

FACULTY OF SCIENCES
SYLLABUS FOR THE BATCH FROM 2024 TO 2028

Programme Code: BSMD

Programme Name: B.Sc. Medical

(Semester I-II)

Examinations: 2024-2025



Department of Zoology

Khalsa College, Amritsar

(An Autonomous College)

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(b) Subject to change in the syllabi at any time.
(c) Please visit the College website time to time.**

S. No.	PROGRAMME OBJECTIVES
1.	To inculcate scientific temperament to broaden the outlook of students.
2.	To provide students a launch-pad for higher education.
3.	Skill development through practical, enabling them to solve common problems in their daily life.
4.	To undertake activities like field survey, photography, projects etc. to unearth their hidden talents.
5.	Holding Science exhibition, poster competition and educational trips, shaping their personality and preparing their minds to face, think and act in different situations.
6.	Participation in various cultural programs to build their confidence which help them to interact with different individuals in the society and work for welfare of the community.

S. No.	PROGRAMME SPECIFIC OUTCOMES (PSOS)
PSO-1	It is one of the most fundamental units of basic sciences studied at undergraduate level.
PSO-2	The programme helps to develop scientific tempers and attitudes which in turn can be useful for the scientific developments that make a nation or society to grow at a rapid pace.
PSO-3	After the completion of this course, students have the option to go higher studies i.e. Ph.D. and then do research work for the welfare of mankind
PSO-4	After higher studies, students can join as scientist or assistant professor and can even look for professional job oriented courses, such as civil services
PSO-5	Students can go to serve in industries and opt for establishing their own industrial units

COURSE SCHEME											
SEMESTER - I											
Course Code	Course Name	Hours/Week	Credits			Total Credits	Max Marks				Page No.
			L	T	P		Th	P	IA	Total	
Major Courses											
BZO-111	Cell Biology	2	2	0	0	2	37		38	150	4
BZO-112	Biodiversity-I	2	2	0	0	2	37				6
BZO-113	Practical-I (Related to BZO-111 and BZO-112)	4	0	0	2	2		38			8

SEMESTER - II											
Course Code	Course Name	Hours/Week	Credits			Total Credits	Max Marks				Page No.
			L	T	P		Th	P	IA	Total	
Major Courses											
BZO-121	Ecology	2	2	0	0	2	37		38	150	10
BZO-122	Biodiversity-II	2	2	0	0	2	37				12
BZO-123	Practical-II (Related to BZO-121 and BZO-122)	4	0	0	2	2		38			14

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**B.Sc. Medical Semester I
COURSE CODE: BZO-111
COURSE TITLE: ZOOLOGY**

**Theory
BZO-111: CELL BIOLOGY**

Periods/week: 4**Credit Hours/Week: 2 hrs.****Credits: L T P: 2 0 0****Maximum Marks: 37****Pass Marks: 35%****Time: 3 Hrs.****Instructions for the Paper Setters:**

1. There will be two sections A and B.
2. Section A is compulsory and will be of 9 marks. The candidates are required to attempt 6 questions out of 8 short answer type questions carrying 1.5 marks each covering the whole syllabus. The answer should not exceed 50 words.
3. Section B will be set from units I, II, III and IV respectively and will consist of two questions of 7 marks each from the respective units. The candidates are required to attempt one question from each of these units. Each question in these units should not have more than two sub-parts.

COURSE OBJECTIVES

1	Understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles
2	Understand how these cellular components are used to generate and utilize energy in cells
3	Understand the cellular components underlying mitotic cell division.
4	Apply their knowledge of cell biology to selected examples of changes or losses in cell function like responses to environmental or physiological changes or mutation.

