# FACULTY OF LIFE SCIENCES

**SYLLABUS**
**of**

# Zoology

**for**

**B. Sc. Medical (Semester I-VI)**

**M. Sc. Zoology (Semester III-IV)**

**M. Sc. Zoology (Semester I- IV) (Credit based system)**

**M. Sc. Chemistry (Semester II)**

**B.Sc. Biotechnology (Semester I, II, IV)**

**B. Sc. Home Science (Semester VI)**

**Session: 2022-23**


## The Heritage Institution
## KANYA MAHA VIDYALAYA
## JALANDHAR

## (Autonomous)

# KANYA MAHAVIDYALAYA, JALANDHAR (AUTONOMOUS)

**SCHEME AND CURRICULUM OF EXAMINATIONS OF THREE-YEAR DEGREE PROGRAM**

## Session-2022-25

| **SEMESTER I** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Course Name** | **Program Name** | **Course Code** | | **Course Type** | **Marks** | | | | | **Examination time (in Hours)** |
| | | | | | **Total** | **Paper** | **Ext.** | | **CA** | |
| | | | | | | | **L** | **P** | | |
| Zoology | B.Sc. (Medical) | BSMM-1483 | I | E | 100 | Cell Biology | 30 | - | 20 | 3 |
| | | | II | | | Biodiversity-I | 30 | - | | 3 |
| | | | P | | | PRACTICAL–I (Related To Cell Biology & Biodiversity-I) | - | 20 | | 3 |
| **SEMESTER II** | | | | | | | | | | |
| Zoology | B.Sc. (Medical) | BSMM-2483 | I | E | 100 | Ecology | 30 | - | 20 | 3 |
| | | | II | | | Biodiversity-II | 30 | - | | 3 |
| | | | P | | | PRACTICAL–II (Related To Ecology & Biodiversity-II) | - | 20 | | 3 |

**B.Sc. Medical (Semester–I) (Session 2022-25)**
**ZOOLOGY**
**CELL BIOLOGY**
**Course Code: BSMM-1483 (I)**
**(THEORY)**

# Course Outcome

- CO1. Perform a variety of molecular and cellular biology techniques
- CO2. Describe cellular membrane structure and function, fine structure and function of cell organelles.
- CO3. Knowledge about structure and function of cell organelles.
- CO4. Learn elementary idea about Cancer and Immunity.

**B.Sc. Medical (Semester–I) (Session 2022-25)**
**ZOOLOGY**
**CELL BIOLOGY**
**Course Code: BSMM-1483 (I)**
**(THEORY)**

**Max. Time: 3 Hrs.** **Max Marks: 30**

**Instructions for the Paper Setter**

Eight questions of equal marks (6 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

**UNIT-I**

Methods in Cell Biology

(a) Principles of light and phase contrast microscopy
(b) Electron microscopy (TEM and SEM)
(c) Fixation and fixatives
(d) Staining techniques.

**UNIT-II**

Organization of Cell: Extra nuclear and nuclear, ultrastructure and functions of cell organelles

(a) Plasma Membrane: Structure, osmosis, active and passive transport, endocytosis and exocytosis.
(b) Endoplasmic reticulum: Structure, types and associated enzymes.
(c) 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.

**UNIT-IV**

Nucleus: Structure and functions of nuclear membrane, nucleolus and chromosomes.

An elementary idea of cell transformation in cancer

An elementary idea of cellular basis of immunity

**Suggested Readings:**


1. Cooper, G. M. (2004), The cell, A Molecular Approach, ASM press, Washington, D. C.
2. Karp, G. (1984). Cell Biology ($4^{th}$ ed), McGraw Hill, New York.
3. Pawar, C.B (1999), Cell Biology, Himalaya Publishing House, Bombay.
4. Dhami P. K. (2000) Zoology I, Pradeep Publishers.

**B.Sc. Medical (Semester–I) (Session 2022-25)**
**ZOOLOGY**
**BIODIVERSITY-I**
**(PROTOZOA TO ANNELIDA)**
**Course Code: BSMM-1483 (II)**
**(THEORY)**

# Course Outcome

- CO1: Knowledge about physiology of unicellular life and parasitic protozoan.
- CO2: Understanding of important marine water non chordates.
- CO3: Learn about parasitic platyhelminthes
- CO4: Understand the economic importance and physiology of Ascaris and earthworm

**B.Sc. Medical (Semester–I) (Session 2022-25)**
**ZOOLOGY**
**BIODIVERSITY-I**
**(PROTOZOA TO ANNELIDA)**
**Course Code: BSMM-1483 (II)**
**(THEORY)**

**Max. Time: 3 Hrs.** **Max Marks: 30**

**Instructions for the Paper Setter**

Eight questions of equal marks (6 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

**Detailed Type study of the following animals**

**UNIT-I**

Protozoa: *Amoeba proteus,*

*Paramecium caudatum* (with special reference to Kappa particles in *P. aurelia*)

*Plasmodium vivax.*

**UNIT-II**

Parazoa (Porifera): *Sycon,*

Cnidaria (Coelentrata): *Obelia*

**UNIT-III**

Platyhelminthes: *Fasciola hepatica,*

*Taenia solium*

Larvae of *Fasciola hepatica* and *Taenia solium*

**UNIT-IV**

Aschelminthes: *Ascaris,* Parasitic adaptations in Helminthes

Annelida: *Pheretima posthuma* (Earthworm)

**Suggested Readings:**

1. Dhami, P.S. &Dhami, J. K(2001), Invertebrates, R. Chand & Co., New Delhi.

2. Brusca, R. C. and Brusca, G. J. (2003), Invertebrates (2nd ed). Sinauer Associates, Inc. Publishers, Sunderland, Massachusetts.
3. Engemann, J. G. and Hegner, R. W. (1981), Invertebrate Zoology (3rd ed.) Macmillan, New York.
4. Gardiner, M. S. (1972), The Biology of Invertebrates, McGraw Hill, New York.
5. Meglitsch, P. A. and Schran, F. R. (1991), Invertebrate Zoology (3rd ed). Oxford University Press, New York.
6. Pechenik, A. Jan. (2000), Biology of the invertebrates, (4th ed), McGraw Hill Book Co. Singapore.

**B.Sc. Medical (Semester–I) (Session 2022-25)**
**ZOOLOGY**
**PRACTICAL-I (RELATED TO CELL BIOLOGY & BIODIVERSITY-I)**
**Course Code: BSMM-1483 (P)**

# Course Outcome

**BSMM 1483 (P): PRACTICAL–I (Related to Cell Biology & Biodiversity-I)**

- CO1. Familiar with Scientific method
- CO2.Recognise the importance of conservation
- CO3. Ability to observe chromosomal arrangements during cell division

**B.Sc. Medical (Semester–I) (Session 2022-25)**

**ZOOLOGY**

**PRACTICAL-I (RELATED TO CELL BIOLOGY & BIODIVERSITY-I)**

**Course Code: BSMM-1483 (P)**

**Time: 3 Hrs.** **Marks: 20**

**Instructions for the Practical Examiners:** Question paper is to set on the spot jointly by the Internal and External Examiners. Two copies of the same should be submitted for the record to COE Office, KanyaMaha Vidyalaya, Jalandhar

**Guideslines for conduct of practical Examination: -**

1. Identifiy and classify the specimens upto order. Write a note on their habit, habitat, special features and economic importance. 4
2. Identify the slides/micrographs and give two reasons for identification. 4
3. Make a temporary mount of protozoa. 2
4. Draw a well labelled sketch of the given system of the organism and explain to the examiner. 3
5. Write down the theory and procedure of gel electrophoresis/ paper chromotogaphy/thin layer chromatography/ SEM & TEM. 2
6. Report 2
7. Viva-voce & Practical file. 3

**I. Classification up to orders with ecological notes and economic importance (if any) of the following animals (Through Specimens or slides):**

**A. Protozoa.***Amoeba, Euglena, Trypanosoma, Noctiluca, Eimeria, Monocystis, Paramecium Opalina, Vorticella, Balantidium, Nyctotherus*and *Polystomella.*

**B. Parazoa.***Sycon, Grantia, Euplectella, Hyalonema, Spongilla, Euspongia.*

**C. Cnidaria.***Porpita, Velella, Physalia, Aurelia, Rhizostoma, Metridium, Millipora, Alcyonium, Tubipora, Zoanthus, Madrepora, Favia, Fungia and Astrangia.*
*Hydra* (W.M.), *Hydra* with buds, *Obelia* (colony and medusa), *Sertularia, Plumularia, Tubularia, Bougainvillea* and *Aurelia*

**D. Platyhelminthes.**
*Dugesia, Fasciola, Taenia, Echinococcus.*

Miracidium, Sporocyst, Redia, Cercaria of *Fasciola,* scolex and proglottids of *Taenia* (mature and gravid).

**E. Aschelminthes.***Ascaris*(male and female), *Trichinella, Ancylostoma.*

**F. Annelida**. *Pheretima, Nereis, Heteronereis, Polynoe, Eunice, Aphrodite, Chaetopterus, Arenicola, Tubifex* and *Pontobdela*

2. **Study of the following permanent stained preparations**:

A. L.S. and T.S. *Sycon,* gemmules, spicules and spongin fibers of a sponge.
B. T.S. *Hydra* (Testis and ovary region)
C. T.S. *Fasciola*(Different regions)
D. T.S. *Ascaris* (Male and Female)

E. T.S. *Pheretima*(pharyngeal and typhlosolar regions), Setae, septal nephridia, spermathecae and ovary of *Pheretima*(Earthworm).

3. **Preparation of the following slides**:

Temporary permanent preparation of freshwater Protozoan culture.

4. **Demonstration of** digestive, reproductive and nervous systems of earthworm with the help of charts/videos/models.

5. **Cell Biology:**

A. Paper chromatography.
B. Gel electrophoresis through photographs or through research laboratories
C. Familiarity with TEM & SEM.
D. Study of different ultra-structures of cell organelles through photographs.

**6. Visit to a vermi–composting unit and submission of report.**

**Note:- Some changes can be made in the practicals depending on the availability of material.**

**B.Sc. Medical (Semester–II) (Session 2022-25)**
**ZOOLOGY**
**Ecology**
**Course Code: BSMM-2483 (I)**
**(THEORY)**

# Course Outcomes

After passing this course the student will be able to:

- CO1. Describe the history, introduction and nature of ecosystem
- CO2. Understand the biogeocycles and ecological adaptations.
- CO3. Know about the characteristics of population & biotic community.
- CO4. Know about the conservation of resources.

**B.Sc. Medical (Semester–II) (Session 2022-25)**
**ZOOLOGY**
**Ecology**
**Course Code: BSMM-2483 (I)**
**(THEORY)**

**Max. Time: 3 Hrs.** **Max Marks: 30**

**Instructions for the Paper Setter**

Eight questions of equal marks (6 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

## UNIT-I

Ecology: Definition, Subdivisions and scope of ecology.

Ecosystem: Components, ecological energetics, food web, major ecosystems of the world.

Ecological factors: Temperature, light and soil as ecological factors.

## UNIT-II

Nutrients: Biogeochemical cycles and concept of limiting factors.

Ecological Adaptations: Morphological, physiological and behavioural adaptations in animals in different habitats.

## UNIT-III

Population: Characteristics and regulations of population. Inter and Intra Specific relationship: Competition, Predation, Parasitism, Commensalism and Mutualism.

Biotic community: Characteristics, ecological succession, ecological niche.

## UNIT-IV

Natural resources: Renewable and nonrenewable natural resources and their conservations.

Environmental Issues: Causes, impact and control of environmental pollution.

**Suggested Readings:**

Anderwartha, H.G. and Birch, L. C. (1970), The distribution and abundance of animals, University of Chicago Press, Chicago London.

Beeby, A. (1992), Applying Ecology, Chapman and Hall Madras.

Begon, M., Harper J. L. and Townsend, C. R. (1995), Ecology – Individuals, populations and communities, Blackwell Science, Cambridge UK.

Brewer, R. (1994), The science of Ecology, Saunders College of Publishing, New York.

Chapman, J. L. and Resis, M. J. (1995), Ecology- Principles and applications, Cambridge University Press, Cambridge UK.

Kaeighs, S. C. (1974), Ecology with special references to animal and Man, Prentice Hall Inc.

Kormondy, E.J. (1975), Concept of Ecology, Englewood Cliffs, N.J. Prentice Hall Inc.

Kreb C.J. (1982), Ecology, Harper & Row, New York.

Putmann, R. J. and Wratten, S. D. ( 1984 ), Principles of Ecology, Crown Helm, London.

**B.Sc. Medical (Semester–II) (Session 2022-25)**
**ZOOLOGY**

**Biodiversity-II (Arthropoda to Hemichordata)**

**Course Code: BSMM-2483 (II)**

**(THEORY)**

# Course Outcomes:

After passing this course the student will be able to:

CO1. Understand physiology and economic importance of cockroach and social organization of insects.

CO2. Knowledge about the general pattern of life history of phylum mollusca

CO3. Learn about life history and larval forms of Echinodermata

CO4. Knowledge about affinities of Hemichordates with Non-Chordates and Chordates

**B.Sc. Medical (Semester–II) (Session 2022-25)**

**ZOOLOGY**

**Biodiversity-II (Arthropoda to Hemichordata)**

**Course Code: BSMM-2483 (II)**

**(THEORY)**

Max. Time: 3 Hrs. Max Marks: 30

**Instructions for the Paper Setter**

Eight questions of equal marks (6 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

**UNIT-I**

Arthropoda: Type study- *Periplaneta americana* (Cockroach),

Social organizations in insects (Honey bee and Termite)

**UNIT-II**

Mollusca: Type study-Pila globosa, Tortion, Pearl formation

**UNIT-III**

Echinodermata: Type study - Asterias (Star fish), Study of Echinoderm larvae

**UNIT-IV**

Hemichordata:Type study - Balanoglossus (External characters only). Affinities of Hemichordates with Non-Chordates and Chordates

**Suggested Readings:**

Barnes, R.D.(1999), Invertebrate Zoology. W.B. Saunder, Philadelphia.

Dhami, P.S. & Dhami, J. K., Invertebrates, R. Chand & Co., New Delhi, 2001.

Barth, R. H. and Broshears, R. E (1982), The Invertebrate world. Holt Saunder, Japan.

Brusca, R. C. and Brusca, G. J. (2003), Invertebrates (2nd ed), Sinauer Associates, Inc. Publishers, Sunderland, Massachusetts.

Engemann, J. G. and Hegner, R. W. (1981), Invertebrate Zoology (3rd ed), Macmillan, New York.

Gardiner, M. S. (1972), The Biology of Invertebrates, McGraw Hill, New York.

Meglitsch, P. A. and Schran, F. R. (1991), Invertebrate Zoology (3rd ed), Oxford University Press, New York.

Pechenik, A. Jan. (2000), Biology of the invertebrates, (4th ed), McGraw Hill Book Co. Singapore.

**B.Sc. Medical (Semester–II) (Session 2022-25)**

**ZOOLOGY**

**Practical-II (Related to Ecology and Biodiversity-II)**

**Course Code: BSMM-2483 (P)**

**(PRACTICAL)**

# Course Outcomes:

After passing this course the student will be able to:

CO1. Know about the morphological, physiological & behavioural adaptations of different animals in different habitats.

CO2. Familiarise with the classification & ecology of invertebrates.

CO3. Identify different zoogeographical realms with fauna.

CO4. Know about the different nest of birds.

**B.Sc. Medical (Semester–II) (Session 2022-25)**

**ZOOLOGY**

**Practical-II (Related to Ecology and Biodiversity-II)**

**Course Code: BSMM-2483 (P)**

**(PRACTICAL)**

**Time: 3 hrs.** **Marks: 20**

**Instructions for the Practical Examiners:**

Question paper is to set on the spot jointly by the Internal and External Examiners. Two copies of the same should be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar

**1. Classification up to orders with ecological notes and economic importance (if any) of the following animals:**

**Arthropoda:** Peripatus, Palaemon (prawn), Lobster, Cancer (crab), Sacculina, Eupagurus (hermit Crab), Lepas, Balanus, Cyclops, Daphnia, Lepisma, Periplaneta (cockroach), Schistocerca (locust), Poecilocerus (ak grasshopper), Gryllus (cricket), Mantis (praying mantis), Cicada, Forficula (earwig), Dragonfly, Termite queen, Bug, Moth, Beetles, Polistes (wasp), Apis (honey bee), Bombyx, Pediculus (body louse) Millipede and Centipede, Palamnaeus (scorpion), Aranea (spider) and Limulus (king Crab).

**Mollusca:** Anodonta, Mytilus, Ostrea, Cardium, Pholas, Solen (razor fish), Pecten, Haliotis, Patella, Aplysia, Doris, Limax, Loligo, Sepia, Octopus, Nautilus shell (Complete and T.S.), Chiton, Dentalium.

**Echinodermata :** Asterias, Echinus Ophiothrix, Antedon.

**Hemichordata :** Balanoglossus.

2. **Study of the following permanent stained preparations:**

Trachea and mouth parts of Insects

Radula and osphradium of Pila

T.S. Star fish (Arm).

3. **Demonstration of digestive and nervous systems of Periplaneta (cockroach) with the help of charts/models/videos.**

4. **Ecology:**

Study of animal adaptations with the help of specimens, charts and models.

Study of abiotic and biotic components of an ecosystem.

Study of different types of nests of birds.

Study and preparation of Zoogeographical charts.

5. **Assignment**

Note:- Some changes can be made in the practicals depending on the availability of material.

**Guideslines for conduct of practical Examination:-**

| | | |
|---|---|---|
| **1.** | Identifiy and classify the specimens upto order. Write a note on their habit, habitat, special features and economic importance. | **4** |
| **2.** | Draw a well labelled sketch of the given system of the animal & explain it to the examiner. | **3** |
| **3.** | Identify the slides/models and give two reasons for identification. | **3** |
| **4.** | Identify the adaptive feature/nest. | **2** |
| **5.** | Mark the distribution of animals of a realm on the map. | **2** |
| **6.** | Assignment | **2** |
| **7.** | Viva-voce & Practical file. | **4** |

# KANYA MAHA VIDYALAYA, JALANDHAR (AUTONOMOUS)

**SCHEME AND CURRICULUM OF EXAMINATIONS OF THREE YEAR DEGREE PROGRAM**

## Session-2022-25

| SEMESTER III | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Course Name** | **Program Name** | **Course Code** | | **Course Type** | **Marks** | | | | | **Examination time (in Hours)** |
| | | | | | **Total** | **Paper** | **Ext.** | | **CA** | |
| | | | | | | | **L** | **P** | | |
| Zoology | B.Sc. (Medical) | BSMM-3483 | BSMM-3483 (I) | E | 100 | Evolution | 30 | - | 20 | 3 |
| | | | BSMM-3483 (II) | | | Biodiversity-III | 30 | - | | 3 |
| | | | BSMM-3483 (P) | | | Practical–III (related to Evolution and Biodiversity-III) | - | 20 | | 3 |
| **SEMESTER IV** | | | | | | | | | | |
| Zoology | B.Sc. (Medical) | BSMM - 4483 | BSMM - 4483 (I) | E | 100 | Biochemistry | 30 | - | 20 | 3 |
| | | | BSMM - 4483 (II) | | | Animal Physiology | 30 | - | | 3 |
| | | | BSMM -4483 (P) | | | Practical–III (related to Biochemistry and Animal Physiology) | - | 20 | | 3 |

**B.Sc. (Medical) (Semester–III) (Session 2022-25)**

**ZOOLOGY**

**EVOLUTION**

**Course Code: BSMM-3483(I)**

**(THEORY)**

# Course Outcome

After passing this course the student will be able to:

- CO1. Understand concept of evolution and identify the contributions of various Evolutionists.
- CO2. Know about origin of life and concept of speciation.
- CO3. Gain knowledge about fossils and its significance as well as evolution of man.
- CO4. Understand ecological adaptations in fishes, reptiles, birds and mammals.

