrate systems

CO2: Learn the comparative account of integument, skeletal components, their functions and modifications in different vertebrates.

CO3: Understand the evolution of heart, modification in aortic arches, and structure of respiratory organs used in aquatic, terrestrial and aerial vertebrates; and digestive system and its anatomical specializations with respect to different diets and feeding habits.

UNIT- I

Integumentary System: Structure, function and derivatives of integument in amphibian, birds and mammals

Skeletal System: Outline of axial and appendicular skeleton: basic plan of bones of skull, girdles and limbs. Classification of vertebrae, structure of a typical vertebra, Jaw suspensorium, Visceral arches.

UNIT –II

Digestive System: Alimentary canal and associated glands, dentition

Respiratory System: Skin, gills, lungs and air sacs; Accessory respiratory organs

UNIT-III

Circulatory System: General plan of circulation, Comparative account of heart and aortic arches

Urinogenital System: Succession of kidney, Evolution of urinogenital ducts, Types of mammalian uteri.

UNIT-IV

Nervous System: Comparative account of brain; Autonomic nervous system, Spinal cord, Cranial nerves inn mammals

Sense Organs: Classification of receptors; Brief account of visual and auditory receptors in man

List of Recommended Books

1. Kardong, K.V. (2005). Vertebrate's Comparative Anatomy, Function and Evolution. IV Edition. McGraw-Hill Higher Education.
2. Kent, G.C. and Carr R.K. (2000). Comparative Anatomy of the Vertebrates. IX Edition. The McGraw-Hill Companies.
3. Leiem C.F., Bermis W.E, Walker, W.F, Grande, L. (2001). Functional anatomy of the vertebrates, An evolutionary perspective. III Edition, Brookes/Cole, Cengage Learning.

Laboratory Course: Practical-3; Course Code: 22-BS-ZOO-303CL**Paper: III; Credits: 2; Total Marks: 50****Objectives:**

1. To make students understand the classification of vertebrates Phylum and ways of identifying respective species
2. This course exposes in practical exercises to know the difference between different organs of different animals.
3. To impart knowledge about different forms of system in different group of organisms helping in maintaining homeostasis.

Outcomes: Upon completion of the practical course, the students will be able to:**CO1:** Students will be able to classify and identify vertebrates' species and their skeleton/morphology**CO2:** Students will also realize and understand economic importance of the vertebrate species and will be aware about their conservation.**CO3:** Gain insight into the important concept of comparative anatomy and animal physiology**CO4:** Understand the important links which leads for animal evolution.**List of Practicals:**

1. Classification up to orders, habit, habitats, external characters and economic importance (if any): Protochordata: *Molqula, Hetryllus, Pyrosoma, Doliolum, Olikopleura, and Amphioxus.*
2. Classification up to orders, habit, habitats, external characters and economic importance (if any): Chondrichthyes: *Zygaena, Pristis, Narcine* (electric ray), *Trygon, Rhinobatus, Raja* and *Chimaera.*
3. Classification up to orders, habit, habitats, external characters and economic importance (if any): Osteichthyes: *Acipenser, Lepidosteus, Muraena, Mystus, Catla, Hippocampus, Syngnathus, Exocoetus, Anabas, Diodon, Ostracion, Tetradon, Echinus, Lophius, Solea* and *Polypterus.*
4. Classification upto orders, habit, habitats, external characters and economic importance (if any): Cyclostomata: *Myxine, Petromyzon* and *Ammocoetus larva.*
5. Disarticulated skeleton of human (Skull, Limb bones, Vertebral Column, Sternum, Girdles, Ribs).
6. Documentary film show on vertebrates/Visit to Zoological Park, Biodiversity Park or Sanctuary.
7. Project on modifications in skeletal structures/GI tract/Respiratory organs in vertebrates.
8. Study of anatomical details of any two organs (brain, heart, lung, kidney, eye and ear) through videos.
9. Study of different types of feathers of birds.
10. Study of digestive, circulatory and urinogenital system of frog/rat through videos on dissection or through virtual dissections.
11. Study of placoid, cycloid and ctenoid scales of fish through permanent slides/photographs.