UNIT-I**Methods in Cell Biology:**

- (a) Resolving Power of Microscope: Principles of light and phase contrast microscopy
- (b) Electron microscopy (TEM and SEM): Principle and construction
Fixation and fixatives; Bouin's Fluid (alcoholic and Aqueous), Carnoy's fluid, Normal Saline; Formalin solution, Mayer's albumen
- (c) Grades of Alcohol
Types of Stain: Borax carmine, Aceto-orcein, Haematoxylin, Eosin, Safranin, Leishman, Giemsa, Methylene Blue, Light green, fast green
- (d) Preparation of Permanent slides: Temporary and Permanent mounting, single and double staining

UNIT-II**Organization of Cell:** Extra nuclear and nuclear, ultrastructure and functions of cell organelles

- (a) Plasma Membrane: Structure of phospholipid, Fluid Mosaic Model
- (b) Types of diffusion, osmosis, active & passive transport
- (c) Bulk Transport: Phagocytosis, Pinocytosis
- (d) Endoplasmic reticulum: Structure, types and associated enzymes

- (e) Mitochondria: Structure, mitochondrial enzymes and role of mitochondria in respiration and mitochondrial DNA

UNIT-III

Organization of Cell:

- (a) Golgi complex: Structure and functions
- (b) Ribosomes: Types of ribosomes, their structure and functions
- (c) Lysosomes: Polymorphism and their function
- (d) Centrosome: Structure and functions
- (e) Cilia and Flagella

UNIT-IV

- Nucleus: Structure and functions of nuclear membrane, nucleolus and chromosomes
- Cancer and its types; causes of cancer and characteristics of cancer cells.
- An elementary idea of cell transformation in cancer; role of P53 gene and telomerase enzyme
- An elementary idea of cellular basis of immunity: Active, passive, innate, humoral and cellmediated immunity, types and structure of antibody.

Suggested Readings

1. Alberts, B., Bray, D., Lewis, J., Raff, M. Roberts, K., Watson J.D.(1998), Molecular Biology of the Cell, Garland Publ. Inc., New York.
2. Chandra Roy, S and DE Kumar, K. (2001), Cell Biology, New Central Book Agency (P) Ltd. Kolkata.
3. Cooper, G. M. (2004), The cell, A Molecular Approach, ASM press, Washington, D. C.
4. De Robertis, E.D.P. De Robertis, E.M.F.(1995) Cell Biology and Molecular Biology (Eighth Edition), W.B. Saunders Co., Philadelphia.
5. Karp, G. (1984). Cell Biology (4th ed), McGraw Hill, New York. 6. Pawar, C.B (1999), Cell Biology, Himalaya Publishing House, Bombay

COURSE OUTCOMES-

CO-1.	Understand the cell theory and cell principle.
CO-2.	Understand properties of cell like cell size, shape, number, life span and death
CO-3.	Know the structure and importance of prokaryotic (Mycoplasma, Bacteria, Cyanobacteria) and eukaryotic cell.
CO-4.	Study the theories of evolution of eukaryotic cell from prokaryotic cell.
CO-5.	Study the structure and functions of the cell organelles like Golgi complex, Endoplasmic reticulum, Mitochondrion, Ribosomes, Peroxysomes and glyoxysomes.
CO-6	Develop understanding about various cell surface modifications: Glycocalyx, Microvilli and Caveolae
CO-7	Study the cytoskeleton including microtubules, actin, myosin, intermediate filaments and their role in muscle contraction
CO-8	Understand the phases of cell cycle including Mitosis and Meiosis.

Theory

BZO-112: BIODIVERSITY-I (PROTOZOA TO ANNELIDA)

Periods/week: 4

Credit Hours/Week: 2 hrs.

Credits: L T P: 2 0 0

Maximum Marks: 37

Pass Marks: 35%

Time: 3 Hrs.

Instructions for the Paper Setters:

1. There will be two sections A and B.
2. Section A is compulsory and will be of 9 marks. The candidates are required to attempt 6 questions out of 8 short answer type questions carrying 1.5 marks each covering the whole syllabus. The answer should not exceed 50 words.
3. Section B will be set from units I, II, III and IV respectively and will consists of two questions of 7 marks each from the respective units. The candidates are required to attempt one question from each of these units. Each question in these units should not have more than two sub-parts.

COURSE OBJECTIVES

1.	Understand the animal kingdom.
2.	Understand the taxonomic position of Protozoa to Annelida.
3.	Understand the general characteristics of animals belonging to Protozoa to Annelida.
4.	Understand the body organization of phylum from Protozoa to Annelida.
5.	Understand the origin and evolutionary relationship of different phylum from Protozoa to Annelida.