**B.Sc. (Medical) (Semester–III) (Session 2022-25)**

**ZOOLOGY**

**EVOLUTION**

**Course Code: BSMM-3483 (I)**

**(THEORY)**

**Max. Time: 3 Hrs.** **Max Marks: 30**

**Instructions for the Paper Setter**

Eight questions of equal marks (6 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

## Units I

Introduction to evolution
Evidences of organic evolution

Theories of organic evolution

## Units II

Origin of life
Concept of micro, macro and mega-evolution
Concept of Species
Speciation

## Units III

Fossils, its types and significance
Evolutionary rate
Origin & Extinction of reptiles
Evolution of man (in Brief)

## Units IV

Migration & Parental Care in Pisces
Flight adaptation & Bird migration
Adaptive radiations like scales & fins in fish, poison apparatus in snakes and dentition in Mammals.

**Suggested Readings:**


1. Avers, C. J.(1989). Evolution Process and Pattern in Evolution, New York Oxford Oxford university press.
2. Bhamarah, H.S.(1993), Juneka K., Cytogenetics & Evolution, Anmol Publication Pvt. Ltd.
3. Brookfield, A. P. (1986). Modern aspects of Evolution. Nelson Thornes publishers
4. Colbert. E.H.(2002), Evolution of Vertebrates, cbspd publishers

5. Freeman, S. and Herron, Jon C. (2007). Evolutionary analysis, Pearson Prentice Hall, New Jersey.
6. Futuyma, D. J. (1998), Evolutionary Biology, Sinauer Assoc. Inc. Pub. USA.
7. Meglitsch, P. A. (1991), Invertebrate Zoology (3rd ed), Oxford University Press.
8. Wen-Hsiung Li (1997), Molecular Evolution, Sinauer associatesInc.Pub. USA.
9. Rastogi, V.B(2003) Organic evolution, Medtech publishers
10. Strickberger, M.N(2000) Evolution , Jones and Bartlett publishers.
11. Tomar, B.S. and S.P.Singh(2000)Evolutionary Biology, Rastogi publishers.

**B.Sc. (Medical) (Semester–III) (Session 2022-25)**

**ZOOLOGY**

**Biodiversity-III**

**(Chordates)**

**Course Code: BSMM-3483 (II)**

**(THEORY)**

# Course Outcomes

After passing this course the student will be able to:

- CO1. Understand general body plan of Herdmania and external characters of Amphioxus.
- CO2. Understand external characters and affinities of Petromyzon as well as body systems of Labeo.
- CO3. Understand body plan and various systems of Frog and Uromastix.
- CO4. Understand body systems of Pigeon and Rat.

**B.Sc. (Medical) (Semester–III) (Session 2022-25)**

**ZOOLOGY**

**BIODIVERSITY-III (Chordates)**

**Course Code: BSMM-3483(II)**

**(THEORY)**

**Max. Time: 3 Hrs.** **Max Marks: 30**

**Instructions for the Paper Setter**

Eight questions of equal marks (6 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

## Units I

Brief Introduction to Protochordata

Urochordata: Type study- *Herdmania*
Cephalochordata: External features and affinities of *Amphioxus*

## Units II

Cyclostomata: External Characters of *Petromyzon*

Affinities of Cyclostomata

Pisces: Type study-*Labeo*

## Units III

Amphibia: Type study-Frog

Reptilia: Type study-*Uromastix*

## Units IV

Aves: Type study-Pigeon
Mammals: Type study-Rat

**Suggested Reading Material.**


1. Dhami, P.S. &Dhami J.K. (1998), Vertebrates, R. Chand & Co., New Delhi.
2. Hildebrand, M. and Goslow. Jr. G.E. (2001), Analysis of Vertebrates Structure, John Wiley, N. Y.
3. Jollie, M. (1968), Chordate Morphology, Reinhold, New York.
4. Kardong, K. V. (1995), Vertebrates – Comparative Anatomy, Function, Evolution. W.B.C. Pub. , Oxford.

5. Kent, G. C. and Carr, R. K. (2001), Comparative Anatomy of the Vertebrates (9th ed), McGraw Hill Higher Education, New York.
6. Linzey, D. (2001), Vertebrate Biology, McGraw Hill Publishing Company, New York.
7. Pough, F. H., Heiser, J. B. and McFarland, W. N. (1990), Vertebrate Life (3rd ed), Macmillan Pub. Co., New York.
8. Young, J. Z. (1982), The Life of Vertebrates, New York.
9. Parker, T.J. and Haswell, W.A (1981) Text Book of Zoology, Vol. II (Vertebrates), ELBS and Macmillian Press Ltd.

**B.Sc. (Medical) (Semester–III) (Session 2022-25)**

**Practical-III (Related to Evolution and Biodiversity-III)**

**Course code:** BSMM-3483(P)

# Course Outcomes

- CO1. Familiarize organ systems.
- CO2. Aware about economically important specimens (preserved).
- CO3. Understanding of evolutionary phenomena.

**B.Sc. (Medical) (Semester–III) (Session 2022-25)**

**Practical-III (Related to Evolution and Biodiversity-III)**
**Course code:** BSMM-3483(P)

**Time: 3 hrs.** **Marks: 20**

**Instructions for the Practical Examiners:** Question paper is to set on the spot jointly by the Internal and External Examiners. Two copies of the same should be submitted for the record to COE Office, KanyaMahaVidyalaya, Jalandhar

**Guidelines for conduct of Practical Examination:**

| | | |
|---|---|---|
| 1. | Draw a labelled sketch of the system of the given animal & explain it to the Examiner. | 3 |
| 2. | Identify and classify the specimensupto order level. Write a short note on habitat, special features, feeding, habits and economic importance of the specimens. | 8 |
| 3. | Idendify and write a note on the evolutionary phenomenon in the given specimen. | 2 |
| 4. | Identify the slides/specimens, give two reasons for identification. | 3 |
| 5. | Viva-voce & Practical file. | 4 |

**I. Classification up to order level, except in case of Pisces and Aves where classification up to subclass level, habits, habitat, external characters and economic importance (if any) of the following animals is required :**

**Urochordata** **:** *Herdmania, Molgula, Pyrosoma, Doliolum, Salpa&Oikopleura.*

**Cephalochordata** : *Amphioxus.* Study of the following prepared slides:

T.S. *Amphioxus* through various regions, Pharynx of *Amphioxus*

**Cyclostomata** : *Myxine, Petromyzon &Ammocoetes*Larva.

**Chondrichthyes** : *Zygaena*(hammer head shark), *Pristis* (saw fish), *Narcine (electric ray), Trygon, Rhinobatus and Chimaera* (rabbit fish).

**Actinoptergii** :*Polypterus, Acipenser, Lepidosteus, Muraena, Mystus, Catla, Hippocampus, Syngnathus, Exocoetus, Anabas, Diodon, Tetradon, Echeneis and Solea.*

**Dipneusti** (**Dipnoi**) : *Protopterus*(African lung fish)

**Amphibia** : *Uraeotyphlus, Necturus, Amphiuma, Amblystoma*and its Axolotl Larva, *Triton, Salamandra, Hyla, Rhacophorus*

**Reptilia** : *Hemidactylus, Calotes, Draco, Varanus, Phrynosoma, Chamaeleon, Typhlops, Python, Eryx, Ptyas, Bungarus, Naja, Hydrus, Vipera, Crocodilus, Gavialis, Chelone*(turtle) and *Testudo* (tortoise),Differences in nonpoisonous and poisonous snakes.

**Aves** : *Casuarius, Ardea, Anas, Milvus, Pavo, Eudynamics, Tyto* and *Alcedo.*

**Mammalia** : *Ornithorynchus, Echidna, Didelphis, Macropus, Loris, Macaca, Manis, Hystrix, Funambulus, Panthera, Canis, Herpestes, Capra, Pteropus.*

II. Study of the following systems with the help of charts/models/videos:

***Herdmania*** **:** General anatomy

***Labeo*** : Digestive and reproductive systems, heart, afferent and branchial arteries, cranial nerves and internal ear.

**Pigeon** : Digestive, arterial, venous and urino-genital systems.

**WhiteRat** : Digestive, arterial, venous and urino-genital systems.

Study of permanent slides of whole mount of Pharynx of *Herdmania*and *Amphioxus.*

Cycloid scales of *Labeo,* blood smear of mammal, Histology of rat/rabbit (compound tissues)

Demonstration of evolutionary phenomena like homology, analogy, mimicry, crypsis.

**Note:- Some changes can be made in the practicals depending on the availability of material.**

**B.Sc. Medical (Semester–IV) (Session 2022-25)**

**ZOOLOGY**

**BIOCHEMISTRY**

**Course Code: BSMM-4483 (I)**

**(THEORY)**

# Course Outcome

After passing this course the student will be able to:

- CO-1. Understand the structure and functions of biologically important molecules.
- CO-2. Understand about enzymes, coenzymes and lipid metabolism.
- CO-3. Understand various processes of carbohydrate metabolism.
- CO-4. Gain knowledge about protein metabolism.

**B.Sc. Medical (Semester–IV) (Session 2022-25)**

**ZOOLOGY**

**BIOCHEMISTRY**

**Course Code: BSMM-4483 (I)**

**(THEORY)**

**Max. Time: 3 Hrs.** **Max Marks: 30**

**Instructions for the Paper Setter**

Eight questions of equal marks (6 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

## Unit I

**Biochemistry and its scope**
**Classification and functions of:**
- Carbohydrates
- Proteins
- Lipids
- Nucleic acids

### Unit II

**Enzymes:**
- Nature and their classification
- Coenzymes.

**Lipid Metabolism:**
- B-Oxidation of fatty acid
- Ketosis

### Unit III

**Carbohydrate Metabolism:**
- Glycolysis
- Tricarboxylic acid cycle
- Hexose monophosphate shunt
- Glycogenesis
- Glycogenolysis
- Gluconeogenesis
- Oxidative Phosphorylation

### Unit IV

**Protein Metabolism:**

Metabolism of amino acids
Oxidative deamination
Transamination
Decarboxylation
Hydrolysis of proteins
Ornithine cycle

**Suggested Reading Material:-**


1. Conn, E.E., Stump. P.K. Bruening, S. and Doi R.H. (2006), Outlines of Biochemistry (5th ed), John Wiley and Sons Inc., New York.
2. Fischer, J. and Arriold, J.R.P. (2001). Instant notes in Chemistry for Biologists, Viva Books Pvt. Ltd.
3. Harper, H.A. (2018): Harper's Biochemistry (31st ed).
4. Holde, K.E.V., Johnson, W.C. and Shing, P. (2005). Principles of Physical Biochemistry Prentice Hall, Inc., USA.
5. Lehninger, A (2017). Principles of Biochemistry, (7th ed).
6. Morris, H. Best, L.R., Pattison, S., Arerna, S. (2013). Introduction to General Organic Biochemistry, (11th ed), Wadsworth Group.
7. Robert, K., Murray, Mayes Daryl, K. Granner, Victor, W., Woodwell (1990), Harper's Biochemistry, 22nd Edition, Prentice Hall International Inc.
8. Sheehan, D (2013). Physical Biochemistry: Principles and Applications – John Wiley & Sons Ltd., England.
9. Stryer, L. (2019). Biochemistry (9th ed), San Francisco W.H. Freeman.

**B.Sc. Medical (Semester–IV) (Session 2022-25)**

**ZOOLOGY**

**Animal Physiology**

**Course Code: BSMM-4483 (II)**

**(THEORY)**

# Course Outcomes

After passing this course the student will be able to:

- CO1.Understand mechanism of digestion and respiration.
- CO2.Have knowledge about composition of blood, blood groups, cardiac cycle and urine formation.
- CO3.Understand mechanism of skeletal muscle contraction and neural integration.
- CO4. Understand physiology of behavior and endocrine system.

**B.Sc. Medical (Semester–IV) (Session 2022-25)**

**ZOOLOGY**

**Animal Physiology**

**Course Code: BSMM-4483 (II)**

**(THEORY)**

**Max. Time: 3 Hrs.** **Max Marks: 30**

**Instructions for the Paper Setter**

Eight questions of equal marks (6 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

**Units I**

**Digestion :** Digestion of dietary constituents, regulation of digestive processes and absorption. Extra and intra cellular digestion, enzymatic digestion and symbiotic digestion.

**Respiration :** Transport of $O_2$ and $CO_2$, Oxygen dissociation curve of haemoglobin, Bohr effect, chloride (-) shift, Haldane effect and control of breathing.

**Units II**

**Heart :** Origin and regulation of heart beat, cardiac cycle, electrocardiogram, cardiac output, Blood pressure and micro-circulation.

**Blood :** Composition and functions of blood and lymph. Blood clotting. Blood groups including Rh factor, haemopoiesis

**Excretion :** Urine formation and osmoregulation.

**Units III**

**Muscles :** Ultrastructure, chemical and physical basis of skeletal muscle contraction.

**Neural Integration:** Structure of neuron, resting membrane potential, Origin and propagation of impulse along the axon, synapse and myoneural function.

**Units IV**

**Physiology of Behavior:** Taxes and reflexes, instinctive and motivate learning and reasoning

**Endocrine :** Structure and physiology of thyroid, parathyroid, adrenal, hypothalamus, pituitary, pancreas and gonads.

**Suggested Reading Material:**


1. Guyton, and Hall, (2015), Text Book of Medical Physiology, 15th Edition, Elsevier.
2. Hill, R. W., Wyse, G. K. and Anderson, N. 3 edi (2012), Animal physiology, Sinauer Associate, INC. Pub. Saunderland, Massachusettes, USA.
3. Hoar, W. S. (1984), General and Comparative Physiology, Prentice Hall of India Pvt. Limited, New Delhi, India.
4. Prosser, C.L.4$^{th}$ Edi (1991), Comparative Animal Physiology, Satish Book Enterprise Books seller & Publishers, Agra.
5. Purves, W. K., Oriane, G. H., Space, H. C. and Salava, D. (2001), Life – The Science of Biology (6$^{th}$ ed), Sinauer Assoc. Inc., USA.
6. Randall, D., Burggren, K.L. and French, K. (2002), Eckert Animal Physiology: Mechanisms and Adaptations, W.H. Freeman and Company, New York.
7. Taneja, S.K.(1997), Biochemistry & Animal Physiology, Trueman Book Co.
8. Willmer, P. Stone, G. and Johnston, I (2000). Environmental Physiology of Animals, Blackwell Science.
9. Withers, P.C. (1992), Comparative Animal Physiology, Saunder College Publishing, New York.

**B.Sc. Medical (Semester–IV) (Session 2022-25)**

**ZOOLOGY**

**Practical -IV (Related to Biochemistry and Animal Physiology)**

**Course Code: BSMM-4483 (P)**

**(PRACTICAL)**

# Course Outcomes

- CO-1. Learn clinical procedures for blood & urine analysis.
- CO-2. Develop skill in simple biochemical laboratory procedures.
- CO-3. Skill in observing and to some extent in analysing various Biological Data.

**B.Sc. Medical (Semester–IV) (Session 2022-25)**

**ZOOLOGY**

**Practical -IV (Related to Biochemistry and Animal Physiology)**

**Course Code: BSMM-4483 (P)**

**(PRACTICAL)**

**Time: 3 hrs.** **Marks: 20**

**Instructions for the Practical Examiners:** Question paper is to set on the spot jointly by the Internal and External Examiners. Two copies of the same should be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar

1. Study of the skeleton of *Scoliodon, Rana, Varanus, Gallus* and *Oryctolagus.*
2. Identification of food stuffs: starch, glucose, proteins and fats in solution.
3. Demonstration of osmosis and diffusion.
4. Demonstrate the presence of amylase in saliva, denaturation by pH and temperature.
5. Determination of coagulation and bleeding time of blood in man/rat/rabbit.
6. Determination of blood groups of human blood sample.
7. Recording of blood pressure of man.
8. Analysis of urine for urea, chloride, glucose and uric acid.
9. Estimation of haemoglobin content.
10. Field study: Visit to a fossil Park/Lab/ Science City and submit a report / Familiarity with the local vertebrate fauna.

**Guidelines for conduct of Practical Examination:**

| | | |
|---|---|---|
| 1. | Identify the given bones, make labeled sketches of their respective–views | 8 |
| 2. | Write down the steps and determine the constituents in the given sample. | 3 |
| 3. | Write the procedure and perform the given physiology experiment. | 3 |
| 4. | Report on visit to a fossil park/lab/Science City/study of local vertebrate fauna. | 2 |
| 5. | Viva-voce & Practical file. | 4 |

**Note:- Some changes can be made in the practicals depending on the availability of material.**

# KANYA MAHA VIDYALAYA, JALANDHAR (AUTONOMOUS)

**SCHEME AND CURRICULUM OF EXAMINATIONS OF THREE YEAR DEGREE PROGRAM**

## Session-2022-25

| SEMESTER V | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Course Name** | **Program Name** | **Course Code** | | **Course Type** | **Marks** | | | | | **Examination time (in Hours)** |
| | | | | | **Total** | **Paper** | **Ext.** | | **CA** | |
| | | | | | | | **L** | **P** | | |
| Zoology | B.Sc. (Medical) | BSMM-5483 | I | E | 100 | Developmental Biology | 30 | - | 20 | 3 |
| | | | II | | | Genetics | 30 | - | | 3 |
| | | | P | | | PRACTICAL-V (Related To Developmental Biology &Genetics) | - | 20 | | 3 |
| **SEMESTER VI** | | | | | | | | | | |
| Zoology | B.Sc. (Medical) | BSMM-6483 | I | E | 100 | Medical Zoology | 30 | - | 20 | 3 |
| | | | II | | | Medical Laboratory Technology | 30 | - | | 3 |
| | | | P | | | PRACTICAL-VI (Related To Medical Zoology &Medical Laboratory Technology) | - | 20 | | 3 |

**B.Sc. Medical (Semester–V) (Session 2022-25)**

**ZOOLOGY**

**Course Title: Developmental Biology**

**Course Code: BSMM-5483 (I)**

**(THEORY)**

# Course Outcome

After successfully completing this course, students will be able to:

CO1: Understand the key events in early embryological development like gametogenesis, fertilization and parthenogenesis.

CO2: Explain the process of cleavage, gastrulation, determination and differentiation.

CO3: Elaborate the development of frog, its metamorphosis and chick up to three germ layers.

CO4: Describe the development of rabbit, formation of foetal membranes and placenta.

**B.Sc. Medical (Semester–V) (Session 2022-25)**
**ZOOLOGY**
**Course Title: Developmental Biology**
**Course Code: BSMM-5483 (I)**
**(THEORY)**

**Examination Time: 3 Hrs.** **Max Marks: 30**

**Instructions for the Paper Setter**

Eight questions of equal marks (6 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

**UNIT-I**

Gametogenesis with particular reference to differentiation of spermatozoa, vitellogenesis; role of

follicle/subtesticular cells in gametogenesis

Egg maturation; egg membranes; polarity of egg

Parthenogenesis

Fertilization

**UNIT-II**

Cleavage and its patterns

Gastrulation

Determination and differentiation

Tissue interactions, basic concepts of organizers and inductors and their role

Embryonic development of Herdmania

**UNIT-III**

Development up to three germinal layers and their fate in frog and chick

Fate maps of chick and frog embryos

Metamorphosis in Frog

**UNIT-IV**

Embryonic development of Rabbit

Foetal membranes, their formation and role

Mammalian placenta–its formation, types and functions

**Suggested Readings:**


1. Balinsky, B.I. (2007), An Introduction to Embryology, Saunders, Philadelphia.
2. Bellairs, R. (1971), Development Processes in Higher Vertebrates, University of MiamiPress, Miami.
3. Berrill. N.J. (1971), Developmental Biology. McGraw Hill, New Delhi.
4. Gilbert, F. (2017), Developmental Biology, Sinaur.
5. Goel, S.C. (1984), Principles and Animal Developmental Biology, Himalaya, Bombay.
6. Karp. G. &Berrill, M.J. (1981), Development. McGraw Hill, New Delhi.
7. Pritchard, D.J. (1986), Foundation of Development Genetics, Taylor and Francis, London.
8. Saunders, J.W. (1982), Developmental Biology, Patterns, Principles, Problems, MacMillan,New York.
9. Waddigton CH. (1966), Principles of Development and Differentiation, MacMillan, NewYork.
10. Miller, W.A. (1997), Developmental Biology Springer Verlag, New York.

**B.Sc. Medical (Semester–V) (Session 2022-25)**
**ZOOLOGY**
**Course Title: Genetics**
**Course Code: BSMM-5483 (II)**
**(THEORY)**

# Course Outcome

After passing this course the student will be able to:

CO1. Understand modification of mendelian ratios, multiple alleles, crossing over and linkage.