Course Title: Developmental Biology; Course Code: 22-BS-ZOO-401C; Paper: I
Credits: 3; Final Theory Examination: 40; Internal Assessment: 10; Total Marks: 50

Objectives:

1. The main aim of the paper on Developmental Biology is to provide the undergraduate students an in-depth knowledge on the embryonic and post embryonic developmental processes.
2. An important aspect of developmental biology is its implication in medicine which is also dealt with in this course.
3. The students are made aware of the areas of great interest including stem cell therapy, tissue engineering and regenerative medicine.

Course Outcomes:

CO-1: Students would have a systematic and organized learning about the knowledge and concepts of growth and development of organisms.

CO-2: Students will be able to describe the events that lead up to fertilization, its stages and cellular mechanisms for gastrulation, and embryonic development.

Unit I

Developmental patterns in metazoans; Generalized structure of mammalian ovum and sperm, Spermatogenesis and Oogenesis, Fertilization, different types of eggs and patterns of cleavage.

Unit II

Cell fate and cell lineages; Process of blastulation and fate-map construction in frog and chick, Neurulation and ectoderm; Mesoderm and endoderm

Unit III

Cytoplasmic determinants and cell specification: Concepts of competence, determination and differentiation, Germ cell determinants, Germ cell migration

Unit IV

Vulva formation genetics of axis specification in *Drosophila*, Limb development and regeneration in vertebrates, Sex determination, Concept of regeneration, parthenogenesis.

List of Recommended Books

1. Balinsky, B.I. (2008). An introduction to Embryology, International Thomson Computer Press.
2. Carlson, Bruce M (1996). Patten's Foundations of Embryology, McGraw Hill, Inc.
3. Gilbert, S. F. (2006). Developmental Biology, VIII Edition, Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts, USA.
4. Walter, H.E. and Sayles, L.P; *Biology of Vertebrates*, Khosla Publishing House.

Course Title: Animal Diversity of Chordates from Amphibia to Mammalia; Course Code: 22-BS-ZOO-402C

Paper: II; Credits: 3; Final Theory Examination: 40; Internal Assessment – 10; Total Marks: 50

Objective: To make students capable of identifying and differentiate between vertebrate groups including amphibians, reptiles, birds, and mammals.

Course Outcomes:

CO-1: Students will be able to understand evolutionary lines of vertebrate class including amphibians, reptiles, birds, and mammals.

CO-2: Students will be able to identify (based on morphological characters) and understand adaptations in vertebrate class including amphibians, reptiles, birds, and mammals.

Unit-I

Amphibia: General characters and classification up to class level; Type study of frog (*Rana tigrina*), Parental care and neoteny in Amphibia

Unit-II

Reptilia: General characters and classification up to classes, Type study of Lizard (*Hemidactylus*): Structural & Functional morphology, Extinct reptiles; Poisonous apparatus in snakes

Unit-III

Aves: General characters and classifications up to classes, Type study of Pigeon (*Columba livia*); Structural and functional morphology; Flight/Aerial adaptation in birds, *Archaeopteryx* as missing link

Unit-IV

Mammals: General characters and classification up to classes; Type study of Rat; Adaptive radiations of mammals, dentition in mammals.

List of Recommended Books

1. B.K. Tikadar. Threatened Animals of India, ZSI Publication, Calcutta.
2. E.O. Wilson. The Diversity of Life (The College Edition), W.W. Northern & Co.
3. Kotpal, R. L. (2010). Modern text book of zoology: vertebrates. Rastogi Publications.
4. Parasitic diseases of wildlife and domestic animals by A. Alonso Aguirr
5. The diversity of living organisms, author: Richard Stephen Kent Barnes

Course Title: Aquatic Biology; Course Code: 22-BS-ZOO 403DSC

Paper: III; Credits: 3; Final Theory Examination: 40; Internal Assessment: 10; Total Marks: 50

Objectives:

1. The primary objective of the course to aware the students about aquatic life on earth.
2. This course is focused on understanding to the students about Importance of living organism in fresh and marine water.