UNIT-I

Detailed study of the following animals-

- Protozoa:
 - *Amoeba proteus* emphasizing theories of amoeboid locomotion
 - *Paramecium caudatum* (Kappa particles in *P. aurelia*)
 - *Plasmodium vivax*

UNIT-II

Detailed study of the following animals-

- Porifera: Detailed study of the following animals-
 - *Sycon* (special reference to canal system)
- Coelenterata:
 - *Obelia*

UNIT-III

Detailed study of the following animals-

- Platyhelminthes:
 - *Fasciola hepatica*
 - *Taenia solium*
- Parasitic adaptations in *Fasciola* and *Taenia*

UNIT-IV

Detailed study of the following animals-

- Aschelminthes:
 - *Ascaris*
- Annelida:
 - *Pheretima posthuma*
- Economic importance of Earthworm

Suggested Readings:-

1. Barnes, R.D. (1999), Invertebrate Zoology. W.B. Saunder, Philadelphia.
2. Dhama, P.S. & Dhama, J. K (2001), Invertebrates, R. Chand & Co., New Delhi.
3. Barth, R. H. and Broshears, R. E (1982), The Invertebrate world. Holt Saunder, Japan.
4. Brusca, R. C. and Brusca, G. J. (2003), Invertebrates (2nd ed). Sinauer Associates, Inc. Publishers, Sunderland, Massachusetts.
5. Engemann, J. G. and Hegner, R. W. (1981), Invertebrate Zoology (3rd ed.) Macmillan, New York.
6. Gardiner, M. S. (1972), The Biology of Invertebrates, McGraw Hill, New York.
7. Meglitsch, P. A. and Schran, F. R. (1991), Invertebrate Zoology (3rd ed). Oxford University Press, New York.
8. Pechenik, A. Jan. (2000), Biology of the invertebrates, (4th ed), McGraw Hill Book Co. Singapore.

COURSE OUTCOMES

CO-1.	The subject of biodiversity helps the students to know about the structural aspects of different animals
CO-2.	Students also gain knowledge about the taxonomies and evolutionary aspects of Zoology.
CO-3.	To study faunal diversity and learn to implement conservation measures to save biodiversity

Practical-I

BZO-113: (Related to BZO-111 and BZO-112)

Periods/week: 6

Credit Hours/Week: 2 hrs.

Credits: L T P: 0 0 2

Maximum Marks: 38

Pass Marks: 35%

Time: 3 Hrs.

Important Note for Practical:

1. Candidates will be required to submit their original note books containing record of their laboratory work.
2. Wherever possible, students must be taken out for excursion to the field (Zoological gardens, sea shores, ponds and hill stations etc.) to study habitat and ecology of the animals.
3. As per the latest UGC guidelines the dissections may please be avoided. In no case an animal falling under the categories of wildlife protection act 1972 should be caught or dissected. The rules of the Prevention of cruelty to Animals act 1960 should be familiar to all who are teaching the Zoology courses.

COURSE OBJECTIVES

1.	Understand the structure of invertebrates and classify them.
2.	Understand various techniques like SEM, TEM and Chromatography.
3.	Understand the structure and function of digestive, reproductive and nervous system of earthworm.
4.	Understand the preparation of temporary slides.