CO2. Understand structure of nucleic acid, process of replication and translation, genetic code.

CO3. Gain knowledge about mutations, inborn errors of metabolism in man, regulation of gene expression in prokaryotes and extranuclear inheritance.

CO4. Understand Hardy-Weinberg law, gene frequency, genetic recombination in bacteria, DNA cloning and finger printing.

**B.Sc. Medical (Semester–V) (Session 2022-25)**

**ZOOLOGY**

**Course Title: Genetics**

**Course Code: BSMM-5483 (II)**

**(THEORY)**

**Examination Time: 3 Hrs.** **Max Marks: 30**

**Instructions for the Paper Setter**

Eight questions of equal marks (6 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

**UNIT-I**

**Modification of Mendelian Ratios:** Non-allelic gene interaction, Modified F2 ratios. (9:7;9:3:4;12:3:1;13:3;15:1;9:6:1), Gene modifications due to incomplete dominance; lethal factors(2:1); Pleiotropic genes.

**Multiple Alleles:** Blood group inheritance, eye colour in *Drosophila*, pseudoallelism.

**Multiple Factors:** Qualitative and quantitative characters, inheritance of quantitative traits (skin colour in man).

**Linkage:** Linkage, sex-linked characters

**Crossing Over and Recombination:** crossing over, frequency of crossing over, cytological basis of crossing over, synaptonemal complex. Recombination in Fungi (Tetrad analysis).

**UNIT-II**

**Gene and Genetic Code:** Structure of nucleic acids **(DNA & RNA).**

**Replication & transcription of DNA**

**Expression of gene** (Protein synthesis in Prokaryotes and Eukaryotes).

**Genetic code:** Properties of genetic code, codon assignment, wobble hypothesis, split and overlapping Genes.

**UNIT-III**

**Mutations:** Spontaneous and induced mutations, physical and chemical mutagen. Detection of mutations in Maize and *Drosophila.* Inborn errors of metabolism in man (Phenylketonuria, Alcaptonuria, Albinism). Somatic mutations and carcinogenesis.

**Regulation of gene expressions** in prokaryotes (Operon model) in eukaryotes.

**Extranuclear inheritance:** Chloroplast with special reference to *Mirabilis jalapa*and kappa particles in *Paramecium.*

**UNIT-IV**

**Population genetics:** Equilibrium of gene frequencies and Hardy-Weinberg law.

**Genetic recombination** in bacteria (conjugation, transduction and transformation) and in plasmids.

**Applied Genetics:** Recombination DNA, Genetic cloning and its applications in medicine and agriculture, DNA finger printing.

**Suggested Readings:**


1. Klug ,Cummings, Spencer, Palladino, Killian(twelth edition),Concepts of Genetics
2. Gardener, E.J., Simmons, M.J. &Sunstad, Principles of Genetics, (8th ed), D.P. John Wiley & Sons, New York.
3. Benjamin A. Pierce ,Genetics: a conceptual approach($6^{th}$ edition)
4. P.S Verma and V.K Aggarwal ,Genetics( $9^{th}$ edition) S.Chand publications.
5. Veer BalaRastogi, Genetics ($4^{th}$ edition) ,Knrn publications.
6. Prof P. K. Gupta($5^{th}$ revised edition 2018-19), ,Genetics Rastogi publications.
7. C. B Powar (2018) ,Cell Biology Himalayan publishing house.
8. Miglani, G.S(2000),Basic Genetics ,Narosa publishing house, New Delhi.
9. Weaver, R.F. and Hedrick, P.W. (1992), Genetics, Wm. C. Brown Publishers Dubuque.

**B.Sc. Medical (Semester–V) (Session 2022-25)**

**ZOOLOGY**

**Course Title: PRACTICAL–V (Related to Developmental Biology and Genetics)**

**Course Code: BSMM-5483 (P)**

# Course Outcomes

CO1: Understanding of development patterns of frog, chick and Larva of *Herdmania*.

CO2: Knowledge of process of gametogenesis.

CO3: Understanding of pedigree analysis and preparation of family charts.

CO4: Understanding of inheritance of morphogenetic human characters.

CO5: Understanding of finger tip patterns.

**B.Sc. Medical (Semester–V) (Session 2022-25)**

**ZOOLOGY**

**Course Title: PRACTICAL–V (Related to Developmental Biology and Genetics)**

**Course Code: BSMM-5483 (P)**

**Examination Time: 3 Hrs.** **Marks: 20**

**Instructions for the Practical Examiners:** Question paper is to set on the spot jointly by the Internal and External Examiners. Two copies of the same should be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar.

**Guideslines for Conduct of Practical Examination:-**

| | | |
|---|---|---|
| **1.** | Two Numericals based on Mendel/Hardy Weinberg Law. | 6 |
| **2.** | Perform the experiment for Dermatoglyphics/ Random mating/ Pod Length. | **3** |
| **3.** | Identification of given spots/slides. | **3** |
| **4.** | Make a pedigree chart from the given data. | **2** |
| **5.** | Chart/Assignment. | **2** |
| **6.** | Viva-voce and practical file. | **4** |

1. Demonstrate the Law of segregation and independent assortment (use of coloured beads capsulesetc.).
2. Numericals for Segregation, Independent assortment,Epistasis&Hardy-Weinberg Law.
3. Demonstration of segregation in preserved material (Maize).
4. Demonstration of cytoplasmic inheritance in snails.
5. Inheritance of human characteristics.
6. Comparison of variance in respect of pod length and number of seeds/pods.
7. Calculation of gene frequencies and random mating (Coloured beads, capsules).
8. Pedigree analysis
9. Dermatoglyphics: Palm print and Finger tip patterns.
10. Study of the following permanent slides :
    - Polytene Chromosomes of *Chironomus.*
    - Stages of gametogenesis, structure of egg and sperm of a mammal.
    - Larva of *Herdmania.*

- Developmental stages offrog-upto tadpole, chick-upto 96 hr.

11. Preparationof slide for Barr body from cheek cells.
12. **Assignment**: Preparation of charts showing developmental stages of any vertebrate.

**Note:- Some changes can be made in the practicals depending on the availability of material.**

**B.Sc. Medical (Semester–VI) (Session 2022-25)**
**ZOOLOGY**

**MEDICAL ZOOLOGY**

**Course Code: BSMM-6483 (I)**
**(THEORY)**

## Course Outcome

After successfully completing this course, students will be able to:

CO-1. Understand about various pathogenic microbes, life history of various pathogenic protozoans and helminths as well as diseases caused by them.

CO-2. Know about life history, diseases and control measures of arthropod vectors and awareness about epidemic diseases.

CO-3. Provide basics knowledge about immune responses, antigens, antibody structure and immunoglobulins.

CO-4. Understand antigen-antibody interactions and gain knowledge about vaccines.

**B.Sc. Medical (Semester–VI) (Session 2022-25)**
**ZOOLOGY**

**MEDICAL ZOOLOGY**

**Course Code: BSMM-6483 (I)**
**(THEORY)**

**Max. Time: 3 Hrs.** **Max Marks: 30**

**Instructions for the Paper Setter**

Eight questions of equal marks (6 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

**UNIT-I**

1. Introduction of Parasitology (various terminologies in use).
2. Brief introduction to pathogenic microbes, viruses, Rickettsiae, spirochaetes and bacteria.
3. Brief accounts of life history, mode of infection and pathogenicity of the following with reference to man; prophylaxis and treatment:

*a)* Pathogenic protozoa: *Entamoeba, Trypanosoma, Leishmania, Giardia, Trichomonas* and *Plasmodium.*

*b)* Pathogenic helminthes: *Fasciola, Schistosoma, Echinococcus, Ancylostoma, Trichinella, Wuchereria, Dracunculus* and *Oxyuris.*

**UNIT-II**

4. Life cycle and control measures of arthropod vectors of human disease: Malaria *(Anopheles stephens, A.culicifaces,* Yellow fever, Dengue, Dengue haemorrhagic fever and Chickengunea. *(Aedes aegypti A. Albopicuts)*; Filariasis *(Culex pipien satigeans) Mansonia* sp. Japanese Encephalitis *(C. trinanelorhynchus);* Plague *(Stenophalide cheopis)* and Epidemic Typhus *(Pediculus spp).*
5. Epidemic diseases, such as Typhoid, Cholera, Small pox; their occurrence and eradication programs.

**UNIT-III**

6. Brief introduction to human defence mechanisms.

7. Humoral and cell mediated immune response. Physical & chemical properties of antigens. Antibody structure and function of M, G, A, E and D immunoglobulins.

## UNIT-IV

8. Antigen and antibody interactions-Serodiagnostic assays (Precipitation, agglutination immunodiffusion, ELISA,RIA)
9. Vaccines

**Suggested Readings:**


1. Baker,F.J.andSilverton,R.E.(1985)IntroductiontoMedicalLaboratoryTechnology,(6th ed), Butlerworth and Co.Ltd.
2. Chatterjee, K.D. (2019), Parasitology, Protozoology and Helminthology (13thed).
3. Cheesborough, M. (1991), Medical Laboratory Technology for Tropical countries, Butlerworth and Co.,Ltd.
4. Garcia, L.S. (2001), Diagnostic Medical Parasitology, (4th ed), ASM Press Washington.
5. Kimball,J.W.(1987),Introduction of Immunology, (2nd ed),MacMillian Publishing Co.,NewYork.
6. Kuby, J. (2013), Immunology, 7th Edition W.H. Freeman & Co.,USA.
7. Roitt, I. (2017), Essential Immunology, 13th Edition, Blackwell Scientific Publications, Oxford.
8. Talib, V.H. (2019), Essential Laboratory Manual,2nd edition, Mehta Publishers, New Delhi.

**B.Sc. Medical (Semester–VI) (Session 2022-25)**
**ZOOLOGY**

**MEDICAL LABORATORY TECHNOLOGY**

**Course Code: BSMM-6483 (II)**
**(THEORY)**

# Course Outcome

After successfully completing this course, students will be able to:

CO 1: Comply with safety regulations and universal precautions during lab investigations and perform basic laboratory techniques on biological specimens.

CO 2: Know about routine clinical laboratory investigations including collection of different samples and perform other routine hematological procedures.

CO 3: Describe basic scientific principles in learning new techniques and procedures in bacteriology and microbiology.

CO 4: Apply knowledge and technical skills associated histopathology, staining techniques and biochemical estimations.

**B.Sc. Medical (Semester–VI) (Session 2022-25)**

**ZOOLOGY**

**MEDICAL LABORATORY TECHNOLOGY**

**Course Code: BSMM-6483 (II)**

**(THEORY)**

**Max. Time: 3 Hrs.** **Max Marks: 30**

**Instructions for the Paper Setter**

Eight questions of equal marks (6 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

## UNIT-I

Laboratory safety rules, hazards and precautions during sample collection and laboratory investigations.

Laboratory Techniques: Colorimetry, Microscopy, Autoclaving, Centrifugation and Spectrophotometry

## UNIT-II

Collection, transportation and preservation of different clinical samples.

Haematology: collection of blood ( venous and capillary), anticoagulants (merits and demerits), Romanowsky's stains, total RBC count, erythrocyte sedimentation rate, TLC, DLC, platelet count.

## UNIT-III

Bacteriology: sterilization (dry heat, moist heat, autoclave, filtration), disinfection, staining techniques,( gram stain, AFB stain,etc),culture media (defined and synthetic media & routine laboratory media), bacterial culture (aerobic and anaerobic) and antibiotic sensitivity.

## UNIT-IV

Histopathology: Common fixatives and staining techniques.

Biochemistry: Principal/theory and significance of estimation of urea, sugar, cholesterol, creatinine, enzymes (transaminase, phosphatase, amylase and lipase), uric acid in blood, estimation of proteins, sugar, bile salts, ketone bodies in urine and liver function test.

**Suggested Readings:**


1. Baker, F.J. and Silverton, R.E. (1985) Introduction to Medical Laboratory Technology,(6th ed), Butlerworth and Co.Ltd.
2. Chatterjee, K.D.(2019), Parasitology, Protozoology and Helminthology (13thed).
3. Cheesborough, M.(1991), Medical Laboratory Technology for Tropical countries,Butlerworth and Co.,Ltd.
4. Garcia, L.S.(2001), Diagnostic Medical Parasitology, (4th ed), ASM PressWashington.
5. Kimball,J.W.(1987),IntroductionofImmunology, (2nd ed),MacMillianPublishingCo.,NewYork.
6. Kuby, J.(2013), Immunology, 7th Edition W.H. Freeman & Co.,USA.
7. Roitt, I. (2017), Essential Immunology, 13th Edition, Blackwell Scientific Publications,Oxford.
8. Talib, V.H.(2019), Essential Laboratory Manual,2nd edition, Mehta Publishers, NewDelhi.

**B.Sc. Medical (Semester–VI) (Session 2022-25)**

**ZOOLOGY**

**PRACTICAL–V (Related to Medical Zoology & Medical Laboratory Technology)**

**Course Code: BSMM-6483 (P)**

**(PRACTICAL)**

**Course Outcomes**

CO1: Apply knowledge and technical skills associated with medical laboratory technology for delivering quality clinical investigations support.

CO2: Perform basic clinical laboratory procedures using appropriate laboratory techniques and instrumentation in accordance with current laboratory safety protocol

CO3: Recognize the role of medical laboratory technology in the context of providing quality patient health care.

CO4: Understanding of sterilization techniques and will also learn about various histotechniques, handling and processing of tissue specimens as well as staining procedures.

CO5: Understanding of estimation of protein & sugar

**B.Sc. Medical (Semester–VI) (Session 2022-25)**

**ZOOLOGY**

**PRACTICAL–VI (Related to Medical Zoology & Medical Laboratory Technology)**

**Course Code: BSMM-6483 (P)**

**(PRACTICAL)**

**Time: 3 hrs.** **Max. Marks:20**

**Instructions for the Practical Examiners:** Question paper is to set on the spot jointly by the Internal and External Examiners. Two copies of the same should be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar

1. Demonstration of safety rules in laboratory like proper handling of patients, specimens and disposal of syringes, needles etc.
2. Demonstration of the use of autoclave, centrifuge and spectrophotometer.
3. Cleaning and sterilization of glass ware, using hot air oven, autoclave etc.
4. Physico-chemical examination of urine.
5. Preparation of thick and thin blood smear.
6. Counting of WBC, RBC and DLC.
7. Study of permanent slides and specimens of parasitic protozoans, helminthes and arthropods mentioned in the theory syllabus.
8. ESR and haematocrit.
9. Estimation of blood sugar, protein.
10. Demonstration of fixation, embedding, cutting of tissue sections, and their staining (routine haematoxylin and eosin).
11. Visit to a pathology Lab and preparation of report.

**Guidelines for conduct of Practical Examination:**

| | | |
|---|---|---|
| 1. | Write down the principle and working of the given equipment. | 4 |
| 2. | Write down the procedure, precautions and perform the experiment for physico-chemical examination of urine/ haematology. | 4 |
| 3. | Identification, pathogenicity and host of parasitic organism. | 4 |
| 4. | Estimation of blood sugar / protein in the given sample. | 4 |

5. Viva-voce and practical file 4

**(Note:- Some changes can be made in the practicals depending on the availability of material.)**

**Scheme of Studies and Examination**
**Master of Science (Zoology)**
**Session: 2022-23**
**(SEMESTER III)**

| **Master of Science (Zoology) Semester III** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Paper No.** | **Course Name** | **Course Type** | **Marks** | | | | **Examination time (in Hours)** |
| | | | **Total** | **Ext.** | | **CA** | |
| | | | | **L** | **P** | | |
| MZOL-3481 | Research Techniques and Methodology | C | 100 | 80 | - | 20 | 3 |
| MZOL-3482 | Developmental Biology | C | 100 | 80 | - | 20 | 3 |
| MZOL-3483 | General Biochemistry | C | 100 | 80 | - | 20 | 3 |
| MZOL-3484 | Applied Zoology-II (Vertebrates) | C | 75 | 60 | - | 15 | 3 |
| MZOP-3485 | Practical -V ( Research Techniques & Applied Zoology-II) | C | 50 | - | 40 | 10 | 3 |
| MZOP-3486 | Practical VI (Developmental Biology & Biochemistry) | C | 50 | - | 40 | 10 | 3 |
| | **Total** | | **475** | | | | |

**Master of Science Zoology**

**Session 2022-23**

**(Semester–III)**

**Course Code: MZOL-3481**

## COURSE OUTCOMES

After passing this course the student will be able to:

- CO1 Understanding of the theoretical principles of centrifugation and chromatography techniques and the scope of their applications.
- CO2 Understanding of the theoretical principles of spectroscopic techniques, microscopy and their applications.
- CO3 Explain various types of electrophoresis techniques.
- CO4 Understanding of Radioisotopic techniques.

**Master of Science Zoology**

**Session 2022-23**

**(Semester–III)**

**Course Code: MZOL-3481**

**Time: 3hrs.** **Max. Marks: 100**
**Theory: 80**

**CA: 20**

**Instructions for the Paper Setter:**

Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

## Unit–I

**Centrifugation:** Basic principles, theory and applications of preparative and analytical centrifugation, rotor types, sedimentation co-efficient and care of rotors.

**Chromatography:** Theory, principle and application of column, paper, thin layer, ion-exchange, affinity chromatography, GLC and HPLC.

## Unit–II

**Spectroscopy:** Lambert Beer's law, Principle and applications of UV/Visible spectroscopy, NMR, ESR and Mass spectroscopy. Visualization of Cells and sub cellular components by light microscopy, Scanning and Transmission Electron microscopy. Freeze fracture methods for electron microscopy. Image processing methods in microscopy.

## Unit–III

**Electrophoresis:** Theory and application SDS-PAGE and Agarose Gel electrophoresis. Introduction to IEF, (Iso-electric focusing). Introduction to gene amplification techniques. Phage DNA detection of plasmid separation of DNA molecules. Southern, Northern and Western techniques.

**Master of Science Zoology**

**Session 2022-23**

**(Semester–III)**

**Course Code: MZOL-3481**

## Unit–IV

**Radioisotopic Techniques:** Basic concepts of radioisotopy, theory and applications of Geiger-Muller tube. Introduction of radio isotopes in biological tissues and cells. Safety rules for radioisotopic studies. Biological applications.

**Books:**

1. Slater, R.J. (1990). Radioisotopes in Biology- A Practical Approach, Oxford University Press, NY.
2. Wilson, K and Goulding, K.H. (1991). Biologist's Guide to Principles and Techniques of Practical Biochemistry. 3rd., Edward Arnold, London.
3. Sawhney, S.K. and Singh, R. (2001). Introductory Practical Biochemistry, Narosa Publishing House, New Delhi.
4. Tinoco Kenneth Saur and J.C. Wang. Physical Chemistry: Principles and Applications in Biological Sciences, 3rd edition.

**Master of Science Zoology**
**Session 2022-23**
**(Semester–III)**
**Course Code: MZOL-3482**
**DEVELOPMENTAL BIOLOGY**

**COURSE OUTCOMES**

After passing this course the student will be able to:

- CO1 develop detailed understanding of essential events of developmental biology through proper explanation of gametogenesis, fertilization, as part of early embryonic development and to impart knowledge regarding in-vitro fertilization.
- CO2 impart knowledge regarding basic concepts of parthenogenesis, cleavage and gastrulation to the students.
- CO3 provide adequate explanation to the students regarding cell commitment, specification and determination.
- CO4 make the students aware about genetic control of development, induction and regulation of developmental events.