Course Outcomes:

CO1: Students aware about of knowledge of Biodiversity of living organism in Aquatic life.

CO2: Students aware about the aquatic life and how the aquatic life is managed by controlling the pollution.

Unit-I

Aquatic Biomes: Brief introduction of the aquatic biomes: Freshwater ecosystem (lakes, wetlands, streams and rivers), estuaries, Oceanic pelagic zone, marine benthic zone and coral reefs.

Unit-II

Marine Biology; Salinity and density of sea water, Continental shelf, Adaptations of deep sea organisms, Coral reefs, Sea weeds

Unit-III

Freshwater Biology; Lakes: Origin and classification, Lake as an ecosystem, Physico–chemical characteristics affecting biodiversity: Light, Temperature, Thermal stratification, Dissolved solids, Carbonate, Bicarbonates, Phosphates and Nitrates, Turbidity, Dissolved gases (Oxygen, Carbon dioxide). Nutrient cycles in Lakes- Nitrogen, Sulphur and Phosphorous.

Unit-IV

Management of Aquatic Resources; Causes of pollution: Agricultural, Industrial, Sewage, Thermal and Oil spills, Eutrophication, Biomagnifications management and conservation (legislations), Sewage treatment water quality assessment- BOD and COD.

List of Recommended Books

1. Anathakrishnan: Bioresources Ecology 3rd Edition
2. Goldman: Limnology, 2nd Edition
3. Odum and Barrett: Fundamentals of Ecology, 5th Edition
4. Pawlowski: Physicochemical Methods for Water and Wastewater Treatment, 1st Edition
5. Wetzel: Limnology, 3rd Edition

Laboratory Course: Practical-4; Course Code: 22-BS-ZOO-404CL**Paper: IV; Credits: 2; Total Marks: 50****Objectives:**

1. To make students understand the classification of vertebrates Phylum and ways of identifying respective species
2. This course exposes in practical exercises to know the difference between different organs of different animals.
3. To impart knowledge about different forms of system in different group of organisms helping in maintaining homeostasis.
4. To impart practical knowledge to the students to perform experiments to identify stages of chick development and preparation of histological slides.

Outcomes: Upon completion of the practical course, the students will be able to:**CO1:** Students will be able to classify and identify vertebrates' species and their skeleton/morphology**CO2:** Students would gain suitable understanding based on learning contents of embryology.**CO3:** Students will be able to prepare and identify the histological slides of various organs and different stages of developing embryo.**List of Practicals:**

1. A Project Report on a visit to a Sewage treatment plant/Marine bioreserve/Fisheries Institutes.
2. Classification up to orders, habit, habitats, external characters and economic importance (if any): Amphibia: *Necturus, Proteus, Amphiuma, Salamandra, Amblystoma, Axolotl larva, Alytes, Bufo, Rana*.
3. Classification up to orders, habit, habitats, external characters and economic importance (if any): Reptilia: *Hemidactylus, Calotes, Draco, Varanus, Phrynosoma, Chamaeleon, Typhlops, Python, Eryx, Ptyas, Bungarus, Naja, Hydruis, Viper, Crocodilus, Gavialis, Chelone* (Turtle) and *Testudo* (Tortoise).
4. Classification up to orders, habit, habitats, external characters and economic importance (if any): Aves: *Casuaris, Arden, Anas, Milvus, Pavo, Eudynamis, Tyto, Alcedo, Halcyon*
5. Classification up to orders, habit, habitats, external characters and economic importance (if any): Mammalia: *Ornithorhynchus, Echidna, Didelphis, Macropus, Loris, Macaque, Hystris, Funambulus, Felix, Panthera, Canis, Herpestes, Capra, Pteropus*.
6. Determine the amount of Turbidity/transparency, Dissolved Oxygen, Free Carbon dioxide, Alkalinity (carbonates & bicarbonates) in water collected from a nearby lake/ water body.
7. Determine the area of a lake using graphimetric and gravimetric method.
8. Field Visit to National Park or Zoo.
9. Identify the important macrophytes, phytoplanktons and zooplanktons present in a lake ecosystem.
10. Instruments used in limnology (Secchi disc, Van Dorn Bottle, Conductivity meter, Turbidity meter, PONAR grab sampler) and their significance.
11. To study Developmental stages of chick embryo.
12. To study the various developmental stages of embryogenesis and life cycle of *Drosophila*.
13. To study the various developmental stages of life cycle of *Caenorhabditis elegans* with the help of charts.
14. To study the various developmental stages of life cycle of Frog.
15. To study various developmental stages of chick embryo with the help of the permanent slides.