1	Classification up to orders with ecological notes and economic importance (if any) of the following animals (Through Specimens or slides):
Protozoa	<i>Amoeba, Euglena, Trypanosoma, Noctiluca, Eimeria, Monocystis, Paramecium, Opalina, Vorticella, Balantidium, Nyctotherus, Polystomella</i>
Parazoa	<i>Sycon, Grantia, Euplectella, Hyalonema, Spongilla, Euspongia</i>
Cnidaria	<i>Porpita, Velella, Physalia, Aurelia, Rhizostoma, Metridium, Millipora, Alcyonium, Tubipora, Zoanthus, Madrepora, Favia, Fungia and Astrangia Hydra (WM), Hydra with buds, Obelia (colony and medusa), Sertularia, Plumularia, Tubularia, Bougainvillea and Aurelia</i>
Platyhelminthes	<i>Dugesia, Fasciola, Taenia, Echinococcus</i>
Aschelminthes	<i>Ascaris (male and female), Trichinella, Ancylostoma</i>
Annelida	<i>Pheretima, Nereis, Heteronereis, Polynoe, Eunice, Aphrodite, Chaetopterus, Arenicola, Tubifex, Pontobdella</i>
2	Study of the permanent stained preparations
	LS and TS <i>Sycon</i> , gemmules, spicules and spongin fibers of a sponge
	TS <i>Hydra</i> (Testis and ovary region)
	TS <i>Fasciola</i> (Different regions)
	Miracidium, Sporocyst, Redia, Cercaria larvae of <i>Fasciola</i>
	Scolex and proglottids of <i>Taenia</i> (mature and gravid)
	TS <i>Ascaris</i> (Male and Female)
	TS <i>Pheretima</i> (pharyngeal and typhlosolar regions), setae, septal nephridia, spermathecae and ovary of <i>Pheretima</i> (Earthworm)
3	Temporary Preparation
	Freshwater Protozoan culture; slide preparation

4	Demonstration of	digestive, reproductive and nervous systems of earthworm with the help of charts/ videos/ models
5	Cell Biology	Paper chromatography
		Thin layers chromatography
		Gel electrophoresis through photographs or through research laboratories
		Familiarity with TEM & SEM
		Study of different ultra-structures of cell organelles through photographs
6	Students must be taken out to study vermicomposting unit and submit the report.	

Guidelines for conduct of practical Examination: -

1	Identify and classify the specimens A-C up to order. Write a note on their habit, habitat, special features and economic importance.	9
2	Identify the slides/models D-G and give two reasons for identification.	8
3	Identify the adaptive feature/nest.	5
4	Mark the distribution of animals of a realm on the map.	5
5	Project/ Assignment report	5
6	Viva-voce & Practical file.	6

COURSE OUTCOMES

CO-1.	Have a knowledge about all the different phyla of invertebrates
CO-2.	Understand the comparative structure of invertebrates
CO-3.	Have an insight about the microscopic life
CO-4.	Differentiate invertebrates on the basis of morphological characteristics

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B.Sc. Medical Semester II
COURSE CODE: BZO-121
COURSE TITLE: ZOOLOGY

Theory
BZO-121: ECOLOGY

Periods/week: 4

Credit Hours/Week: 2 hrs.

Credits: L T P: 2 0 0

Maximum Marks: 37

Pass Marks: 35%

Time: 3 Hrs.

Instructions for the Paper Setters:

1. There will be two sections A and B.
2. Section A is compulsory and will be of 9 marks. The candidates are required to attempt 6 questions out of 8 short answer type questions carrying 1.5 marks each covering the whole syllabus. The answer should not exceed 50 words.
3. Section B will be set from units I, II, III and IV respectively and will consists of two questions of 7 marks each from the respective units. The candidates are required to attempt one question from each of these units. Each question in these units should not have more than two sub-parts.

COURSE OBJECTIVES

1.	Describe the interaction between organisms and environment.
2.	Describe the ecological adaptations in animals in different habitats.
3.	Understand ecological niche and succession.
4.	Understand the exchange of nutrients within the ecosystem.
5.	Describe the population dynamics.

UNIT-I

- Meaning of Ecology, its divisions and levels of organization
- Biotic and Abiotic components of Ecosystem, Ecological energetics (10% law), food chains and webs, major ecosystems of the world
- Temperature, light and soil as ecological factors

UNIT-II

- Biogeochemical cycles (Carbon, Nitrogen, Sulphur, Phosphorus and Water cycle)
- Adaptations, its types (Morphological, physiological and behavioural adaptations) in different animals

UNIT-III

- Characteristics of population and its regulation strategies
- Interactions among animals (Competition, Predation, Parasitism, Commensalism and Mutualism)
- Ecological succession and its types (Hydrosere and Xerosere), Concept of ecological niche

UNIT-IV

- Renewable and non-renewable natural resources and their conservation
- Causes, impact and control of air, water and soil pollution