**Master of Science Zoology**
**Session 2022-23**
**(Semester–III)**
**Course Code: MZOL-3482**
**DEVELOPMENTAL BIOLOGY**

**Time: 3 hrs.** **Max. Marks: 100**
**Theory: 80**

**CA: 20**

**Instructions for the Paper Setter:**

Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

## Unit–I

**Gametogenesis and Fertilization**

Spermatogenesis, oogenesis,
vitellogenesisEgg and sperm interaction,
fertilization Natural and artificial
parthenogenesis

In vitro fertilization and embryo transplantation

## Unit–II

**Cleavage, Gastrulation & Differentiation**

Cleavage and its patterns
Biochemical changes duringcleavage

Gastrulation and morphogenetic movements
Morphogenesis of germ layers
Morphogenetic field

Differentiation

Determination, transdetermination

## Unit–III

**Induction**

Induction, competence and inductive response, hierarchies of induction, principles of reciprocal action

**Metamorphosis and Regeneration** Morphophysiology and metamorphosis in insects andamphibians

Regeneration in Platyhelminthes and Coelenterates Histomorphological changes in regeneration of tail in Amphibians andReptiles, limb in amphibians

Vertebrate lens regeneration

# UNIT IV

**Genetic Control of Development**

Nuclear determination of developmental events
Molecular basis of early embryonic development
Influence of extrinsic factors on genetic control

Nucleus and cytoplasmic interactions during development
Concept of growth at cellular, subcellular and organ level

**Suggested Readings:-**


1. Balinsky, B.I. (1981). An Introduction to Embryology, Saunders, Philadelphia.
2. Bellairs, R. (1971). Development Processes in Higher Vertebrates, University of Miami Press, Miami.
3. Berrill. N.J. (1971): Developmental Biology. McGraw Hill, New Delhi.
4. Dawnpart, Developmental Biology.
5. Gilbert, F. (1985, 95 & 2000): Developmental Biology, Sinaur.
6. Goel, S.C. (1984): Principles and Animal Developmental Biology, Himalaya, Bombay.
7. Grant, P. (1978): Biology of Developing System.
8. Spratt, N.T. Jn. (1971): Developmental Biology, Wordsworth, Belmont, Co.
9. Waddigton CH. (1966): Principles of Development and Differentiation. MacMillan, New York.
10. Miller, W.A. (1997). Developmental Biology Springer Verlag, New York.

**Master of Science Zoology**
**Session 2022-23**
**(Semester–III)**
**Course Code: MZOL-3483**
**GENERAL BIOCHEMISTRY**

**COURSE OUTCOMES**

After passing this course the student will be able to:

- CO1 Explain Enzyme kinetics
- CO2 Describe Glycolysis.
- CO3 Reactions and regulation of citric acid cycle
- CO4 Oxidation of fatty acids and amino acids.

**Master of Science Zoology**
**Session 2022-23**
**(Semester–III)**
**Course Code: MZOL-3483**
**GENERAL BIOCHEMISTRY**

**Time: 3 hrs.** **Max. Marks: 100**
**Theory: 80**

**CA: 20**

**Instructions for the Paper Setter:**

Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

UNIT I

**Biomolecules**

Structure and function of biomolecules: Amino acids, Carbohydrates, Lipids, Proteins and Nucleic acids

Enzymes: As catalyst specificity, enzyme substrate complex, active sites. Michaelis – Menton kinetics, Vmax and Km and their significance.. Reversible and Irreversible inhibition, Regulatory enzymes.

## Unit–II

**Brief introduction to Bioenergenetics and thermodynamics**
Phosphoryl group transfer and ATP

**Glycolysis**
Fates of glycolysis

Fates of pyruvate under aerobic and anaerobic conditions
Gluconeogenesis and the carbohydrate catabolism
Pentose phosphate pathway

## Unit–III

**Citric acid cycle**
Oxidation of pyruvate, production of acetate
Reactions of citric acid cycle

Regulation of citric acid cycle
Glyoxylate cycle

## Unit–IV

**Oxidation of fatty acids and amino acids**

Metabolism and transport of fats
Oxidation of fatty acid

Generation reactions and metabolism of amino acids acids

**Oxidative phosphorylation**

Electron transport reactions in mitochondria
Shuttle system in mitochondria

Regulation of oxidative phosphorylation

**Suggested Reading Material:-**


1. Lehninger A.D. Nelson D.L. & Cox M.M. (1993) & (2000), Principles of Biochemistry,2nd and 3rd ed. Worth Publishers, New York.
2. Lehninger, A (2000). Principles of Biochemistry. 3rd Edition.
3. Fischer, J. and Arriold, J.R.P. (2001). Instant notes in Chemistry for Biologists Viva Books Pvt. Ltd.
4. Harper, H.A. (2000): Harper's Biochemistry 25th ed.
5. Morris, H. Best, L.R., Pattison, S., Arerna, S. (2001). Introduction to General Organic Biochemistry. 7th Ed. Wadsworth Group.
6. Sheehon, D (2000). Physical Biochemistry: Principles and Applications – John Wiley & Sons Ltd., England.

**Master of Science Zoology**
**Session 2022-23**
**(Semester–III)**
**Course Code: MZOL-3484 APPLIED ZOOLOGY-II (VERTEBRATES)**

## COURSE OUTCOMES

After passing this course the student will be able to:

- CO1.Learn skill development for small scale industry such as fisheries, piggeries.
- CO2. Gain knowledge about processing and use of fur and wool industry.
- CO3.Understandselection and products of dairy animals and processing of leather industry.
- CO4.UnderstandingofPharmaceuticalproductsfromanimals.

**Master of Science Zoology**
**Session 2022-23**
**(Semester–III)**
**Course Code: MZOL-3484 APPLIED ZOOLOGY-II (VERTEBRATES)**

**Time: 3hrs** **Max. Marks: 75**
**Theory: 60**

**CA: 15**

**Instructions for the Paper Setter:**

Eight questions of equal marks (12 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

UNIT I

**Pisciculture**

Economically important fresh water and marine fishes
Aims and evolution of Fish culture

Fish Farming Technologies
Factors affecting fish culture

Problems of seed collection from natural resources (in brief)
Induced breeding methods

Products and by products from pisciculture.

**Poultry**

Nomenclature and breeds of poultry birds

Egg structure and quality, nutritive values, abnormalities in eggs, factors affecting size and egg processing

Broilers, meat processing
Poultry Rearing / Farming

Nutritional Requirements
Housing and equipment
Poultry diseases

Poultry products and by products

## Unit–II

**Fur and wool Industry**

Fur producing animals

Fur farming, dressing, processing and dyeing
Fur industry in India

Animals of wool industry

Types, structure and physicochemical properties of wool

Processing of wool: shearing, clearing, drying, bleaching, dyeing, spinning and twisting

## Unit–III

**Dairy Farming**

Milching animals, Breeds, Housing, raising and Tools of management
Artificial insemination and IVF for improvement of stock

Milk composition and dairy products

**Leather Industry**

Animals of leather industry

Processing of skin: flaying, Curing, salting and tanning during
Enemies of skin industry

## Unit–IV

**Piggery**

Characteristics of swine and important breeds

Breed selection, management and housing and nutritional needs
Products (Pork, Bristles, Lard, Sausages) and by products
Diseases of Pigs

**Other Utilities of Animals**

Pharmaceuticals from animals (in brief)
Use of animals in vaccine production

**Suggested Reading Material:**


1. Banarjee, G.C. (1991), Text book of Animal Husbandry. Oxford and IBH Pub, New Delhi.
2. Jawal, P.L. (1977), Handbook of Animal Husbandry, I. C. A. R., Pub. New Delhi.
3. Jhingaran, V.G. (1991), Fish and Fisheries of India, Hindustan Pub. Co. India.
4. Mustafa, S. (1990), Applied and Industrial Zoology, Rastogi publications, Meerut.
5. Sarkar, K. T. (1991), Theory and Practice of Leather manufacture. The Author, Madras.
6. Shami, Q. J. and Bhatnagar, S. (2002) Applied Fisheries . Agrobios India.
7. Shukla, G. S. & Upadhaya, V. B. (1991-92), Economic Zoology, Rastogi Publications, Meerut.

8. Toor, H. S. and Kaur, K. (1996), Fish Culture Manual. PAU, Ludhiana.
9. Yadav, M. (2003) Economic Zoology, Discovery Publication House, New Delhi.

**Master of Science Zoology**
**Session 2022-23**
**(Semester–III)**
**Course Code: MZOL-3485**

## PRACTICAL V (RESEARCH TECHNIQUES & APPLIED ZOOLOGY-II)

### COURSE OUTCOMES

After passing this course the student will be able to:

- CO1Understandingofvariousscientificresearchtechniques.
- CO2 Estimation of protein content, DNA/RNA
- CO3 Use ELISA and PAGE

**Master of Science Zoology**
**Session 2022-23**
**(Semester–III)**
**Course Code: MZOL-3485**

## PRACTICAL V (RESEARCH TECHNIQUES & APPLIED ZOOLOGY-II)

**Time: 3 hrs** **Max. Marks: 50**

**Practical: 40**
**CA: 10**

**Centrifugation:**
-Sedimentation using Swing out Rotor and Angle Rotor -Differential centrifugation

**Chromatography Techniques:** (for separation of macromolecules)

- Paper chromatography
- Thin layer chromatography
- Gel permeation chromatography

**Spectrophotometric Techniques:**
- Preparation of standard curve of BSA, DNA, RNA
- Measurement of transmission of light through different solutions or substances at differentwavelengths of light.
- Estimation of DNA/RNA

**Electrophoresis Techniques:**
-Preparation of native polyacrylamide gel.

-Gel separation of proteins by native PAGE.

-Preparation of SDS-polyacrylamide gels

-Separation of proteins by SDS-PAGE.

-Direct and Indirect ELISA

Vist to a fish farm/poultry form/pig farm/sheep or goat farm/meat processing industry/leather industry/wool industry and preparation of report.

**Master of Science Zoology**
**Session 2022-23**
**(Semester–III)**
**Course Code: MZOL-3486**

## PRACTICAL VI (DEVELOPMENTAL BIOLOGY AND BIOCHEMISTRY)

## COURSE OUTCOMES

After passing this course the student will be able to:

- CO1 Understanding of developmental stages of chick
- CO2 Explain process of gametogenesis.
- CO3 Understanding of proteins, lipids and carbohydrates estimation.

**Master of Science Zoology**

**Session 2022-23**
**(Semester–III)**
**Course Code: MZOL-3486**

## PRACTICAL VI (DEVELOPMENTAL BIOLOGY AND BIOCHEMISTRY)

**Time: 3hrs.** **Max. Marks: 50**

**Practical: 40**
**CA: 10**

-Study of different larval forms across the animal Kingdom using charts/models/videos.

-Developmental stages of chick and frog through slides/charts.

-Metamorphosis through charts/audio video means in frog and insect.

-Study of Gametes through permanent slides:-

a) Spermatogenesis in rat/frog/grasshopper
b) Study of testis (rat/frog/grasshopper)
c) Study of Ovary(rat/frog/grasshopper)
d) Oogenesis in rat / frog/fish

-Quantitative analysis of proteins by Lowry/ Bradford method.

-Estimation of Lipids

-Estimation of Carbohydrates

**Master of Science (Zoology)**
Session-2022-23

**(SEMESTER-IV)**

| **Master of Science (Zoology) Semester IV** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Paper No.** | **Course Title** | **Course Type** | **Marks** | | | | **Examination time (in Hours)** |
| | | | **Total** | **Ext.** | | **CA** | |
| | | | | **L** | **P** | | |
| MZOL-4481 | Animal Behavior and Wildlife Conservation | C | 100 | 80 | - | 20 | 3 |
| MZOL-4482 | Animal Genetics & Biotechnology | C | 100 | 80 | - | 20 | 3 |
| MZOL-4483 | Concepts of Immunology | C | 100 | 80 | - | 20 | 3 |
| MZOL-4484 | Biosystematics | C | 50 | 40 | - | 10 | 3 |
| MZOP-4485 | Practical –VII (Animal Behaviour and Wildlife Conversation) | C | 50 | - | 40 | 10 | 3 |
| MZOP-4486 | Practical - VIII (Genetics & Biosystematics) | C | 50 | - | 40 | 10 | 3 |
| MZOD-4487 | Project Report | C | - | - | - | - | - |
| | **Total** | C | **450** | | | | |

**Master of Science (Zoology) Semester–IVSession-**2022-23

**Course Code:** MZOL-4481

**Course Title:** Animal Behaviour and Wildlife Conservation

## COURSE OUTCOMES

After passing this course the student will be able to:

- CO1 Demonstrate knowledge of key concepts in animal behavior, its patterns, and analysis. It will also enable the students to understand the proximate controls of behavior including the role of hormones, the animal's genotype and the animal's environment in the development of behavior.
- CO2 Adaptive significance of behaviour, emphasizing social behavior, territoriality, sexual selection, parental care and mating systems
- CO3 Understanding and awareness for wildlife conservation. To impart knowledge regarding conservation of threatened animal species.
- CO4 Understand the significance of various wildlife projects for conservation of threatened species and the status of wildlife in Punjab.

**Master of Science (Zoology) Semester–IVSession-**2022-23

**Course Code:** MZOL-4481

**Course Title:** Animal Behaviour and Wildlife Conservation

**Time: 3hrs** **Max. Marks: 100**
**Theory: 80**

**CA: 20**

**Instructions for the Paper Setter:**

Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

## Unit–I

**Introduction**

Ethology as a branch of biology

Animal Psychology – classification of behavioural patterns, analysis of behaviour (ethogram)

**Neural and Hormonal Control of Behaviour**

Genetic and environmental components in the development of behaviour

**Communication:**

Chemical, Visual tactile and Audio communication
Functions of communication

Song specificity in birds
Evolution of language (primates)
Host-parasite relations

## Unit–II

**Social Behaviour**

Aggregations-schooling in fishes, flocking in birds, herding in mammals, Advantages and disadvantages of living in groups

Group selection, kin selection, altruism, reciprocal altruism, inclusive fitness Social organization in insects and primates

**Reproductive Behaviour**

Evolution of sex.

Mating and Courtship behaviour
Sperm competition

Sexual selection and Parental care

**Learning and Memory**

Conditioning, Habituation, Associative learning, Reasoning and Cognitive skills

## Unit–III

**Wild life in India**

Wild life as a resource and its value
Causes of depletion of wildlife

Wild life ecology, ecological sub regions, distribution of wildlife in India
Methods of studying wildlife and census of wildlife National and state animals of India

Names, Organization and management of Wildlife sanctuaries, National parks and Biosphere reserves

**Wildlife conservation measures**

Role of Zoos, parks and sanctuaries for conservation of some wild animals
Laws, legislation and statuary bodies for protecting wildlife

Red data book, endangered, vulnerable, rare, threatened and intermediate species
Measures for Wildlife conservation

## Unit–IV

**Status of Wildlife in Punjab**

**Special projects for Endangered and Threatened Species and concerns**

Project Tiger
Project Hangul
Project Rhino
Project Elephant

Gir Lion Sanctuary Project
Project Great Indian Bustard
Crocodile breeding Project

Ecology & Conservation of the Himalayan Musk deer and the Manipur Brow antlered deer

**Suggested Reading Material:**

1. Aggarwal,. (2000), Biodiversity.
2. Aggarwal,. ( 2000 ), Wildlife of India.
3. Alcock, J. (1998), Animal behaviour, An evolutionary approach Sinauer Assoc., Sunderland, Mass, USA.
4. Ali, S. (1971), The Books of Indian Birds, Bombay Natural History Society, Bombay.
5. Burton, L. D. (2003), Fish and Wildlife: Principles of Zoology and Ecology. Delmar Thompson Learning Pb.
6. Dasmann, R. F., ( 1982 ), Wildlife Biology, Wiley Eastern, New Delhi.
7. Drickamer, L. C. and Vessey, S. H. (1986), Animal Behaviour - Concepts, Processes and Methods. (2nd ed.), Wordsworth Publ. Co., California.
8. Fulbright, Timothy, E. and Hewitt, D. G. (2008). Wildlife Science: Linking Ecological Theory and Management Applications. CRC Press, Taylor and Francis : BocaRaton, F L.
9. Giles, R. H. (1984), Wildlife Management Techniques, Natraj Publishers, Dehradun.
10. Gopal, R. ( 1992), Fundamental of Wildlife management Justice Home Allahabad.
11. Goodenough, J., McGurie and Wallace, R. A. (2001), Perspective on animal behaviour. John Wiley & Sons, Inc. New York.
12. Hosetti, B. B. ( 1997 ), Concepts in Wildlife Management, Chawla Press, Delhi.
13. Huntingford F. ( 1984 ), The study of animal Behaviour, Chapman and Hall, London.
14. Manning, A. and Dawkins, M. S. ( 1992 & 1998 ), An Introduction to Animal Behaviour , 4th ed. ( Cambridge low price editions ). Cambridge University Press, Cambridge.

15. Manning, A. (1979), An Introduction to Animal Behaviour, 3rd Edition . The English Language Book Society and Edward Arnold Publishers Ltd.
16. McFarland, D. (1985 & 1999), Animal Behaviour. Pitman Publishing Ltd. London.
17. Majupuria T. C. (1990), Wildlife Wealth of India (Resources and Management), ISBN, Tecpress Services, Thailand.
18. Moulton, M. P. and Sanderson, J. (1997), Wildlife issues in a changing world. St. Luice Press Florida.
19. Negi, S. S. ( 1995 ), Hand Book of National Park, Sanctuaries and Biosphere Reservoirsin India, Indus publishing Co., New Delhi
20. Prater, S. H. (1980), The Book of Indian Animals, Bombay Natural History Society, Bombay.
21. Saharia, V. P. (1982), Wildlife in India, Natraj Publisher, Dehradun.
22. Samways, M. J. (1994), Insect Conservation Biology, Chapman and Hall, New York.
23. Sharma, B. D. (1994), High Altitude Wildlife of India, Oxford IBH, New Delhi.
24. Sharma, B.D. ( 1999 ), Indian Wild Life Resources Ecology and Development . Daya Publishing House, Delhi.
25. Sharma, B.D. (2002 ), Man environment and wildlife animal. IBH Publishing Co., Pvt .Ltd. New Delhi.
26. Teague, R. D. ( 1987), A manual of Wildlife Conservation, Natraj Publishers, Dehradun.
27. Tikadar, B. K. ( 1988 ), Threatened Animals of India, Publications of Zoological Surveyof India, Calcutta.
28. Tirvedi, P.R. and Singh, U. K. ( 1996 ), Environmental Laws of Wildlife.

**Master of Science (Zoology) Semester–IVSession-**

2022-23

**Course Code:** MZOL-4482

**COURSE OUTCOMES**

**After passing this course the student will be able to:**

- CO1 Describe DNA replication and DNA repair.
- CO2 Describe transcription and Post-transcriptional modifications in RNA.
- CO3 Explain translation in prokaryotes and eukaryotes
- CO4 Understand Genetics of Cancer.

**Master of Science (Zoology) Semester–IVSession-**

2022-23

**Course Code:** MZOL-4482

**Time: 3 hrs.** **Max. Marks: 100**
**Theory: 80**

**CA: 20**

**Instructions for the Paper Setter:**

Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

## Unit–I

**DNA- The genetic material:**

DNA: Structure, Properties, Replication and packaging into chromosomes Prokaryote nucleoid structure

Chemical composition of eukaryote chromosomes
Euchromatin, Heterochromation and banding pattern
Repetitive DNA and sequence organization

Protein synthesis

Linkage, Crossing over and Chromosome Mapping
Cytological basis of crossing over

Two factor crosses, Three factor crosses and interference
Somatic Cell hybirdization.

## Unit–II

**Mutations**

Introduction and classification of mutation
Molecular basis of mutation

Radiation and chemical inducted mutation

Correlation between mutagenicity and carcinogenicity
Mutation Frequency

Practical applications of Mutations

**Gene Concepts**

Classical versus molecular concepts of Gene
Complementation test for functional allelism

Regulation of gene expression in prokaryotes and Eukaryotes

## Unit–III

**Bacterial Genetics**

Transformation, transduction and conjugation.
F mediated sex-duction.

Mechanism of recombination in bacteria.

Plasmid, Episome, IS elements and Transposons.

**Genetics of Viruses**

Organisation and expression of bacteriophage genomes
Structure and infection cycles of Viruses of eukaryotes
Animal viruses and cancer

## Unit–IV

**Recombinant DNA technology**

Gene cloning and Sequencing.
Restriction endonuclease.

Vectors.
cDNA cloning.

Identification of Specific clone with a specific probe.

Techniques: Southern, Northern, Western Blotting, PAGE, PCR, DNA finger printing, DNA foot printing.

In situ hybridization, RFLP.

Practical applications of gene cloning.

**Extranuclear inheritanc**

Criteria for extranuclear inheritance
DNA and drug resistance.