**Course Title: Ecology and Evolution; Course Code: 22-BS-ZOO 501DSE; Paper: I
Credits: 3; Final Theory Examination: 40; Internal Assessment: 10; Total Marks: 50**

Objectives:

1. The primary objective of the course to aware the students about different life form on earth.
2. This course is focused on understanding to the students about interaction of living organism with environment.

Outcomes:

CO1: Students aware about of knowledge of evolution and know about relationship between different living organism.

CO2: Students would be able to take up functional studies of many organisms. Students will be exposed to the fundamental aspects of ecology.

Unit-I

Introduction and scope and types of Ecology, Biotic and Abiotic factors, Concept of habitat and niche- fundamental and realized niche, Characters displacement, Key stone species

Unit-II

Ecosystem Ecology: Ecosystem structure and function, Energy flow through ecosystem, Ecological pyramids, Primary production and decomposition. Food chain and its types

Unit-III

Major Events in History of Life, Macro-evolution and Microevolution, Evidence of evolution; vestigial organ, Atavism, divergent and convergent evolution, Phylogeny of Horse and human.

Unit-IV

Species Concept: Biological species concept (Advantages and Limitations); Speciation and Modes of speciation (Allopatric, Sympatric).

Lamarckism, Darwinism; Natural selection, types of Natural selection (Directional, Stabilizing, Disruptive), Artificial selection and Sexual selection.

List of Recommended Books:

1. Barton, N. H., Briggs, D. E. G., Eisen, J. A., Goldstein, D. B. and Patel, N. H. (2007). Evolution. Cold Spring, Harbour Laboratory Press.
2. Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). Principles of Genetics. VIII Edition. Wiley India.
3. Hall, B. K. and Hallgrimsson, B. (2008). Evolution. IV Edition. Jones and Bartlett, Publishers
4. Ridley, M. (2004). Evolution. III Edition. Blackwell Publishing
5. Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V Edition. John Wiley and Sons Inc.

Course Title: Insect Vector and Diseases; Course Code: 22-BS-ZOO 502DSE**Paper: 1; Credits: 3; Final Theory Examination: 40; Internal Assessment: 10; Total Marks: 50****Objectives:**

1. Insect vectors cause many diseases which lead to millions of deaths across the world every year especially in developing countries.
2. The rate of pathogen transmission by insects is increasing at an alarming rate posing a growing threat to the human population.

Course Outcomes: Upon completion of the course, the students will be able to:**CO1:** Identify different insects and classify them based on their morphology and behaviour**CO2:** Describe the host-pathogen relationships and the role of the host reservoir on transmission of parasite**CO3:** Identify the risk groups and characterize them on the basis of exposure risk**CO4:** Explain control methods of insect vector diseases including spreading awareness on public health programs and mitigating insect borne diseases**CO5:** Employ the use of advanced management strategies in disease control with respect to parasite evolution**UNIT- I**

Introduction to Insects: General features of insects, Classification of insects up to Orders- key identification feature; Morphological features: Head- Eyes, Types of antennae, Types of Mouth parts *w.r.t.* feeding habits: siphoning type (butterfly), sponging type (housefly), biting and chewing type (cockroach), piercing and sucking type (mosquito), chewing and lapping type (honey bee); thorax: types of legs.

UNIT –II

Concept of Vectors: Brief introduction to carriers and vectors (mechanical and biological vector); Insect reservoirs; Host-vector relationship; Vectorial capacity; Adaptations in insects to act as vectors; Host Specificity; Modes of disease transmission- vertical and horizontal transmission.