Suggested Readings:-

1. Anderwartha, H.G. and Birch, L. C. (1970), The distribution and abundance of animals, University of Chicago Press, Chicago London.
2. Beeby, A. (1992), Applying Ecology, Chapman and Hall Madras.
3. Begon, M., Harper J. L. and Townsend, C. R. (1995), Ecology – Individuals, populations and communities, Blackwell Science, Cambridge UK.
4. Brewer, R. (1994), The science of Ecology, Saunders College of Publishing, New York.
5. Chapman, J. L. and Resis, M. J. (1995), Ecology- Principles and applications, Cambridge University Press, Cambridge UK.
6. Kaeighs, S. C. (1974), Ecology with special references to animal and Man, Prentice Hall Inc.
7. Kormondy, E.J. (1975), Concept of Ecology, Englewood Cliffs, N.J. Prentice Hall Inc.
8. Krebs C.J. (1982), Ecology, Harper & Row, New York. 9. Putmann, R. J. and Wratten, S. D. (1984), Principles of Ecology, Crown Helm, London.

COURSE OUTCOMES

CO-1.	Have a knowledge about the biodiversity
CO-2.	assess effects of human activities on biosphere
CO-3.	Pursue various courses M.Sc. Environmental studies etc. in future & can opt for carrier in academics.
CO-4.	Work for wildlife and biodiversity agencies.



Theory

BZO-122: BIODIVERSITY-II (ARTHROPODA TO HEMICHORDATA)

Periods/week: 4

Credit Hours/Week: 2 hrs.

Credits: L T P: 2 0 0

Maximum Marks: 37

Pass Marks: 35%

Time: 3 Hrs.

Instructions for the Paper Setters:

1. There will be two sections A and B.
2. Section A is compulsory and will be of 9 marks. The candidates are required to attempt 6 questions out of 8 short answer type questions carrying 1.5 marks each covering the whole syllabus. The answer should not exceed 50 words.
3. Section B will be set from units I, II, III and IV respectively and will consists of two questions of 7 marks each from the respective units. The candidates are required to attempt one question from each of these units. Each question in these units should not have more than two sub-parts.

COURSE OBJECTIVES

1.	Understand the animal kingdom.
2.	Understand the taxonomic position of arthropods to hemichordates.
3.	Understand the general characteristics of animals belonging to arthropods up to hemichordates.
4.	Understand the body organization of phylum from arthropods to hemichordates.
5.	Understand the origin and evolutionary relationship of different phylum from arthropods to hemichordates.

UNIT-I

- **Arthropoda-** General characteristics and economic importance
- Type study: *Periplaneta americana* (Cockroach)
- Social organizations in insects (Honey bee and Termite)

UNIT-II

- **Mollusca-** General Characteristics and Economic importance
- Type study: *Pila globosa*
- Torsion and its effect, advantage and disadvantage of torsion, Detorsion, Pearl formation

UNIT-III

- **Echinodermata-** General Characteristics and Economic importance
- Type study: *Asterias* (Star fish)
- Study of Echinoderm larvae (Dipleurula, Bipinnaria and Brachiolaria)

UNIT-IV

- **Hemichordata:** General Characteristics and Economic importance
- *Balanoglossus* (External characters only)
- Affinities of Hemichordates with Non-Chordates and Chordates

Suggested Readings:-

1. Barnes, R.D. (1999), Invertebrate Zoology. W.B. Saunder, Philadelphia.
2. Dhami, P.S. & Dhami, J. K., Invertebrates, R. Chand & Co., New Delhi, 2001.
3. Barth, R. H. and Broshears, R. E (1982), The Invertebrate world. Holt Saunder, Japan.
4. Brusca, R. C. and Brusca, G. J. (2003), Invertebrates (2nd ed), Sinauer Associates, Inc. Publishers, Sunderland, Massachusetts.
5. Engemann, J. G. and Hegner, R. W. (1981), Invertebrate Zoology (3rd ed), Macmillan, New York.
6. Gardiner, M. S. (1972), The Biology of Invertebrates, McGraw Hill, New York.
7. Meglitsch, P. A. and Schran, F. R. (1991), Invertebrate Zoology (3rd ed), Oxford University Press, New York.
8. Pechenik, A. Jan. (2000), Biology of the invertebrates, (4th ed), McGraw Hill Book Co. Singapore.