Mitochondrial DNA and genetic diseases.

Mechanism of Sex determination, Sex differentiation, Sex linked inheritance.

**Books Recommended:**


1. Ayala, F.J. & Kiger, Jr. J.A. (1980) Modern Genetics. The Benjamin Cummings Publishing Co. Inc.
2. Brown T.A. (1992). Genetics- A Molecular Approach, 2nd ed. Van Nostrand Rainhold (international).
3. De-Robertis, F.D.P. and De-Robertis Jr., E.M.E. (1987). Essentials of Cell and Molecular Biology, Saunders, Philadelphia.
4. De-Robertis, F.D.P. and De-Robertis Jr., E.M.E. (1987). Cell and Molecular Biology, Saunders, Philadelphia.
5. Freifelder, D. & Malacinski. G.M. (1993) : Essentials of Molecular Biology, Jones & Bartlett Publishers, Boston.
6. Gardener, E.J., Simmons, M.T.J. & Sunstad, D.P. (1999) : Principles of Genetics, 8th ed. John Wiley & Sons, New York.
7. Miglani, G.S. (2000). Basic Genetics Narosa Publishing House, New Delhi.
8. Sambrook, J., Fritisch, E.F. and Maniatis, J. (1989). Molecular Cloning. A lab manual.
9. Winter, P.C., Hickey, G.I. and Fletcher, H.L. (1999) Instant notes in Genetics. New Delhi
10. Satson, J.D. et. al. (1987) : Molecular Biology of Gene, 4th ed. Vol. I & II. The Benjamin / Cummings Publishing Co., Inc.
11. Weaver, R.F. and Hedrick, P.W. (1992). Genetics Wm. C. Brown Publishers Dubuque.
12. Zubay. U.G. (1987), Genetics. The Cummings Publishing Co., Inc.

**Master of Science (Zoology) Semester–IV**

**Session-**2022-23

**Course Code:** MZOL-4483

**Course Title:** Concepts of Immunology

## COURSE OUTCOMES

After passing this course the student will be able to:

- CO1 Describe the basic mechanisms, distinctions and functional interplay of innate and adaptive immunity.
- CO2 Define the cellular/molecular pathways of humoral/cell-mediated adaptive responses and understand the cellular as well as molecular aspects of lymphocyte activation, homeostasis, differentiation, and memory.
- CO3 Understand the molecular basis of complex, cellular processes involved in inflammation and immunity, in states of health and disease.
- CO4 Understand immunodiagnostics techniques.

**Master of Science (Zoology) Semester–IV**

**Session-**2022-23

**Course Code:** MZOL-4483

**Course Title:** Concepts of Immunology

**Time: 3 hrs.** **Max. Marks: 100**
**Theory: 80**

**CA: 20**

**Instructions for the Paper Setter:**

Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

## Unit–I

**Introduction**

Types of immunity-innate and adaptive. Features of immune response-memory, specificity and recognition of self and non-self. Terminology and approaches to the study of immune system. Immunity to viruses bacteria, fungi and tumours.

**Cells and Organs of the immune system**

Lymphoid cells, heterogeneity of lymphoid cells, T-cells, B-cells, Null cells, Monocytes, polymorphs; primary and secondary lymphoid organs-thymus, Bursa of fabricius spleen, lymph nodes, lymphatic system, Mucosa Associated Lymphoid Tissue (MALT), Lymphocytes traffic.

## Unit–II

**Humoral Immunity*:***

Antigen-antibody interactions, affinity and avidity, high and low affinity anti-bodies. Immunoglobulins, classes and structure. Molecular mechanism of generation of antibody diversity. Complement fixing antibodies and complement cascade.

**Cell Mediated Immunity**

T-cell subset and surface markers. T-dependent and T-independent antigens, recognition of antigens by T-cells and role of MHC, structure of

T – cell antigen receptors.

## Unit–III

**Immunological Disorders**

Types of Hypersensitivity reactions, autoimmune disorders, their underlying molecular mechanism, actiology, diagnostic, prognostic and prophylactic aspects, Immunodeficiency disorders, Aids

**Immuno biotechnology:**

**Hybridoma Technology**

Immunization of animals, isolation of stimulated spleen cells, Myeloma cell lines used as fusion partners. Fusion methods, Detection and applications of monoclonal antibodies, Vaccines: conventional vaccines, Viral vaccines, Bacterial vaccines, peptide vaccines, genetically engineered vaccines, Production and application of lymphokines.

## Unit–IV

**Immunodiagnostic Procedures**

Various types of Immunodiffusion and immunoelectrophoretic procedures, Immunoblot, ELISA, RIA, Agglutination of pathogenic bacteria, haemagglutination and inhibition.

**Books Recommended:**


1. Kuby, J., Immunology W. H. Freeman and Company, New York, (1992).
2. Roitt, I. M. Brostoff, J and Male, D., Immunology, 2nd edition, Gover Medical Publishing, New York. (1989).
3. Roitt, I. M., Essential Immunology, 6th edition, Blackwell Scientific Publications, Oxford. (1988).
4. Paul, W.E., Fundamental Immunology, 2nd edition, Raven Press, New York. (1989).
5. Playfair, J.H.L.: Immunology at a glance, 5th edition, Blackwell Scientific Publications, Oxford. (1992).
6. Paul, W.E.: Immunology; recognition and response. W.H. Freeman, New York. (1991).

**Master of Science (Zoology) Semester–IV**

**Session-** 2022-23

**Course Code:** MZOL-4484

**Course Title:** Biosystematics

## COURSE OUTCOMES

After completion of course the student will be able to:

- CO1 Evaluate the taxonomic characters and apply this for the identification and classification of living things.
- CO2 Apply the various taxonomic procedures for collection, preservation and identification of living organisms.
- CO3 Knowledge of different types of publications
- CO4: Knowledge about major and minor phyla

**Master of Science (Zoology) Semester–IV**

**Session-** 2022-23

**Course Code:** MZOL-4484

**Course Title:** Biosystematics

**Time: 3 hrs.** **Max. Marks: 50**
**Theory: 40**

**CA: 10**

**Instructions for the Paper Setter:**

Eight questions of equal marks (8 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

## Unit–I

**Introduction**

Terms / Definitions

History/ Development of theories / kinds of classification
Importance of Biosystematics

**Material basis of Biosystematics**

**Different attributes or evidences**

Character kinds

Character weighing

**New aspects of Biosystematics:**

Cytotaxonomy

Chemotaxonomy

Molecular taxonomy

**Unit–II**

**Taxonomic Procedures**Taxonomic collections Preservation Identification

Taxonomic keys ( Different kind, salient features, merits and demerits)
International Code of Zoology/ Cal Nomenclature

Nomenclature Principles, important rules, their interpretation and application in scientific nomenclature.

## Unit–III

**Taxonomic Publications**

The Scientific publications
Systematic publications
Contents of publications

**Taxonomic Hierarchy**

Species category and various concepts of species
Hierarchy of categories

Lower and higher categories

Subspecies and other sub specific categories
Decision at species and sub species level

## Unit–IV

**History of kingdom systems (resume of whittakar's system and other recent systems of classification)**

An outline of classification of kingdom Animalia
Salient features of minor phyla.

**Suggested Reading Material:**


1. Gote, H.E. (1982), Animal Taxonomy, Edward Arnold.
2. Jaffery, C. (1973), Biological Nomenclature, Edward Arnold.
3. Kapoor, V.C. (1987), Theory and Practice of Animal Taxonomy, IPH Pb. New Delhi.
4. Mayer, E. (1969), Principle of Systematic Zoology, McGraw Hill Book Co. London.
5. Mayer, E. & Aschhok (1991), Principles of Systematics, McGraw Hill Book Co. London.
6. Minell, A. (1993), Biological Systematics, The State of Art. Chapman & Hall, London.
7. Quicke, D.L.J, (1996), Principles & Techniques of Contemporary Taxonomy, Blacky Academic & Professional, London, New York, Madras.
8. Kitching, I.J., Forey, P.L. Humpheries, C.J. & William, D. 1998. Cladistics: Theory and Practice of Parsimony Analysis, Oxford University Press.
9. Sebuh, Randall T. 2000, Biological Systematics: Principles & Applications Cornell University Press 256 pp.
10. Winston, J. 1999. Describing Species Practical Taxonomic Procedure of Biologists. Columbia University Press, Lincoln, R.J. Dictionary of Ecology, Evolution and Systematics.

**Master of Science (Zoology) Semester–IV**

**Session-** 2022-23

**Course Code:** MZOP-4485

## COURSE OUTCOMES

After passing this course the student will be able to:

- CO1 Understanding of behavior of animals
- CO2 Understanding of wild life

**Master of Science (Zoology) Semester–IV**

**Session-** 2022-23

**Course Code:** MZOP-4485

**Time: 3 hrs** **Max. Marks: 50**

**(Practical: 40, CA: 10)**

**1.** To study the influence of temperature on development and populationbuilt up of *Tribolium*/*Rhizopertha*/*Callosobruchus*.

**2.** To study the food preference in different animals.

*a) Tribolium /Rhizopertha*

*b) Pieris brassicae.*

**3.** To investigate the locomotive, explorative, withdrawal and habituation behaviours inEarthworm and Slug

**4.** To study the latent and operant learning in rat.

**5.** To study the thigmotaxis response in *Callosobruchus*/ *Tribolium/ Rhizopertha*

**6. To study the Geotaxis Responses in**

*a) Tribolium*

b) Ant

c) *Pieris brassicae* Larvae

d) Slug

**7. To study the Humidity Preference in**

*a) Drosphila / Zaprionus*

*b) Tribolium*

*c) Callosobruchus*

d) *Pieris brassicae* Larvae

**8. To study the Phototaxis to Point Source and Different Colours of Light.**

a) Earthworm

b) *Zaprionus*.

*c) Tribolium*

*d) Callosobruchus*

e) *Pieris brassicae* Larvae

**9. Use of videos to Study the**

a) Grooming and righting behaviour in cockroach.
b) Tarsal response in butterfly/housefly.
c) Equilibrium study on housefly.
d) Effect of temperature on opercular movement in fish

10. **To Investigate the Chemosensory Responses in *Zaprionus* / *Bactrocera***
11. Study of body rhythms in human beings
12. Animal behaviour patterns using photostat sheets.
13. Assignment on Wildlife project.

**Master of Science (Zoology) Semester–IV**

**Session-** 2022-23

**Course Code:** MZOP-4486

## COURSE OUTCOMES

After passing this course the student will be able to:

- CO1 Understanding of pedigree analysis and preparation of familycharts
- CO2 Knowledge of isolation of DNA from human blood and buccalcells.
- CO3 Understanding of cell division.
- CO4 Understanding of inheritance of morphogenetic human characters.
- CO5 Knowledge of collection ,preservation and nomenclature ofanimals

**Master of Science (Zoology) Semester–IV**

**Session-** 2022-23

**Course Code:** MZOP-4486

**Time: 4 hrs** **Max. Marks: 50**
**(Practical: 40, CA: 10)**

-To prepare and study the karyotype of human cell from meta phase pictures.

-To study the pedigree analysis of a family.

-To study blood groups in human beings.

-Demonstration of Barr body in the oral epithelium of human beings.

-To study different stages of mitosis in root tips of *Allium cepa.*

-To study permanent slides of:-

- Mitosis in bone marrow cells of rat.

-Stages of meiosis in testis of rat/grasshopper/*Allium cepa.*

-Polytene chromosomes in third instar larvae of *Zaprionus paravittiger*.

-To study dermatoglyphics with palms of hands and fingertips.

-To study inheritance of morphogenetic human characters.

-Isolation of DNA from plant tissues.

-Numericals on Mendelian laws of inheritance and linkage.

-Serum extraction from blood.

-ELISA & RIA, Rocket Immuno- electrophoresis.

-Demonstration of various kinds of equipment required for collection and preservation of animals.

-Videos of Methods of collection and preservation.

-Kinds of keys and their use at higher and lower category levels.

**Session 2022-23**

**Master of Science Zoology (Semester – IV)**

**Course Title: Project**

**Course Code: MZOD- 4487**

**COURSE OUTCOMES**

After passing this course the student will be able to:

- CO1 Express their innovative ideas and creativity on any scientific phenomenon & developinterest in research aptitude.
- CO2 Explore field work and research work.
- Learn how to design an experiment and various research strategies.

**Session 2022-23**

**Master of Science Zoology (Semester – IV)**

**Course Title: Project**

**Course Code: MZOD- 4487**

In this non credit compulsory course students learn how to design an experiment and what the various research strategies are.Students can opt for any one from the following and will submit a detail report after successful completion:

- Review on a research topic
- Small Research Project
- Hands on Training in any Industry/Research Lab

**Kanya Maha Vidyalaya, Jalandhar (Autonomous)**

**SCHEME AND CURRICULUM OF EXAMINATIONS OF TWO-YEAR DEGREE PROGRAMME**

**(Under Credit Based Continuous Evaluation Grading System) (CBCEGS)**

**Session 2022-24**

**Masters of Sciences (Zoology) Semester-I**

| Course Code | Course Name | Course Type | Hours Per Week | Credits | Total Credits | Marks | | | | Examination time (in hours) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Ext. | | CA | Total | |
| | | | | L-T-P | | L | P | | | |
| MZOL-1481 | Functional Organization of Animals–I | C | 4 | 4-0-0 | 4 | 80 | - | 20 | 100 | 3 |
| MZOL-1482 | Animal Ecology | C | 4 | 4-0-0 | 4 | 80 | - | 20 | 100 | 3 |
| MZOL-1483 | Cell Biology | C | 4 | 4-0-0 | 4 | 80 | - | 20 | 100 | 3 |
| MZOL-1484 | Concepts of Biotechnology | C | 4 | 4-0-0 | 4 | 80 | - | 20 | 100 | 3 |
| MZOM-1134 | Computer Programming and Data Processing | C | 4 | 2-0-1 | 3 | 25 | 15 | 10 | 50 | 3 |
| MZOP-1485 | Practical-I (Functional Organization of Animals-I) | C | 6 | 0-0-3 | 3 | 40 | - | 10 | 50 | 3 |
| MZOP-1486 | Practical-II (Ecology and Cell Biology) | C | 6 | 0-0-3 | 3 | 40 | - | 10 | 50 | 3 |
| IDEC-1101 | Effective Communication Skills | IDC Students can opt any one | 3 | 4-0-0 | 4 | 80 | - | 20 | 100 | 3 |
| IDEM-1362 | Basic Fundamentals of Music (Vocal) | | 3 | 2-0-2 | 4 | 40 | 40 | 20 | 100 | 3 |
| IDEH-1313 | Human Rights and Constitutional Duties | | 3 | 4-0-0 | 4 | 80 | - | 20 | 100 | 3 |
| IDEI-1124 | Basics of Computer Applications | | 3 | | 4 | | | | | 3 |
| Total | | | | | **29** | | | | **550** | |

# Kanya Maha Vidyalaya, Jalandhar (Autonomous)

**SCHEME AND CURRICULUM OF EXAMINATIONS OF TWO-YEAR DEGREE PROGRAMME**
**(Under Credit Based Continuous Evaluation Grading System) (CBCEGS)**
**Session 2022-24**

**Masters of Sciences (Zoology)**
**Semester-II**

| Course Code | Course Name | Course Type | Hours Per Week | Credits | Total Credits | Marks | | | | Examination time (in hours) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Ext. | | | | |
| | | | | L-T-P | | L | P | CA | Total | |
| MZOL-2481 | Functional Organization of Animals–II | C | 4 | 4-0-0 | 4 | 80 | - | 20 | 100 | 3 |
| MZOL-2482 | Applied Zoology-I (Invertebrates) | C | 4 | 4-0-0 | 4 | 80 | - | 20 | 100 | 3 |
| MZOL-2483 | Evolution | C | 4 | 4-0-0 | 4 | 80 | - | 20 | 100 | 3 |
| MZOL-2334 | Biostatistics | C | 4 | 4-0-0 | 4 | 40 | - | 10 | 50 | 3 |
| MZOS-2485 | Seminar | C | 4 | 0-0-2 | 2 | 40 | - | 10 | 50 | 3 |
| MZOP-2486 | Practical-III (Functional Organization of Animals–II) | C | 6 | 0-0-3 | 3 | 40 | - | 10 | 50 | 3 |
| MZOP-2487 | Practical- IV (Evolution and Applied Zoology-I) | C | 6 | 0-0-3 | 3 | 40 | - | 10 | 50 | 3 |
| Total | | | | | **24** | | | | **550** | |

# Kanya Maha Vidyalaya, Jalandhar (Autonomous)

**SCHEME AND CURRICULUM OF EXAMINATIONS OF TWO-YEAR DEGREE PROGRAMME**
**(Under Credit Based Continuous Evaluation Grading System) (CBCEGS)**
**Session 2022-24**

**Masters of Sciences (Zoology)**
**Semester-III**

| Course Code | Course Name | Course Type | Hours Per Week | Credits | Total Credits | Marks | | | | Examination time (in hours) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Ext. | | | | |
| | | | | L-T-P | | L | P | CA | Total | |
| MZOL-3481 | Research Techniquesand Methodology | C | 4 | 4-0-0 | 4 | 80 | - | 20 | 100 | 3 |
| MZOL-3482 | DevelopmentalBiology-I | C | 4 | 4-0-0 | 4 | 80 | - | 20 | 100 | 3 |
| MZOL-3483 | GeneralBiochemistry | C | 4 | 4-0-0 | 4 | 80 | - | 20 | 100 | 3 |
| MZOL-3484 | AppliedZoology-II (Vertebrates) | C | 4 | 4-0-0 | 4 | 80 | - | 20 | 100 | 3 |
| MZOP-3485 | Practical –V (ResearchTechniquesand AppliedZoology-II) | C | 6 | 0-0-3 | 3 | 40 | - | 10 | 50 | 3 |
| MZOP-3486 | Practical VI (DevelopmentalBiologyand Biochemistry) | C | 6 | 0-0-3 | 3 | 40 | - | 10 | 50 | 3 |
| IDEC-3101 | Effective Communication Skills | IDC<br>Students can opt any one | 3 | 4-0-0 | 4 | 80 | - | 20 | 100 | 3 |
| IDEM-3362 | Basic Fundamentals of Music (Vocal) | | 3 | 2-0-2 | 4 | 40 | 40 | 20 | 100 | 3 |
| IDEH-3313 | Human Rights and Constitutional Duties | | 3 | 4-0-0 | 4 | 80 | - | 20 | 100 | 3 |
| IDEI-3124 | Basics of Computer Applications | | 3 | | 4 | | | | | 3 |
| Total | | | | | **26** | | | | **500** | |

| Masters of Sciences (Zoology)<br>Semester-IV | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Course Code** | **Course Name** | **Course Type** | **Hours Per Week** | **Credits** | **Total Credits** | **Marks** | | | | **Examination time (in hours)** |
| | | | | | | **Ext.** | | | | |
| | | | | **L-T-P** | | **L** | **P** | **CA** | **Total** | |
| MZOL-4481 | AnimalBehaviorandWildlifeConservation | C | 4 | 4-0-0 | 4 | 80 | - | 20 | 100 | 3 |
| MZOL-4482 | Molecular Genetics | C | 4 | 4-0-0 | 4 | 80 | - | 20 | 100 | 3 |
| MZOL-4483 | ConceptsofImmunology | C | 4 | 4-0-0 | 4 | 80 | - | 20 | 100 | 3 |
| MZOL-4484 | DevelopmentalBiology- II | C | 4 | 4-0-0 | 4 | 80 | - | 20 | 100 | 3 |
| MZOL-4485 | Biosystematics | C | 4 | 4-0-0 | 4 | 80 | - | 20 | 100 | 3 |
| MZOP-4486 | Practical–VII(Animal BehaviorandWildlifeConversation) | C | 6 | 0-0-3 | 3 | 40 | - | 10 | 50 | 3 |
| MZOP-4487 | Practical–VIII (GeneticsandBiosystematics) | 6 | 6 | 0-0-3 | 3 | 40 | - | 10 | 50 | 3 |
| MZOP-4488 | Project | C | 6 | 3-0-3 | 6 | 40 | - | 10 | 50 | 1 |
| Total | | | | | **32** | | | | **600** | |

**Master of Science (Zoology) (Session 2022-24)**

**Program Specific Outcomes**

PSO1 Used the evidences 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 are able to use specific examples to explicate how descent with modification has shaped animal morphology, physiology, life history, and behavior.