UNIT-III

Insects as Vectors: Features of orders with insects as vectors (Diptera, Siphonaptera, Siphunculata, Hemiptera) *w.r.t.* evolutionary, anatomical, physiological, cellular and molecular adaptations towards their role as vectors; Management strategies to control insect vectors- quarantine, cultural, mechanical, chemical, biological, behavioural.

UNIT-IV

Dipterans as Disease Vectors: Dipterans as important insect vectors- Mosquitoes, Sand flies, Houseflies; Study of mosquito borne diseases- Malaria, Dengue, Chikungunya, Viral encephalitis, Filariasis; Control of mosquitoes; Study of sand-fly borne diseases- Leishmaniasis, phlebotomus fever; Control of sand flies. Study of house fly as important mechanical vector; Myiasis; Control of housefly.

List of Recommended Books:

1. Burgess, N.R.H and Cowan, G.O. (1993) A Colour Atlas of Medical Entomology. Springer Science.
2. Chandra G. 2000. Mosquito. Sribhumi Publication Co. Kolkata.
3. Chapman RF. 1998. The Insects: Structure and Function. IV Edition, Cambridge University Press
4. Ricard P. Lane and Crosskey R. W. (1993) Medical insects and Arachnids. Springer Science.
5. Service, M.W. (1980) A Guide to Medical Entomology. Macmillan Press.
6. Wilson, E. O., The Insect Societies, Harward Univ. Press, UK.

Course Title: Insect Vector and Diseases; Course Code: 22-BS-ZOO 503DSE

Paper: II; Credits: 2; Final Theory Examination: 40; Internal Assessment: 10; Total Marks: 50

Objectives: To provide knowledge about Aquaculture, Poultry and Animal husbandry, Parasitism in relation to man, Insects in relation to man that will include, insect pest & vectors of human diseases.

Course Outcomes:

CO-1: Students will be able to identify different species and casts of honeybees and species of silkworm.

CO-2: Students will be able to use the tools and techniques used in aquaculture, poultry and capabilities to initiate startups will develop.

Unit I

Introduction to Host-parasite Relationship: Host, Definitive host, Intermediate host, Parasitism, Symbiosis, Commensalism, Reservoir, Zoonosis, Transmission, prevention and control of diseases: Tuberculosis and typhoid

Unit I

Brief account of *Rickettsia prowazekii*, *Borrelia recurrentis* and *Treponema pallidum*, Life history and pathogenicity of Parasitic Protozoa (*Entamoeba histolytica*, *Plasmodium vivax* and *Trypanosoma gambiense*) and: Parasitic Helminthes (*Ancylostoma duodenale* and *Wuchereria bancrofti*)

Unit III

Insects of economic importance: Control and damage caused by *Helicoverpa armigera*, *Pyrilla perpusilla* and *Papilio demoleus*, *Callosobruchus chinensis*, *Sitophilus oryzae* and *Tribolium castaneum*, Insects of Medical Importance, Medical importance and control of *Pediculus humanus corporis*, *Anopheles*, *Culex*, *Aedes*, *Xenopsylla cheopis*

Unit IV

Animal Husbandry: Preservation and artificial insemination in cattle; Induction of early puberty and synchronization of estrus in cattle, Poultry farming: Principles of poultry breeding, Management of breeding stock and broilers, Processing and preservation of eggs, Fish Technology: Genetic improvements in aquaculture industry; Induced breeding and transportation of fish seed

List of Recommended Books

1. Arora, D. R and Arora, B. (2001). Medical Parasitology. II Edition. CBS Publications and Distributors.
2. Jabde, P. V. (2005). Text Book of Applied Zoology. Discovery Publishing House.
3. Park, K. (2007). Preventive and Social Medicine. XVI Edition. B.B Publishers.

Laboratory Course: Practical-5; Course Code: 22-BS-ZOO 504DSE CL; Paper: III**Credits: 2; Total Marks: 50****Objectives:**

1. This course exposes in practical exercises to learn some fundamental aspects of Insect, Vector and Diseases related study.