COURSE OUTCOMES

CO-1.	The subject of biodiversity helps the students to know about the structural aspects of different animals.
CO-2.	Students also gain knowledge about the taxonomies and evolutionary aspects of Zoology.
CO-3.	To study faunal diversity and learn to implement conservation measures to save biodiversity
CO-4.	The students get in depth knowledge about various animal phyla (Arthropoda to Hemichordata)
CO-5.	Detailed type studies of representative organisms of each phyla.
CO-6.	This course also provides detailed knowledge about evolutionary relationships between Non-Chordates, Hemichordates & Chordates.

Practical-II

BZO-123: (Related to BZO-121 and BZO-122)

Periods/week: 6

Credit Hours/Week: 2 hrs.

Credits: L T P: 0 0 2

Maximum Marks: 38

Pass Marks: 35%

Time: 3 Hrs.

Important Note for Practical:

1. Candidates will be required to submit their original note books containing record of their laboratory work.
2. Wherever possible, students must be taken out for excursion to the field (Zoological gardens, sea shores, ponds and hill stations etc.) to study habitat and ecology of the animals.
3. As per the latest UGC guidelines the dissections may please be avoided. In no case an animal falling under the categories of wildlife protection act 1972 should be caught or dissected. The rules of the Prevention of cruelty to Animals act 1960 should be familiar to all who are teaching the Zoology courses.

COURSE OBJECTIVES

1.	Classify the organisms up to orders with their ecological notes and economic importance.
2.	Understand the permanent stained slides of insects and molluscs.
3.	Understand digestive and nervous system of <i>Periplaneta</i> .
4.	Study abiotic and biotic components of an ecosystem.
5.	Study and prepare the charts related to Zoogeographical realms.

1.	Classification up to orders with ecological notes and economic importance (if any) of the following animals:	
	Arthropoda :	<i>Peripatus, Palaemon, Lobster, Cancer, Sacculina, Eupagurus, Lepas, Balanus, Cyclops, Daphnia, Lepisma, Periplaneta, Schistocerca, Mantis, Poeciloceris, Gryllus, Cicada, Forficula, Dragonfly, Termite queen, Apis, Bug, Moth, Beetles, Polistes, Bombyx, Pediculus, Scolopendra (Centipede), Julus (Millipede), Palamnaeus, Aranea, Limulus,</i>
	Mollusca:	<i>Anodonta, Mytilus, Ostrea, Cardium, Pholas, Solen, Pecten, Haliotis, Patella, Aplysia, Doris, Limax, Loligo, Sepia, Octopus, Nautilus shell (Complete and T.S.), Chiton, Dentalium</i>
	Echinodermata:	<i>Asterias, Echinus Ophiothrix, Antedon</i>
	Hemichordata:	<i>Balanoglossus</i>
2.	Study of permanent stained preparations:	Trachea and mouth parts of insects Radula and osphradium of <i>Pila</i> T.S. Star fish (Arm)
3.	Study of	Mouth parts of <i>Periplaneta</i>
4.	Demonstration using charts/models/software	Digestive and nervous system of <i>Periplaneta</i>
5.	Ecology:	Study of animal adaptations with the help of specimens, charts & models Study of abiotic and biotic components of an ecosystem Study of different types of nests in birds Study and preparation of charts Zoogeographical realms
6.	Assignment:	Study of local invertebrates fauna/Preparation of scrap book

Guidelines for conduct of practical Examination: -

1.	Identify and classify the specimens A-C up to order. Write a note on their habit, habitat, special features and economic importance.	9
2.	Identify the slides/models D-G and give two reasons for identification.	8
3.	Identify the adaptive feature of animals/nest.	5
4.	Mark the distribution of animals of a realm on the map.	5
5.	Project/ Assignment report	5
6.	Viva-voce & Practical file.	6

COURSE OUTCOMES

CO-1.	Differentiate invertebrates on the basis of morphological characteristics
CO-2.	Understand the comparative structure of invertebrates
CO-3.	Have an insight about the internal systems of different invertebrates
CO-4.	Have a knowledge about different phyla of invertebrates