PSO2 Explicate the ecological interconnectedness of life on earth by tracing energy and nutrient flows through the environment. They are able to relate the physical features of the environment to the structure of populations, communities, and ecosystems.

PSO3 Subjects such as invasive or endangered species, embryonic development in mammals and ageing in social insects. Lead to advances in medicine to prevent disease amongst both animals and human beings.

PSO4 Develop knowledge and understood of living organisms at several levels of Zoological and Biological organization from the molecular, through to cells and whole organisms and ecosystems all organs of evolutionary perspectives.

PSO5 Understand how the chemistry and structure of the major biological macromolecules, including proteins and nucleic acids, determines their biological properties.

PSO6 Demonstrate knowledge to acquire, articulate, retain, and employ practical skills relevant to Fundamentals of computer, Molecular biology& rDNA technology.

PSO7 Define event, outcome, trial, simple event, sample space and calculate the probability of events for more complex outcomes related to conditional, additive and multiplicative law of probability.

PSO8 Understand the concept of mathematical expectation and use it to find out the mean, variance, standard deviation, kurtosis etc. of different probability distributions like Binomial, Poisson and Normal etc.

PSO9 Use Correlation to identify the strength and direction of a linear relationship between two variables and using Regression to predict how much a dependent variable changes based on adjustments to an independent variable and also apply Karl Pearson Correlation coefficient and Spearman's Rank Correlation and Least Square technique for Regression lines.

**Session 2022-24**
**Master of Science Zoology (Semester–I)**
**Course Title: Functional Organization of Animals– I (Theory)**
**Course Code: MZOL-1481**

## COURSE OUTCOMES

After passing this course the student will be able to:

- CO1 Understand the physiology of digestive system of chordates and non-chordates.
- CO2 Understand the blood composition, types, groups and circulatory system.
- CO3 Explain various circulatory and transport mechanisms.
- CO4 Understand the physiology of excretory and reproductive systems.

**Session 2022-24**
**Master of Science Zoology (Semester–I)**
**Course Title: Functional Organization of Animals– I (Theory)**
**Course Code: MZOL-1481**

**L-T-P: 4-0-0**

**Maximum marks: 100**
**Theory marks: 80**
**CA:20**

**Instructions for the Paper Setter:**
Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A- D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

**Unit –I**

**Nutrition and Digestion**
Ingestion of soluble food and particulate food in relation to habitat and habits
Symbiotic nutrition
Mechanism of digestion and regulation of secretion in non-chordates and chordates

**Unit – II**

**Transport and circulatory mechanisms**
Intracellular transport in Protozoa
Circulation of external medium of transport within the body of sponges and cnidarians
Open and closed types of circulatory system
Chambered, tubular and ampullary hearts
Neurogenic and myogenic hearts
Evolution of Heart and Cardiovascular system

**Unit–III**

**Respiratory System**
Respiratory organs in aquatic animals and aquatic respiration
Respiratory organs and aerial mode of respiration
Distribution and brief chemistry of respiratory pigments and their function in nonchordates and chordates

**Unit – IV**

**Excretion and Reproduction**
Excretory structures and waste disposal in non-chordates, coelom, coelomic ducts, nephridia, antennal / green glands, malpighian tubules

Regulation of water salt balance
Pattern of reproduction in non-chordates and their larval forms
Evolution of the urinogenital system in chordates with special reference to the separation of the two systems

**Suggested Reading Material:**


- Barrington, E. U. W. (1967), Invertebrates Structure and Functions. Houghton Mifflin Co. Boston.
- Barth, R. H. and Broshears, R. E (1982), The Invertebrate world. Holt Saunder, Japan.
- Brusca, R. C. and Brusca, G. J. (2003), Invertebrates second edition. Sinauer Associates, Inc. Publishers, Sunderland, Massachusetts.
- Cooper, G. M. (2004), The Cell: A Molecular Approach IIIrd edition, ASM Press, Washington, D.C.
- Engemann, J. G. and Hegner, R. W. (1981), Invertebrate Zoology (3rd ed.) Macmillan, New York.
- Gardiner, M. S. (1972), The Biology of Invertebrates, McGraw Hill, New York.
- Hill, R. W., Wyse, G. K. and Anderson, N. (2004), Animal physiology. Sinauer Associate, INC. Pub. Saunderland, Massachusettes, USA.
- Hoar, W. S. (1984), General and Comparative Physiology. Prentice Hall of India Pvt. Limited, New Delhi, India.
- Karp, G.(2005), Cell and Molecular Biology; concepts and experiments (4th ed.),Hoboken, John Willy and Sons, New York.
- Meglitsch, P. A. and Schran, F. R. (1991), Invertebrate Zoology 3rd Ed. Oxford University Press, New York.
- Pechenik, A. Jan. (2000), Biology of the invertebrates, Fourth Edition, McGraw Hill Book Co. Singapore.
- Prosser, C.L. (1984), Comparative Animal Physiology. Satish Book Enterprise Books seller & Publishers, Agra.
- Purves, W. K., Oriane, G. H., Space, H. C. and Salava, D. (2001), Life – The Science of Biology 6th ed., Sinauer Assoc. Inc., USA.
- Randall, D., Burggren, K.L. and French, K. (2002), Eckert Animal Physiology:Mechanisms and Adaptations. W.H. Freeman and Company, New York
- Ruppert, E. E. and Barnes, R. D. (2004), Invertebrate Zoology 7th ed. Saunders Publ., Philadelphia.
- Willmer, P. Stone, G. and Johnston, I ( 2000 ). Environmental Physiology of Animals, Blackwell Science.
- Withers, P.C. (1992), Comparative Animal Physiology Saunder College Publishing, New York.

**Session 2022-24**
**Master of Science Zoology (Semester–I)**
**Course Title: Animal Ecology (Theory)**
**Course Code: MZOL-1482**

## COURSE OUTCOMES

Afterpassingthiscoursethestudentwillbeableto:

- CO1DemonstrateandUnderstandtheecologicalrelationshipsbetweenorganismsandtheir environment.
- CO2 Explainandidentifytheroleoftheorganismsinenergytransfers.
- CO3Understand various types of adaptations and ecology of population
- CO4.Understandtheapplied aspect of ecology

**Session 2022-24**
**Master of Science Zoology (Semester–I)**
**Course Title: Animal Ecology (Theory)**
**Course Code: MZOL-1482**

**L-T-P: 4-0-0**

**Maximum marks: 100**
**Theory marks: 80**
**CA:20**

**Instructions for the Paper Setter:**
Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A- D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

**Unit-I**

**Introduction and History of Ecology**
Structure and Functions of some special types of ecosystems (Grasslands, forests, deserts, aquatic ecosystems and agroecosystem)
**Abiotic factors**
Temperature, Moisture, Light, fire, Malentite, Pollution

**Unit – II**

**Biotic Factors**
Analysis of Environment
Place in which to live
**Community Structure**
Ecological Niche, Food chains, Food webs, biomagnifications, succession / temporal changes
**Interactions and Coactions**
Intraspecific Interactions
Interspecific Interactions
Predation, Parasitism, Commensalism, Mutualism etc

**Unit- III**

**Adaptations**
Cave, deep sea, arboreal, aerial, and subterrestrial
Co-adaptations and adaptive resemblances (mimicry, warning colouration, seasonal polymorphism)
**Population Ecology**
Concept of Population
Biotic potential and carrying capacity, dispersal and distribution, population growth and its regulations
Methods of sampling
Life tables and longevity, Migration and Ecesis

## Unit – IV

**Applied Ecology**

Anthropogenic interferences

Bio monitoring of environment using animal species

Modeling and Use of remote sensing (GIS ) in ecology (introduction)

Overview of sustainable development of ecosystems

**Bio Geography**

Zoo Geographical regions

Island ecology (endemicity)

**Suggested Reading Material:**


- Anderwartha, H.G. and Birch, L. C. (1970), The distribution and abundance of animals, University of Chicago Press, Chicago London.
- Beeby, A. (1992), Applying Ecology Chapman and Hall Madras.
- Begon, M., Harper J. L. and Townsend, C. R. (1995), Ecology – Individuals, populations and communities, Blackwell Science, Cambridge UK.
- Brewer, R. (1994), The science of Ecology, Saunders College of Publishing, New York.
- Chapman, J. L. and Resis, M. J. (1995), Ecology- Principles and applications, Cambridge University Press, Cambridge UK.
- Kaeighs, S. C. (1974), Ecology with special references to animal and Man, Prentice Hall Inc.
- Odum, E. P. (1983), Basic Ecology.
- Putmann, R. J. and Wratten, S. D. (1984), Principles of Ecology, Crown Helm, London.
- Salanki, J., Jeffery E. and Hughes G. M. (1994), Biological Monitoring ofthe Environment (A manual of Methods) CAB International, Wallingford UK.

**Session 2022-24**
**Master of Science Zoology (Semester–I)**
**Course Title: Cell Biology (Theory)**
**Course Code: MZOL-1483**

## COURSE OUTCOMES

After passing this course the student will be able to:

- CO1 Describe structure of cell, cell membrane and organization and processing of nucleus.
- CO2 Describe the ultra-structure and functions of Ribosomes, Golgi complex and Endoplasmic reticulum.
- CO3 Describe the ultra-structure and functions of Mitochondria, Lysosomes and Peroxisomes.
- CO4 Understand cell signaling and cell cycle.

**Session 2022-24**
**Master of Science Zoology (Semester–I)**
**Course Title: Cell Biology (Theory)**
**Course Code: MZOL-1483**

**L-T-P: 4-0-0**

**Maximum marks: 100**
**Theory marks: 80**
**CA:20**

**Instructions for the Paper Setter:**
Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A- D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

## Unit-I

**Introduction**
Cell – a unit of structure and function, cell theory
Prokaryotes and eukaryotes cells
**Cytoskeleton**
Actin filament, Myosin, Intermediate filament, microtubules
**Structure of Cell Membrane**
Chemical composition
Various Lipoprotein models including fluid mosaic model
**Nucleus**
The Nuclear Envelope and Traffic between the Nucleus and the Cytoplasm
Internal Organization of the Nucleus
The Nucleolus and rRNA Processing

## Unit – II

**Ribosomes**
Prokaryotic and Eukaryotic ribosomes
Role of ribosomes in protein synthesis in prokaryotes and eukaryotes
**Golgi complex**
Structure and Function of: Cisternae, vacuoles and vesicles
Types of Vesicle Transport and their functions
Protein sorting and targeting
GERL concept
**Endoplasmic Reticulum**
Structure and Function of endoplasmic reticulum
Membrane synthesis in the ER

Mechanism ensuring destruction of misfolded protein
ER to Golgi vesicular transport

## Unit -III

**Mitochondria**
Structure and Functions
Oxidative metabolism in the Mitochondrion
Role of Mitochondria in the formation of ATP
Electron-Transport complexes
**Lysosomes**
Lysosomal acid hydrolases
Endocytosis and Lysosome formation
Lipofuscin pigments
**Peroxisomes**
Functions of peroxisomes
Glyoxylate pathway
Peroxisome assembly

## Unit – IV

**Cell signaling**
Signaling molecules and their receptors
Functions of cell surface receptors
Pathways of intracellular signal transduction
Signal transduction and the cytoskeleton
**Cell Cycle**
Various cell cycle check points
Cyclin and cyclin dependent kinases
Regulation of CDK- cyclin activity

**Suggested Reading Material:**


- Alberts, B. Bracy, P. Lewis , J. Raff, M. Roberts K and Watson, J. (eds) (1994). Molecular Biology of the Cell, Garland Publishing , New York.
- Avers, C. J. (1976). Cell Biology , Van Nostrand Reinhold, New York.
- Cooper, G. M. (2004). The cell, A Molecular Approach ASM press, Washington, D.C.
- Darnell, J. Lodish, H. and Baltimore, D. (2004). Molecular Cell Biology, 2nd edition, Freeman, New York.
- Derobertis, E. D. P. and Derobertis, E.M.F. (1987). Essentials of Cell and Molecular Biology. Hold Saunders – Philadelphia.
- Karp, G. (1984). Cell Biology 4th Edition, McGraw Hill, New York.
- Karp G. (1999). Cell and Molecular Biology. Concepts and Experiments, 2nd Editon John Wiley and Sons, Inc. New York, Brisbane, Toronto.
- Powar, C. B. (1990). Cell Biology. Himalaya Publishing House, Bombay.

**Session 2022-24**
**Master of Science Zoology (Semester–I)**
**Course Title: Concepts of Biotechnology (Theory)**
**Course Code: MZOL-1484**

## COURSE OUTCOMES

After passing this course the student will be able to:

- CO1 Describe cell culture, cell lines and applications of stem cells.
- CO2 Understand molecular markers and vectors used in biotechnology fields.
- CO3 Understand various techniques used in biotechnology.
- CO4 Describe monoclonal antibodies and vaccines.

**Session 2022-24**
**Master of Science Zoology (Semester–I)**
**Course Title: Concepts of Biotechnology (Theory)**
**Course Code: MZOL-1484**

**L-T-P: 4-0-0**

**Maximum marks: 100**
**Theory marks: 80**
**CA:20**

**Instructions for the Paper Setter:**
Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A- D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

## Unit – I

**Brief introduction to Biotechnology**
**Cell culture and medium**
Cell culture, Cell lines, protocol cryo-preserving cultured cells, cell viability and cell proliferation
**Restriction Enzymes**
DNA ligase, Klenow enzyme, T4 DNA polymerase, Polynucleotide kinase, Alkaline phosphatase
**Stem Cells and Tissue engineering**
Embryonic stem cell, adult stem cells, stem cell differentiation

## Unit – II

**Markers and Vectors**
**Molecular markers**
RFLP, RAPD, SSLP markers
**Vectors**
Plasmid vectors, Bacteriophage vectors, Cosmids, M13, Phagemids, Fosmids, BACs andYACs
**Cloning**
Gene cloning and sequencing, cDNA cloning, Identification of Specific clone with a specific probe, Practical applications of gene cloning

## Unit – III

**Techniques**
Principal, theory and application of Southern, Northern, Western Blotting
Polyacrylamide gel electrophoresis (PAGE)
Polymerase chain reaction (PCR)
DNA finger printing
DNA foot printing
In situ hybridization
Restriction fragment length polymorphism (RFLP)

## Unit – IV

**Hybridoma Technology**
Immunization of animals: isolation of stimulated spleen cells
Myeloma cell lines used as fusion partners
Fusion methods
**Monoclonal antibodies**
Detection and applications
**Vaccines**
Conventional vaccines
Viral vaccines
Peptide vaccines
Genetically engineered vaccines
Production and applications of Cytokines

**Suggested Reading Material:**


- Spier, R.R. and Grifftths, J.B. (1994). Animal Cell Biotechnology, 6th Ed., Academic Press, London.
- KrogsgaardP. ,Liljefors T., Madsen U. and Larsen K, Liljefors T. Madsen U. (2016). Textbook of Drug Design and Discovery, 5 th Ed. Taylor and Francis Publications, Washington D.C.
- Gupta, P. K. (1996). Elements of Biotechnology, Rastogi and Co.,Meerut.
- Henry, R. J. (1997). Practical Applications of Plant Molecular Biology, Chapman and Hall.

**Session 2022-24**
**Master of Science Zoology (Semester–I)**
**Course Title:Practical-I (Functional Organization of Animals-I)**
**Course Code: MZOP-1485**

## COURSE OUTCOMES

After passing this course the student will be able to:

- CO1 Understand the comparative anatomy of gut through demonstration.
- CO2 Understand the comparative physiology of circulatory, excretory & reproductive system through ICT based videos, presentations and charts

**Session 2022-24**
**Master of Science Zoology (Semester–I)**
**Course Title: Practical-I (Functional Organization of Animals-I)**
**Course Code: MZOP-1485**

**L-T-P: 0-0-3**

**Maximum marks: 50**
**Practical marks: 40**
**CA:10**

**Instructions for the Practical Examiners:**
Question paper is to set on the spot jointly by the Internal and External Examiners. Two copies of the same should be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar.

**Study of permanent slides**
Mouth parts: honey bee, housefly, cockroach, butterfly, mosquito, and bug
Salivary glands
Blood smear of animals
Radula of Pila
Jaws of Leech

**Using slides/charts/models/videos study of following**

Anatomy of gut in relation to food and feeding habits of detritivores, carnivores, herbivores, omnivores and sanguivores
Different kinds of Heart and blood vascular system in animals
Respiratory structures: Gills (Crustaceans, Bivalves, Cephalopods, and Fish); Book Lungs (Scorpion); Trachea and spiracles (Cockroach)
Nephridia in annelids (earthworm), green glands in crustaceans, Malpighian tubules in Cockroach
Excretory system of frog, lizard, bird and rat
Histology of ovary, oviduct, uterus, testis and placenta in different groups of invertebrates and vertebrates
Reproductive organs in Hydra, Flatworm, Earthworm, Cockroach, Pila, Fish, Frog, Lizard, Bird and Rat

Note: The above mentionedpracticals are in accordance with the guidelines of UGC. Practicals involving animal material will be conducted using models/charts/e- resources. Minor modifications in the curriculum are allowed subject to availability of resources.

**Session 2022-24**
**Master of Science Zoology (Semester–I)**
**Course Title:Practical-II (Ecology and Cell Biology)**
**Course Code: MZOP-1486**

## COURSE OUTCOMES

After passing this course the student will be able to:

- CO1 Perform the experiments to analyze the macromolecules in animals
- CO2 Describe the fine structure and functions of cell organelles.
- CO3 Perform a variety of cellular biology techniques.
- CO4 Analyse various physicochemical parameters in environmental matrices.

**Session 2022-24**
**Master of Science Zoology (Semester–I)**
**Course Title:Practical-II (Ecology and Cell Biology)**
**Course Code: MZOP-1486**

**L-T-P: 0-0-3** **Maximum marks: 50**
**Practical marks: 40**
**CA:10**

**Instructions for the Practical Examiners:**
Question paper is to set on the spot jointly by the Internal and External Examiners. Two copies of the same should be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar.

**Population estimations**
Using Mark and Release method and to study the effect of migration on them (Using colored beads).

**Estimation of population**
Protozoans, Nematodes and Soil arthropods

**Combined population studies using quadrates**
Intra-population distribution and Poisson distribution, construction of life table and survivorship curves from given data.

**Analysis of following**
Normal and abnormal constituents in urine sample
RBC, WBC (TLC, DLC), platelet counts
Determination of ESR and PCV of human blood

**Study of cell using permanent slides**
Prokaryote cells: Lactobacillus, E. coli. Blue green algae
Eukaryote cells, Testicular material (for studies of spermatogenesis).

**Microtomy**
Introduction of the instrument – its use, care

**Study of permanent slides of various tissues**
(gut region, liver, lung, spleen kidney, pancreas, testis, ovary, tongue, skin etc.).

**Study of electron micrographs of various cell organelles**

Plasma membrane, Mitochondria, Golgi complex, Lysosomes, Endoplasmic reticulum (smooth and granular), Cilia, Centrioles, inclusions like glycogen and lipids etc

Note: The above mentionedpracticals are in accordance with the guidelines of UGC. Practicals involving animal material will be conducted using models/charts/e- resources. Minor modifications in the curriculum are allowed subject to availability of resources.

**Session 2022-24**
**Master of Science Zoology (Semester–II)**
**Course Title:Functional Organization of Animals –II (Theory)**
**Course Code: MZOL-2481**

## COURSEOUTCOMES

After passing this course the student will be able to:

- CO1 Describe the Integumentary system and muscular system.
- CO2 Explain Appendicular skeletal system and locomotion in vertebrates
- CO3 Understand the physiology endocrine system.
- CO4 Describe various sensory organs and receptors.