Course Outcomes: Upon completion of the practical course, the students will be able to:**CO1:** Identify insects and vectors**CO2:** Employ the use of advanced management strategies in disease control with respect to parasite evolution**List of Practical:**

1. Biochemical analysis of pond or river water for dissolved O₂/CO₂/Chloride/Nitrate and Sulfate
2. Identify different stages of malarial parasites
3. Identifying feature and economic importance of *Helicoverpa (Heliothis) armigera*, *Papilio demoleus*, *Pyrilla perpusilla*, *Callosobruchus chinensis*, *Sitophilus oryzae* and *Tribolium castaneum*
4. Maintenance of freshwater aquarium
5. Study of adaptive modifications of feet and claws in birds.
6. Study of all the biotic and abiotic components of any simple ecosystem- natural pond or terrestrial ecosystem or human modified ecosystem.
7. Study of arthropod vectors associated with human diseases: *Pediculus*, *Culex*, *Anopheles*, *Aedes* and *Xenopsylla*.
8. Study of different kinds of mouth parts of insects through slides/specimens
9. Study of Homologous organs through forelimbs of *Talpa*, Bat, Monkey, Gibbon, Whale and horse.
10. Study of insect damage to different plant parts/stored grains through damaged products/photographs.
11. Study of insect vectors through permanent slides or photographs: *Aedes*, *Culex*, *Anopheles*, lice (head, body, pubic), bed bug, *Phlebotomus* (sand fly), *Musca domestica* (house fly)
12. Study of *Plasmodium vivax*, *Entamoeba histolytica*, *Trypanosoma gambiense*, *Ancylostoma duodenale* and *Wuchereria bancrofti* and their life stages through permanent slides/photomicrographs or specimens.
13. Visit to poultry farm or animal breeding centre. Submission of visit report

Course Title: Sericulture; Course Code: 22-BS-ZOO 601DSC**Paper: I; Credits: 3; Final Theory Examination: 40; Internal Assessment: 10; Total Marks: 50****Objectives:**

1. The course will make the students aware about the significance of sericulture as a profit-making enterprise.
2. It will help the students to understand the biology of silkworms and its nutritional requirement to secrete quality silk. The course would clarify the techniques of silkworm rearing, reeling of silk and various measures to be taken to maximize the benefits.
3. It would also help the students to know about various uses of silk and develop entrepreneurial skills required for self-employment in sericulture and silk production sector.

Course Outcomes: Upon completion of the course, students should be able to:**CO1:** Learn about the history of sericulture and silk route.**CO2:** Recognize various species of silk moths in India, and exotic and indigenous races.**CO3:** Be aware about the opportunities and employment in sericulture industry- in public, private and government sector.**CO4:** Develop entrepreneurial skills necessary for self-employment in mulberry and seed production and be apprised about practicing sericulture as a profit-making enterprise.**UNIT- I**

Sericulture: Definition, history and present status; Silk route; Types of silkworms, Distribution and races; Exotic and indigenous; Mulberry sericulture; Non-mulberry Sericulture, Eri, Muga, Tassar

UNIT –II

Life cycle of *Bombyx mori*; Structure of silk gland and secretion of silk; Composition and properties of silk

UNIT-III

Selection of mulberry variety and establishment of mulberry garden, Rearing house and rearing appliances, Disinfectants: Formalin, bleaching powder, RKO Silkworm rearing technology: Early age and Late age rearing, Types of mountages, Harvesting and storage of cocoons, Postharvest technology- Silk reeling, Dyeing and weaving, Ahimsa silk

UNIT-IV

Pests of silkworm: Uzi fly, dermestid beetles and vertebrates; Pathogenesis of silkworm diseases: Protozoan, viral, fungal and bacterial; Control and prevention of pests and diseases

Prospects of Sericulture in India: Sericulture industry in different states, Employment opportunities in mulberry and non-mulberry sericulture sector, Economics in small scale and large-scale silk worm rearing, Scope for women entrepreneurs in sericulture sector

List of Recommended Books

1. A Guide for Bivoltine Sericulture; K. Sengupta, Director, CSR & TI, Mysore 1989.
2. Appropriate Sericultural Techniques; Ed. M. S. Jolly, Director, CSR & TI, Mysore.
3. Handbook of Practical Sericulture: S.R. Ullal and M.N. Narasimhanna CSB, Bangalore
4. Handbook of Silkworm Rearing: Agriculture and Technical Manual-1, Fuzi Pub. Co. Ltd., Tokyo, Japan 1972.
5. Manual of Silkworm Egg Production; M. N. Narasimhanna, CSB, Bangalore 1988.

Course Title: Immunology; Course Code: 22-BS-ZOO 602DSC**Paper: II; Credits: 3; Final Theory Examination: 40; Internal Assessment: 10; Total Marks: 50****Objectives:**

1. To discuss the structure, functions and integration of immune system.
2. To explain the antigen-antibody interactions and how the immune system is protecting the body from foreign pathogens/germs.

Course Outcomes:

1. The students after completing the course would be aware of immune system structure and functions.
2. The students would be aware of the concepts and mechanism behind allergy and hypersensitivity reactions.

Unit I

Introduction to basic concepts in immunology, components of immune system, principles of innate and adaptive immune system, Haematopoiesis, Cells and organs of the immune system

Unit II

Antigens: Basic properties of antigens, B and T cell epitopes, haptens and adjuvants, Antibodies: Structure, classes and function of antibodies, monoclonal antibodies, antigen antibody interactions

Unit III

Structure and functions of MHC, antigen presentation and processing (exogenous and endogenous pathways), Basic properties and functions of cytokines, Complement system: Components and pathways

Unit IV

Brief description of various types of hypersensitivities (Gell and Coomb's classification), Introduction to concepts of autoimmunity and immunodeficiency, General introduction to vaccines, Various types of vaccines

List of Recommended Books

1. Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's Immunology. 6th edition W.H. Freeman and Company, New York.
2. Murphy K, Travers P, Walport M. (2008). Janeway's Immunobiology. 7th edition Garland Science Publishers, New York.
3. Peakman M, and Vergani D. (2009). Basic and Clinical Immunology. 2nd edition Churchill Livingstone Publishers, Edinburgh.
4. Richard C and Geiffrey S. (2009). Immunology. 6th edition. Wiley Blackwell Publication

Course Title: Animal Biotechnology; Course Code: 22-BS-ZOO-603DSE

Paper: II; Credits: 3; Final Theory Examination: 40; Internal Assessment: 10; Total Marks: 50

Objectives: Identification and characterization of animals breed and study about different types of method to introduce foreign gene in to host and gets idea about Basic study of tissue culture method and used in agriculture.

Course Outcomes:

CO1: Students will understand how genes are expressed and what regulatory mechanisms contribute to control of gene expression, basic principles and techniques in genetic manipulation

CO2: Students will understand about genetic engineering and gene transfer technologies for animals and animal cell lines.

Unit-I

Biotechnology: Scope and Application, Tissue culture in animals, Media Composition, Preparation and sterilisation,

Unit-II

Cell harvesting methods, Micro propagation, Protoplast fusion and somatic hybridisation; Cybrides.

Unit-III

Transgenic animals: Methods for gene transfer in developing transgenic animals, Hybridoma technology, Application of transgenic animals,

Unit-IV

Stem cells: Scope, Properties and identification, Stem cell culture, techniques and their application in clinical science.

List of Recommended Books:

1. Ballinic C. A., Philips J.P and Moo Young M. Animal Biotechnology. Pergamon press, New York. Latest addition.
2. Berger S. L. and A.R. Kimmel. Methods in enzymology guide to molecular cloning techniques (Vol 152). Academic Press Inc. San Diego.1996
3. Glick, B.R. and Pasternak J.J. Molecular Biotechnology.ASM Press, Washington DC.2003
4. Watson J.D.et al. Molecular Biology of Gene (Latest adition.) Publisher Benjamin Cummings. 2007.