**Session 2022-24**
**Master of Science Zoology (Semester–II)**
**Course Title:Functional Organization of Animals –II (Theory)**
**Course Code: MZOL-2481**

**L-T-P: 4-0-0**

**Maximum marks: 100**
**Theory marks: 80**
**CA:20**

**Instructions for the Paper Setter:**
Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A- D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

## Unit - I

**Integumentary System**
Embryonic origin
General features of the Integument
Specializations of integument
Evolution of Skin
**Muscular System**
Classification of Muscles
Structure of Skeletal Muscles and cardiac muscle
Tendons
Muscle mechanics
**Muscle Function**
Basis of Muscles contraction
Muscle Fiber
Muscle organs and fibers
Bone-muscle lever systems

## Unit–II

**Skeletal System**
Exo and Endo Skeleton in Invertebrates
Appendicular skeleton in vertebrates
Basic Components
Phylogeny of fishes and tetrapods
Evolution of the appendicular system
Form and Function
Swimming
Terrestrial locomotion

## Unit – III

**Integratory Systems**
Chemical coordination of body functions through neuro-secretion in non-chordates
Physiology of nerve net and giant fiber system
Evolution of functional anatomy of brain
**Endocrine System**
Endocrine organs
Chemical coordination of body functions through hormones and neuro-secretions

## Unit-IV

**Sensory System**
General sensory organs Free sensory receptors
Encapsulated sensory receptors
Associated sensory receptors
Mechanisms of perceiving stimuli
Special sensory organs (Mechano, Radiation, Chemo. and Electroreceptors)
Additional special sensory organ

**Suggested Reading Material:**


- Barrington, E. U. W. (1967), Invertebrates Structure and Functions. Houghton Mifflin Co. Boston.
- Barth, R. H. and Broshears, R. E (1982), The Invertebrate World. Holt Saunder, Japan.
- Brusca, R. C. and Brusca, G. J. (2003), Invertebrates Second Edition. Sinauer Associates, Inc. Publishers, Sunderland, Massachusetts.
- Prosser, C.L. (1984), Comparative Animal Physiology. Satish Book Enterprise Books Seller & Publishers, Agra.
- Purves, W. K., Oriane, G. H., Space, H. C. and Salava, D. (2001), Life – The Science of Biology 6th ed., Sinauer Assoc. Inc., USA.
- Randall, D., Burggren, K.L. and French, K. (2002), Eckert Animal Physiology: Mechanisms and Adaptations. W.H. Freeman and Company, New York.
- Ruppert, E. E. and Barnes, R. D. (2004), Invertebrate Zoology 7th ed. Saunders Publ., Philadelphia.
- Willmer, P., Stone, G. and Johnston, I (2000). Environmental Physiology of Animals, Blackwell Science.
- Withers, P.C. (1992), Comparative Animal Physiology. Saunder College Publishing New York.

**Session 2022-24**
**Master of Science Zoology (Semester–II)**
**Course Code:Applied Zoology–I (Theory)**
**Course Code: MZOL-2482**

## COURSE OUTCOMES

After passing this course the student will be able to:

- CO1 understand the methods of bee keeping, diseases of honeybee and various bee products.
- CO2 Know the culture and harvesting methods of Lac and mulberry silkworm.
- CO3 Understand the various methods of prawn farming. The students will also know about the spoilage, processing and preservation of prawns.
- CO4 Understand the artificial pearl formation and economics of Vermiculture.

**Session 2022-24**
**Master of Science Zoology (Semester–II)**
**Course Code:Applied Zoology–I (Theory)**
**Course Code: MZOL-2482**

**L-T-P: 4-0-0**

**Maximum marks: 100**
**Theory marks: 80**
**CA:20**

**Instructions for the Paper Setter:**
Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A- D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

## Unit – I

**Apiculture**
History and Introduction Honey bee and kinds
Social organization of colony and nests Life Cycle
Relation between honeybees and plants Flora for Apiculture
Honey composition, quality and importance
Bee keeping, selection, methods, precautions Products of bee keeping
Bee enemies and diseases

## Unit – II

**Lac culture**
Introduction
Lac insect species, Life cycle and Host plants Lac composition, properties & importance Cultivation and harvesting of Lac
Enemies of Lac insect and host plants Lac industry in India
**Sericulture**
Indian sericulture industry (distribution and prospects) Silk moth species and their Life Cycle
Silk composition, kinds and uses Mulberry cultivation
Rearing of silkworm
Treatment and disposal of cocoons Silk reeling, twisting and weaving Diseases & pests of silkworm

## Unit – III

**Prawn Culture**
Introduction to prawns Prawn: species
Fresh water prawn farming and Marine Prawn farming
Methods of Prawn farming
Spoilage and its prevention

Processing and preservation of prawns
Future of prawn culture

## Unit – IV

**Pearl Culture**
Historical background
Pearl oyster –species
Pearl formation, composition, quality and commercial value
Artificial Culturing of Pearls
Synthetic pearls types and their manufacturing
Methods of harvesting
Problems of pearl industry

**Vermiculture**
Species of worms
Conditions for efficient Vermiculture (domestic and commercial level)
Economics of Vermiculture

**Suggested Reading Material:**


- Bhamrah, H. S. &Juneja, K. (2001), An Introduction to Mollusca. Anmol Publications Pvt,. Ltd. New Delhi.
- Bhatnagar, R. K. and Palta, R. K. (2003), Earthworm ; Vermiculture and Vermicomposting , Kalyani Publishers India.
- Carter, G. A. (2004) Beekeeping, Biotech Books, New Delhi.
- Fenermore, P. G. and Prakash, A. (1992), Applied Entomology, Wiley Eastern Ltd. New Delhi
- Ghorai, N. (1995), Lac Culture in India. International Books and Periodicals, New Delhi.
- Jhingran, V. G. (1991) Fish and Fisheries of India, Hindustan Publishing Company India.
- Kumar, A. and Nigam, P. M. (1989), Economic and Applied Entomology EMKAY Publishing Co. New Delhi.
- Mishra, R. C. (1995), Honey Bees & their Management in India. ICAR, New Delhi.
- Mustafa, S. (1990) Applied and Industrial Zoology. Associated Publishing Company, New Delhi.
- Shukla, G. S. &Upadhaya, V. B. (1991-92), Economic Zoology, Rastogi Publications, Meerut.
- Sathe, T. V. and Jadhav, A. D. (2001) Sericulture and Pest Management, Daya Publishing House, New Delhi.
- Shimizu, M. (1972) Handbook of Silkworm Rearing (Agricultural Techniques Manual- Fuji Publishing Co. Ltd , Tokyo, Japan.
- Singh, S. (1962), Bee Keeping in India, I. C. A. R. Publications, New Delhi.
- Sobti, R. C. (1992), Medical Zoology, Nagin Chand & Co. Jalandhar.
- Srivastava, P. A. (1977), Economic Zoology, Commercial Publication Bureau, Kanpur.

**Session 2022-24**
**Master of Science Zoology (Semester–II)**
**Course Title: Evolution**
**Course Code: MZOL-2483**

## COURSE OUTCOMES

After passing this course the student will be able to:

CO1: Understand that by biological evolution we mean that many of the organismsthat inhabit the Earth today are different from those that inhabited it in the past

CO2: Understand that variations lead to natural selection that can bring about evolution.

CO3: Describe the Isolating mechanisms, modes of speciation, their impact on distribution of species and extinction of organisms

CO4: Population genetics; how selection, mutation, migration (gene flow), and inbreeding affect the genetic structure of populations; genetic drift, the other important evolutionary force

**Session 2022-24**
**Master of Science Zoology (Semester–II)**
**Course Title: Evolution**
**Course Code: MZOL-2483**

**L-T-P: 4-0-0**

**Maximum marks: 100**
**Theory marks: 80**
**CA:20**

**Instructions for the Paper Setter:**
Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A- D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

**Unit – I**

**Origin of Life**
Origin of Micro molecules
Origin of Macro molecules
Origin of Viruses
Origin of Prokaryotes
Origin of Unicellular eukaryotes and multicellularity
**Organic Evolution**
Theories (Lemarkism and Darwinism)
Evidences
Separation of kingdoms

**Unit –II**

**Variations**
Types of variations
Causes of variations
Mutation rates and directions
**Natural Selection**
Types of selection
Selection forces
Experimental demonstration of Natural selection
Industrial melanism and polymorphism
Sexual selection
Selection and non adaptive characters

**Unit –III**

**Speciation**
Isolation and its types
Gradual and abrupt
Origin of higher categories
**Distribution of Species**

Island, Ocean and Continental distribution
Theories of continental drift

**Extinction**
Kinds of extinction and causes of extinction
Major extinctions

## Unit-IV

**Quantative and Molecular Aspects of Evolution**
Hardy- Weinberg law
Genetic drift
Selection pressure
Mutation pressure
Migration
Meiotic drive
**Brief account of**
Evolution of genome in viruses, prokaryotes and eukaryotes
Evolution of sexual reproduction
Molecular clocks
Evolution of Horse, Elephant, Man (in brief)
Future Course of Evolution

**Suggested Reading Material:**


- Avers, C. J.(1989). Evolution Process and Pattern in Evolution Oxford University, Press, New York, Oxfor.
- Ayala, F. J. and Valentine J. W. (1979). Evolving the theory and Process of Organic Evolution, Benjamin Cumming.
- Brookfield, A. P. (1986). Modern aspects of Evolution. Hutchinson London, Melbourne.
- Gallow, P. (1983). Evolutionary principles. Chapman and Hall.
- Freeman, S. and Herron, Jon C. (2007). Evolutionary analysis Pearson Prentice Hall, New Jersey.
- Futuyma, D. J. (1998), Evolutionary Biology, Sinauer Assoc. Inc. Pub. USA.
- Meglitsch, P. A. (1991), Invertebrate Zoology (3rd edition), Oxford University Press.
- Minkoff, E. C. (1983), Evolutionary Biology, Addison Wesley Pub. Co., London.
- Wen-Hsiung Li (1997), Molecular Evolution, Sinauer associates Inc.Pub. USA.

**Session 2022-24**
**Master of Science Zoology (Semester–II)**
**Course Title: PRACTICAL –III (Functional Organizations of Animals-II)**
**Course Code: MZOP-2486**

## COURSE OUTCOMES

After passing this course the student will be able to:

- CO1 Understand the comparative anatomy through demonstration.
- CO2 Understand the comparative physiology of sense organs, muscles, endocrine system through ICT based videos, presentations and charts.

**Session 2022-24**
**Master of Science Zoology (Semester–II)**
**Course Title:PRACTICAL –III (Functional Organizations of Animals-II)**
**Course Code: MZOP-2486**

**L-T-P: 0-0-3**

**Maximum marks: 50**
**Practical marks: 40**
**CA:10**

**Instructions for the Practical Examiners:**
Question paper is to set on the spot jointly by the Internal and External Examiners. Two copies of the same should be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar.

**1. Study of permanent slides**
Skin of fish, frog, lizard, bird and mammal
Setae of earthworm
Spicules of Sponges and Herdmania
Internal ear of fish
Tentorium of grasshopper
Muscle fibers, cartilage and bone
Endocrine glands of vertebrates
**2. Appendicular skeleton**
**3. Study the following with the help of charts/models/videos/permanent slides**
Appendages of Prawn
Wing venation, coupling and types of wings of insects
Comparative anatomy of nervous system in Earthworm, Cockroach, Pila, Sepia, Fishes, Bird and Mammal
Eye muscles of fish/mammal
Modification of antennae of arthropods

**Note:** The above mentionedpracticals are in accordance with the guidelines of UGC. Practicals involving animal material will be conducted using models/charts/e-resources. Minor modifications in the curriculum are allowed subject to availability of resources.

**Session 2022-24**
**Master of Science Zoology (Semester–II)**
**Course Title: PRACTICAL –IV (Evolution and Applied Zoology-I)**
**Course Code: MZOP-2487**

## COURSE OUTCOMES

After passing this course the student will be able to:

- CO1 Know the Animals of evolutionary importance, fossils, analogousand homologous organs, Mimicry and Colouration.

- CO2 Acquaint with the applied aspects of Zoology i.e. sericulture, lacculture, apiculture, dairy farming, poultry etc.

- CO3 Understand the propositions underlying theories of evolution through demonstrations.

(1) More individuals are produced than can survive;
(2) There is therefore, a struggle for existence
(3) Individuals within a species show variation
(4) Offspring tend to inherit their parental characters

**Session 2022-24**
**Master of Science Zoology (Semester–II)**
**Course Title: PRACTICAL –IV (Evolution and Applied Zoology-I)**
**Course Code: MZOP-2487**

**L-T-P: 0-0-3**

**Maximum marks: 50**
**Practical marks: 40**
**CA:10**

**Instructions for the Practical Examiners:**
Question paper is to set on the spot jointly by the Internal and External Examiners. Two copies of the same should be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar.

1. Calculations for regression, correlation and variance of gene frequency and genetic equilibrium (taking pea pods).
2. Examination of the principle of natural selection as a process related to evolution in a population (using coloured marbles /beads).
3. Comparison of skeletons for listing evolutionary trends.
4. Comparison of molluscan shells to depict polyphyletic origin.
5. Comparison of homologous and analogous structures (e.g. insect antenna, legs, limbs of vertebrate etc.).
6. Demonstration of kinds of mimicry in various groups of animals.
7. Mapping of geographic distribution of some birds, insects, fish etc.
8. Study of various evolutionary phenomenon using slides / photographs.
9. Study of fossils.
10. Preparation of Phylogenetic tree using some Priory weight characters with the help of 8 – 10 animals from various categories.
11. Visit to apiary/vermicomposting unit/ sericulture unit/ Prawn Farm and preparation of report.

**Note:** The above mentioned practicals are in accordance with the guidelines of UGC. Practicals involving animal material will be conducted using models/charts/e-resources. Minor modifications in the curriculum are allowed subject to availability of resources.

**Session 2022-24**
**Master of Science Zoology (Semester–II)**
**Course Title: Seminar**
**Course Code: MZOS-2485**

## COURSE OUTCOMES

After passing this course the student will be able to:

- CO1 Express their innovative ideas & creativity on any scientific phenomenon & develop interest in research aptitude.
- CO2 Build up confidence for public speaking.
- CO3 Improve their presentation skills.

**Session 2022-24**
**Master of Science Zoology (Semester–II)**
**Course Title: Seminar**
**Course Code: MZOS-2485**

**L-T-P: 0-0-2**

**Maximum marks: 50**
**Theory marks: 40**
**CA:10**

**Instructions for the Paper Setters:**

The students are required to present a seminar on a topic of relevance and importance from the subject Zoology. The seminar carries 40 marks for the seminar based paper at the end of the semester.

**Session 2022-24**
**Master of Science Zoology (Semester–III)**
**Course Title: Research Techniques and Methodology (Theory)**
**Course Code: MZOL-3481**

## COURSE OUTCOMES

**After passing this course the student will be able to:**

- CO1 Understanding of the theoretical principles of centrifugation and chromatography techniques and the scope of their applications.
- CO2 Understanding of the theoretical principles of spectroscopic techniques, microscopy and their applications.
- CO3 Explain various types of electrophoresis techniques.
- CO4 Understanding of Radioisotopic techniques.

**Session 2022-24**
**Master of Science Zoology (Semester–III)**
**Course Title: Research Techniques and Methodology (Theory)**
**Course Code: MZOL-3481**

**L-T-P: 4-0-0**

**Maximum marks: 100**
**Theory marks: 80**
**CA:20**

**Instructions for the Paper Setter:**
Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A- D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

## Unit–I

**Centrifugation**
Basic principles
Theory and applications of preparative and analytical centrifugation
Rotor types
Sedimentation co-efficient
Care of rotors

**Chromatography**
Theory, principle and application of column, paper, thin layer, ion-exchange, affinity chromatography, GLC and HPLC

## Unit–II

**Spectroscopy**
Principle and applications of UV/Visible spectroscopy, NMR, ESR and Mass spectroscopy
Luminometry, Atomic spectroscopy

**Microscopy**
Scanning and Transmission Electron microscopy
Fluorescence Resonance Energy Transfer microscopy

**Techniques**
X-ray crystallography
Patch clamp

## Unit–III

**Electrophoresis**
General principles
Support media
Electrophoresis of proteins
Electrophoresis of nucleic acids
Capillary electrophoresis
Microchip electrophoresis

## Unit–IV

**Radioisotopic Techniques**
Basic concepts of radioisotope
Theory and applications of Geiger- Muller tube
Solid and Liquid Scintillation
Safety rules for radioisotopic studies
Biological applications

**Suggested Reading Material:**


- Slater, R.J. (1990). Radioisotopes in Biology- A Practical Approach, Oxford University Press, NY.
- Wilson, K and Goulding, K.H. (1991). Biologist's Guide to Principles and Techniques of Practical Biochemistry. 3rd., Edward Arnold, London.
- Sawhney, S.K. and Singh, R. (2001). Introductory Practical Biochemistry, Narosa Publishing House, New Delhi.
- Tinoco Kenneth Saur and J.C. Wang. Physical Chemistry: Principles and Applications in Biological Sciences, 3rd edition.

**Session 2022-24**
**Master of Science Zoology (Semester–III)**
**Course Title: Developmental Biology – I (Theory)**
**Course Code: MZOL-3482**

## COURSE OUTCOMES

After passing this course the student will be able to:

- CO1 To develop detailed understanding of essential events of developmental biology through proper explanation of gametogenesis, fertilization, as part of early embryonic development and to impart knowledge regarding in-vitro fertilization.
- CO2 To impart knowledge regarding basic concepts of parthenogenesis, cleavage and gastrulation to the students.
- CO3 To provide adequate explanation to the students regarding cell commitment, specification and determination.
- CO4 To make the students aware about genetic control of development, induction and regulation of developmental events.

**Session 2022-24**
**Master of Science Zoology (Semester–III)**
**Course Title: Developmental Biology – I (Theory)**
**Course Code: MZOL-3482**

**L-T-P: 4-0-0**

**Maximum marks: 100**
**Theory marks: 80**
**CA:20**

**Instructions for the Paper Setter:**
Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A- D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

**Unit–I**

**Gametogenesis**
Spermatogenesis
Oogenesis
Vitellogenesis
**Fertilization**
Types of Fertilization (External and Internal)
Acrosome reaction & capacitation of sperm
Fusion of the egg-sperm membranes and genetic material during fertilization
The fast and slow block to polyspermy
The cortical granule reaction
Activation of egg metabolism
**Invitro fertilization and embryo transplantation**

**Unit–II**

**Natural and artificial parthenogenesis**
**Cleavage**
Cleavage and its patterns
**Gastrulation**
Gastrulation and morphogenetic movements
Morphogenesis of germ layers
Morphogenetic field

**Unit–III**

**Cell commitment and beginning of new organism**
Commitment of Cells during early development
Various levels of Commitment
Specification and its types (autonomous, conditional, Syncytial)
Determination of early embryonic induction

Transdetermination

## Unit -IV

**Genetic Control of Development and Induction**
**Regulation of early development**
Mechanisms of differential gene expression
Differential RNA processing Control at the level of translation
Post translational regulation of gene expression

**SuggestedReading Material:-**


- Balinsky, B.I. (1981). An Introduction to Embryology, Saunders, Philadelphia.
- Bellairs, R. (1971). Development Processes in HigherVertebrates, University of Miami Press, Miami.
- Berrill. N.J. (1971): Developmental Biology. McGraw Hill, NewDelhi.
- Dawnpart, Developmental Biology.
- Gilbert, F. (1985, 95 & 2000): Developmental Biology, Sinaur.
- Goel, S. C. (1984): Principles and Animal Developmental Biology, Himalaya, Bombay.
- Grant, P. (1978): Biology of Developing System.
- Spratt, N.T. Jn. (1971): Developmental Biology, Wordsworth, Belmont, Co.
- Waddigton C.H. (1966): Principles of Development and Differentiation. MacMillan, New York.
- Miller, W. A. (1997). Developmental Biology. Springer Verlag, New York.

**Session 2022-24**
**Master of Science Zoology (Semester–III)**
**Course Title: General Biochemistry (Theory)**
**Course Code: MZOL-3483**

## COURSE OUTCOMES

After passing this course the student will be able to:

- CO1 Explain Enzyme kinetics
- CO2 Describe Glycolysis.
- CO3 Reactions and regulation of citric acid cycle
- CO4 Oxidation of fatty acids and amino acids.