Course Title: Medical Diagnostics; Course Code: 22-BS-ZOO-604 SEC**Paper: II; Credits: 2; Final Theory Examination: 40; Internal Assessment: 10; Total Marks: 50****Objectives:**

1. Medical diagnostics paper is aimed to provide students a unique opportunity to study how doctors or clinicians come to a conclusion regarding disease prediction, prevention, diagnosis, and optimal treatment regimens.
2. Students will learn about multiple diagnostic tools, techniques and technologies used in medical practices.

Course Outcomes: Upon completion of the course, the students will be able to:**CO1:** Understand the use of histology and biochemistry of clinical diagnostics and learn about the molecular diagnostic tools and their relation to precision medicine.**CO2:** Develop their skills in various types of tests and staining procedure involved in hematology, clinical biochemistry and will know the basics of instrument handling.**CO3:** Learn scientific approaches/techniques used in the clinical laboratories to investigate various diseases and will be skilled to work in research laboratories.**CO4:** Gain knowledge about common imaging technologies and their utility in the clinic to diagnose a specific disease.**UNIT- I**

Introduction to medical diagnostics and its importance

Diagnostics methods used for analysis of blood: Blood composition, Preparation of blood smear and Differential Leucocyte Count (D.L.C) using Leishman's stain, Platelet count using haemocytometer, Erythrocyte Sedimentary Rate (E.S.R), Packed Cell Volume (P.C.V.)

UNIT –II

Diagnostic methods used for urine analysis: Urine analysis: Physical characteristics; Abnormal constituents, PSA test

Non-infectious Diseases: Causes, types, symptoms, complications, diagnosis and prevention of diabetes (Type I and Type II), Hypertension (primary and secondary), Testing of blood glucose using Glucometer/Kit

UNIT-III

Infectious Diseases: Causes, types, symptoms, diagnosis and prevention of Tuberculosis and Hepatitis

Tumors: Types (Benign/Malignant), Detection and metastasis; Medical imaging: X-Ray of Bone fracture, PET, MRI and CT scan (using photographs).

UNIT-IV

Lipid profiling, liver function test, Causes, types, symptoms, diagnosis and prevention of Tuberculosis and Hepatitis, Malarial parasite (Microscope based and ELISA based)

List of Recommended Books

1. Gunasegaran JP. 2010. A Text book of Histology and a Practical Guide. Elsevier
2. Poddar T, Mukhopadhyay S, Das S K. An advanced Laboratory Manual of Zoology (Trinity Press)
3. Sinha J K, Chatterjee A K. and Chattopadhyay P. – Advanced Practical Zoology (New Central Book Agency)

Laboratory Course: Practical-6; Course Code: 22-BS-ZOO-605 DSE CL**Paper: III; Credits: 2; Total Marks: 50****Objectives:**

1. This course exposes in practical exercises to know the difference between different organs of different animals.
2. To impart knowledge about different forms of system in different group of organisms helping in maintaining homeostasis.
3. The candidate will gain hands-on knowledge and acquire adequate skill required to identify and enumerate immune cells and also perform agglutination reactions.

Outcomes: Upon completion of the practical course, the students will be able to:**CO1:** Gain insight into the important concept of comparative anatomy and animal physiology**CO2:** Understand the important links which leads for animal evolution.**CO3:** Identify various immune cells and enumerate them**CO4:** Identify blood groups and types**CO5:** Analyze the components of human sera by performing agarose and polyacrylamide gel electrophoresis**List of Practicals:**

1. Study of the life cycle of different species of silk moths - *Bombyx mori*, *Philosamia ricini*, *Antherea paphia*/*Antherea mylitta*/*Antherea assama*.
2. Study of the sexual dimorphism in caterpillar, pupae and adults of *Bombyx mori*.
3. Determination of human blood groups.
4. Demonstration of lymphoid organs
5. Histological study of spleen, thymus and lymph nodes through slides/ photographs
6. Preparation of stained blood film to study various types of blood cells.
7. Perform Total Leukocyte Count of the given blood sample.
8. Perform Differential Leukocyte Count of the given blood sample.
9. Perform immunodiffusion by Ouchterlony method.
10. Demonstration of a) ELISA b) Immunoelectrophoresis