**Session 2022-24**
**Master of Science Zoology (Semester–III)**
**Course Title: General Biochemistry (Theory)**
**Course Code: MZOL-3483**

**L-T-P: 4-0-0**

**Maximum marks: 100**
**Theory marks: 80**
**CA:20**

**Instructions for the Paper Setter:**
Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A- D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

**Unit–I**

**Enzymes**
Enzyme substrate complex
Active sites
Energy mechanics of enzymatic reactions
Michaelis-Menton kinetics
Vmax and Km and their significance
Modifiers of Enzyme activity
Regulatory enzymes

**Unit–II**

**Glycolysis**
Fates of glycolysis
Fates of pyruvate under aerobic and anaerobic conditions
Gluconeogenesis and the carbohydrate catabolism
Pentose phosphate pathway

**Unit–III**

**Citric acid cycle**
Oxidation of pyruvate
Production of acetate
Reactions of citric acid cycle
Regulation of citric acid cycle
Glyoxylate cycle

**Unit–IV**

**Oxidation of fatty acids and amino acids**

Metabolism and transport of fats
Oxidation of fatty acid
Generation reactions and metabolism of amino acids
**Oxidative phosphorylation**
Electron transport reactions in mitochondria
Shuttle system in mitochondria
Regulation of oxidative phosphorylation

**Suggested Reading Material:**


- Lehninger A.D. Nelson D.L. & Cox M.M. (1993) & (2000), Principles of Biochemistry, 2nd and 3rd ed. Worth Publishers, New York.
- Lehninger, A (2000). Principles of Biochemistry. 3rd Edition.
- Fischer, J. and Arriold, J.R.P. (2001). Instant notes in Chemistry for Biologists Viva Books Pvt. Ltd.
- Harper, H.A. (2000): Harper's Biochemistry 25th ed.
- Morris, H. Best, L.R., Pattison, S., Arerna, S. (2001). Introduction to General Organic Biochemistry. 7th Ed. Wadsworth Group.
- Sheehon, D (2000). Physical Biochemistry: Principles and Applications – John Wiley & Sons Ltd., England.

**Session 2022-24**
**Master of Science Zoology (Semester–III)**
**Course Title: Applied Zoology – II (Vertebrates) (Theory)**
**Course Code: MZOL-3484**

## COURSE OUTCOMES

After passing this course the student will be able to:

- CO1.Learn skill development for small scale industry such as fisheries, piggeries.
- CO2. Gain knowledge about processing and use of fur and wool industry.
- CO3.Understandselection and products of dairy animals and processing of leather industry.
- CO4.UnderstandingofPharmaceuticalproductsfromanimals.
-

**Session 2022-24**
**Master of Science Zoology (Semester–III)**
**Course Title:Applied Zoology – II (Vertebrates)(Theory)**
**Course Code: MZOL-3484**

**L-T-P: 4-0-0**

**Maximum marks: 100**
**Theory marks: 80**
**CA:20**

**Instructions for the Paper Setter:**
Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A- D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

**Unit–I**

**Pisciculture**
Economically important fresh water and marine fishes
Fish Farming Technologies
Factors affecting fish culture
Induced breeding methods
Products and by products from Pisciculture

**Poultry**
Breeds of poultry birds
Egg structure and quality, nutritive values, abnormalities in eggs, factors affecting size and egg processing
Broilers, meat processing
Poultry Rearing / Farming
Housing and equipment Poultry diseases
Poultry products and by products

**Unit–II**

**Fur Industry**
Fur producing animals
Fur farming, dressing, processing and dyeing
Fur industry in India

**Wool Industry**
Animals of wool industry
Types, structure and physicochemical properties of wool
Processing of wool: shearing, clearing, drying, bleaching, dyeing, spinning and twisting

**Unit–III**

**Dairy Farming**
Milching animals, Breeds, Housing, raising and Tools of management

Artificial insemination and IVF for improvement of stock
Milk composition and dairy products

**Leather Industry**

Animals of leather industry
Processing of skin: flaying, Curing and tanning
Enemies of skin industry

**Unit–IV**

**Piggery**

Characteristics of swine and important breeds
Breed selection, management and housing
Products (Pork, Bristles, Lard, Sausages) and by products
Diseases of Pigs

**Other Utilities of Animals**

Pharmaceuticals from animals (in brief)
Use of animals in vaccine production

**Suggested Reading Material:**


- Banarjee, G.C. (1991), Text book of Animal Husbandry. Oxford and IBH Pub, New Delhi.
- Jawal, P.L. (1977), Handbook of Animal Husbandry, I. C. A. R., Pub. New Delhi.
- Jhingaran, V.G. (1991), Fish and Fisheries of India, Hindustan Pub. Co. India.
- Mustafa, S. (1990), Applied and Industrial Zoology, Rastogi publications, Meerut.
- Sarkar, K. T. (1991), Theory and Practice of Leather manufacture. The Author, Madras.
- Shami, Q. J. and Bhatnagar, S. (2002) Applied Fisheries. Agrobios India.
- Shukla, G. S. &Upadhaya, V. B. (1991-92), Economic Zoology, Rastogi Publications, Meerut.
- Toor, H. S. and Kaur, K. (1996), Fish Culture Manual. PAU, Ludhiana.
- Yadav, M. (2003) Economic Zoology, Discovery Publication House, New Delhi.

**Session 2022-24**
**Master of Science Zoology (Semester–III)**
**Course Title: Practical V (Research Techniques and Applied Zoology-II)**
**Course Code: MZOP-3485**

## COURSE OUTCOMES

After passing this course the student will be able to:

- CO1Understandingofvariousscientificresearchtechniques.
- CO2 Estimation of protein content, DNA/RNA
- CO3 Use ELISA and PAGE

**Session 2022-24**
**Master of Science Zoology (Semester–III)**
**Course Title:Practical V (Research Techniques and Applied Zoology-II)**
**Course Code: MZOP-3485**

**L-T-P: 0-0-3**

**Maximum marks: 50**
**Practical marks: 40**
**CA:10**

**Instructions for the Practical Examiners:**
Question paper is to set on the spot jointly by the Internal and External Examiners. Two copies of the same should be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar.

**Centrifugation**
-Sedimentation using Swing out Rotor and Angle Rotor Differential centrifugation

**Chromatography Techniques: (for separation of macromolecules)**
Paper chromatography
Thin la yer chromatography
Gel permeation chromatography

**Spectrophotometric Techniques**
Preparation of standard curve of BSA, DNA, RNA
Measurement of transmission of light through different solutions or substances at different wavelengths of light.
Estimation of DNA/RNA

**Electrophoresis Techniques**
-Preparation of native polyacrylamide gel.
-Gel separation of proteins by native PAGE.
-Preparation of SDS-polyacrylamide gels
-Separation of proteins by SDS-PAGE.
-Direct and Indirect ELISA

Note: Vist to a fish farm/poultry form/pig farm/sheep or goat farm/meat processing industry/leather industry/wool industry and preparation of report.

**Session 2022-24**
**Master of Science Zoology (Semester–III)**
**Course Title: Practical VI (Developmental Biology and Biochemistry)**
**Course Code: MZOP-3486**

## COURSE OUTCOMES

After passing this course the student will be able to:

- CO1. Understanding of development patterns of frog and chick
- CO2 Knowledge of process of gametogenesis
- CO3Understanding of techniques related to protein, lipids and carbohydrates estimation

**Session 2022-24**
**Master of Science Zoology (Semester–III)**
**Course Title:Practical VI (Developmental Biology and Biochemistry)**
**Course Code: MZOP-3486**

**L-T-P: 0-0-3**

**Maximum marks: 50**
**Practical marks: 40**
**CA:10**

**Instructions for the Practical Examiners:**
Question paper is to set on the spot jointly by the Internal and External Examiners. Two copies of the same should be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar.

1. Study of different larval forms across the animal Kingdom using charts/models/videos.
2. To study developmental stages of chick through slides/charts.
3. To study developmental stages of frog through slides/charts
4. Metamorphosis through charts/audio video means in frog and insect.
5. Study of spermatogenesis and oogenesis through permanent slides
6. Study of testis and ovary through permanent slides.
7. Quantitative analysis of proteins by Lowry/ Bradford method.
8. Estimation of Lipids
9. Estimation of Carbohydrates

**Session 2022-24**
**Master of Science Zoology (Semester–IV)**
**Course Title: Animal Behaviour and Wildlife Conservation (Theory)**
**Course Code: MZOL-4481**

## COURSEOUTCOMES

Afterpassing thiscoursethe student willbeableto:

- CO1 Demonstrate knowledge of key concepts in animal behavior, its patterns, and analysis. It will also enable the students to understand the proximate controls of behavior including the role of hormones, the animal's genotype and the animal's environment in the development of behavior
- CO2 Adaptive significance of behaviour, emphasizing social behavior, territoriality, sexual selection, parental care and mating systems
- CO3 Understanding and awareness for wildlife conservation. To impart knowledge regarding conservation of threatened animal species.
- CO4 Understand the significance of various wildlife projects for conservation of threatened species and the status of wildlife in Punjab.

**Session 2022-24**
**Master of Science Zoology (Semester–IV)**
**Course Title: Animal Behaviour and Wildlife Conservation (Theory)**
**Course Code: MZOL-4481**

**L-T-P: 4-0-0**

**Maximum marks: 100**
**Theory marks: 80**
**CA:20**

**Instructions for the Paper Setter:**
Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A- D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

**Unit–I**

**Introduction**
Ethology as a branch of biology
Animal Psychology – classification of behavioural patterns
Analysis of behaviour (ethogram)
Neural control of Behaviour
Hormonal control of Behaviour
Genetic and environmental components in the development of behaviour
**Communication**
Chemical, Visual tactile and Audio communication
**Functions of communication**
Song specificity in birds
Host-parasite relations

**Unit–II**

**Social Behaviour**
Aggregations-schooling in fishes, Flocking in birds, Herding in mammals, Advantages and disadvantages of living in groups
Group selection, kin selection, altruism, reciprocal altruism, inclusive fitness
Social organization in insects and primates
**Reproductive Behaviour**
Mating and Courtship behaviour
Sexual selection
Parental care
Learning and Memory
Conditioning, Habituation, Associative learning, Reasoning and Cognitive skills

**Unit–III**

**Wild life**

Biodiversity as a resource and causes of its depletion
Methods of studying wildlife

**Wildlife conservation measures**

Role of zoos, parks and sanctuaries for conservation of some wild animals Laws, legislation and statuary bodies for protecting wildlife
Red data book, endangered, vulnerable, rare, threatened and intermediate species

**Unit–IV**

**Status of Wildlife in Punjab**
**National and state animals of India**
**Special projects for Endangered and Threatened Species and concerns**
Project Tiger
Project Hangul
Project Rhino
Project Elephant
Gir Lion Sanctuary Project
Project Great Indian Bustard
Crocodile breeding Project
Ecology & Conservation of the Himalayan Musk deer and the Manipur Brow antlered deer

**Suggested Reading Material:**


- Alcock, J. (1998), Animal behaviour, An evolutionary approach Sinauer Assoc., Sunderland, Mass, USA.
- Ali, S. (1971), The Books of Indian Birds, Bombay Natural History Society, Bombay.
- Burton, L. D. (2003), Fish and Wildlife: Principles of Zoology and Ecology. Delmar Thompson Learning Pb.
- Dasmann, R. F., ( 1982 ), Wildlife Biology, Wiley Eastern, New Delhi.
- Drickamer, L. C. and Vessey, S. H. (1986), Animal Behaviour - Concepts, Processes and Methods. (2nd ed.), Wordsworth Publ. Co., California.
- Fulbright, Timothy, E. and Hewitt, D. G. (2008). Wildlife Science: Linking Ecological
- Theory and Management Applications. CRC Press, Taylor and Francis :BocaRaton, F L.
- Giles, R. H. (1984), Wildlife Management Techniques, Natraj Publishers, Dehradun.
- Gopal, R. ( 1992), Fundamental of Wildlife management Justice Home Allahabad.
- Goodenough, J., McGurie and Wallace, R. A. (2001), Perspective on animal behaviour. John Wiley & Sons, Inc. New York.
- Hosetti, B. B. ( 1997 ), Concepts in Wildlife Management, Chawla Press, Delhi.
- Huntingford F. ( 1984 ), The study of animal Behaviour, Chapman and Hall, London.
- Manning, A. and Dawkins, M. S. ( 1992& 1998 ), An Introduction to Animal Behaviour , 4th ed. ( Cambridge low price editions ). Cambridge University Press, Cambridge.
- Manning, A. (1979), An Introduction to Animal Behaviour, 3rd Edition . The English Language Book Society and Edward Arnold Publishers Ltd.
- McFarland, D. (1985 & 1999), Animal Behaviour. Pitman Publishing Ltd. London.
- Majupuria T. C. (1990), Wildlife Wealth of India (Resources and Management), ISBN, Tecpress Services, Thailand.
- Moulton, M. P. and Sanderson, J. (1997), Wildlife issues in a changing world. St. Luice Press Florida.

- Negi, S. S. ( 1995 ), Hand Book of National Park, Sanctuaries and Biosphere Reservoirs in India, Indus publishing Co., New Delhi
- Sharma, B. D. (1994), High Altitude Wildlife of India, Oxford IBH, New Delhi.
- Sharma, B.D. ( 1999 ), Indian Wild Life Resources Ecology and Development . Daya Publishing House, Delhi.
- Sharma, B.D. (2002 ), Man environment and wildlife animal. IBH Publishing Co., Pvt . Ltd. New Delhi.
- Teague, R. D. ( 1987), A manual of Wildlife Conservation, Natraj Publishers, Dehradun.
- Tikadar, B. K. ( 1988 ), Threatened Animals of India, Publications of Zoological Survey of India, Calcutta.
- Tirvedi, P.R. and Singh, U. K. ( 1996 ), Environmental Laws of Wildlife.

**Session 2022-24**
**Master of Science Zoology (Semester–IV)**
**Course Title: Molecular Genetics (Theory)**
**Course Code: MZOL-4482**

## COURSE OUTCOMES

**After passing this course the student will be able to:**

- CO1 Describe DNA replication and DNA repair.
- CO2 Describe transcription and Post-transcriptional modifications in RNA.
- CO3 Explain translation in prokaryotes and eukaryotes
- CO4 Understand Genetics of Cancer.

**Session 2022-24**
**Master of Science Zoology (Semester–IV)**
**Course Title: Molecular Genetics (Theory)**
**Course Code: MZOL-4482**

**L-T-P: 4-0-0**

**Maximum marks: 100**
**Theory marks: 80**
**CA:20**

**Instructions for the Paper Setter:**
Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A- D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

**Unit–I**

**DNA replication and Repair**
**Replication**
Mechanism of Prokaryotic and Eukaryotic DNA replication
Enzymes and accessory proteins involved in DNA replication
**Repair**
Overview of DNA Repair
DNA Mismatch Repair system
General Excision Repair system
Specialised DNA Repair Mechanisms
SOS Error Prone Repair in Bacteria
Repair in Eukaryotes

**Unit - II**

**Transcription**
Prokaryotic Transcription
Eukaryotic Transcription
RNA Polymerase
**Post-transcriptional Modifications in RNA**
5’ – Cap formation
Transcription termination
3’- end processing and polyadenylation
Splicing, Editing, mRNA stability
Mechanism of transcription regulation
Transcriptional and post transcriptional gene silecncing.

**Unit - III**

**Translation**
Genetic code
Prokaryotic and Eukaryotic translation
The translational machinery

Mechanism of initiation, elongation and termination
Co- and post translational modification of proteins
Regulation of translation

**Unit - IV**

**Genetics of Cancer**
Development and Causes of Cancer
Oncogenes
Tumor Suppressor Genes
Molecular Approaches to cancer treatment

**Suggested Reading Material:**


- Ayala, F.J. & Kiger, Jr. J.A. (1980) Modern Genetics. The Benjamin Cummings Publishing Co. Inc.
- Brown T.A. (1992). Genetics- A Molecular Approach, 2nd ed. Van Nostrand Rainhold (international).
- De-Robertis, F.D.P. and De-Robertis Jr., E.M.E. (1987). Essentials of Cell and Molecular Biology, Saunders, Philadelphia.
- Gardener, E.J., Simmons, M.T.J. &Sunstad, D.P. (1999) : Principles of Genetics, 8th ed. John Wiley & Sons, New York.
- Miglani, G.S. (2000). Basic Genetics Narosa Publishing House, New Delhi.
- Weaver, R.F. and Hedrick, P.W. (1992). Genetics Wm. C. Brown Publishers Dubuque.
- Zubay. U.G. (1987), Genetics. The Cummings Publishing Co., Inc.

**Master of Science Zoology (Semester–IV)**
**Course Title: Concepts of Immunology (Theory)**
**Course Code: MZOL-4483**

## COURSE OUTCOMES

After passing this course the student will be able to:

- CO1 Describe the basic mechanisms, distinctions and functional interplay of innate and adaptive immunity.
- CO2 Define the cellular/molecular pathways of humoral/cell-mediated adaptive responses and understand the cellular as well as molecular aspects of lymphocyte activation, homeostasis, differentiation, and memory.
- CO3 Understand the molecular basis of complex, cellular processes involved in inflammation and immunity, in states of health and disease.
- CO4 Understand immunodiagnostics techniques.

**Master of Science Zoology (Semester–IV)**
**Course Title: Concepts of Immunology (Theory)**
**Course Code: MZOL-4483**

**L-T-P: 4-0-0**

**Maximum marks: 100**
**Theory marks: 80**
**CA:20**

**Instructions for the Paper Setter:**
Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A- D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

## Unit–I

**Introduction**
Types of immunity-innate and adaptive
Features of immune response-memory
Specificity and recognition of self and non-self
Terminology and approaches to the study of immune system
**Cells and Organs of the immune system:**
Heterogeneity of lymphoid cells
Primary and secondary lymphoid organs
Mucosa Associated Lymphoid Tissue (MALT), GALT, CALT
Lymphocytes traffic

## Unit–II

**Humoral Immunity**
Ag-Ab interaction
Affinity and avidity
High and low affinity anti-bodies
Classes and structure of immunoglobulins
B-cell generation, activation and proliferation
Complement fixing antibodies and complement cascade
**Cell Mediated Immunity**
Structure of MHC
Antigen processing and presentation
T-cell receptor- role and structure
T-cell maturation, activation and differentiation

## Unit - III

**Immunological Disorders**
Types of Hypersensitivity reactions
Mechanism of Hypersensitivity reactions
Autoimmune disorders, their underlying molecular mechanism
Immunodeficiency disorders
AIDS

## Unit–IV

**Antigen-antibody interactions**
Immunodiagnostic Procedures
Various types of Immuno diffusion and immunoelectrophoretic procedures
Immunoblot
ELISA
RIA
Agglutination of pathogenic bacteria
Haemagglutination and inhibition

**Suggested Reading Material:**


- Kuby, J., Immunology W. H. Freeman and Company, New York, (1992).
- Roitt, I. M. Brostoff, J and Male, D., Immunology, 2nd edition, Gover Medical Publishing, New York. (1989).
- Roitt, I. M., Essential Immunology, 6th edition, Blackwell Scientific Publications, Oxford. (1988).
- Paul, W.E., Fundamental Immunology, 2nd edition, Raven Press, New York. (1989).
- Playfair, J.H.L.: Immunology at a glance, 5th edition, Blackwell Scientific Publications, Oxford. (1992).
- Paul, W.E.: Immunology; recognition and response. W.H. Freeman, New York. (1991).

**Course Code: MZOL-4484**

## COURSE OUTCOMES

After passing this course the student will be able to:

- CO1 Impart knowledge regarding cell cell communication, induction and competence.
- CO2 Develop detailed understanding of essential events of organogenesis in developmental biology.
- CO3 Explain the adequate explanation to the students regarding concepts of organizer, axis specification and influence of extrinsic factors on the genetic control.
- CO4 Gain adequate information regarding metamorphosis, regeneration and growth.

**L-T-P: 4-0-0**

**Maximum marks: 100**
**Theory marks: 80**
**CA:20**

**Instructions for the Paper Setter:**
Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A- D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

**Unit–I**

**Cell -Cell Communication in development**
Role of adhesion molecules
Induction and competence of cells during development
Vulval formation
Vertebrate lens regeneration
The extracellular matrix as a source of developmental signals
The epithelial Mesenchymal transition

**Unit–II**

**Organogenesis**
**Ectodermal derivatives**
Formation of neural tube and brain
Differentiation of neurons in the brain
Tissue architecture of the central nervous system
Formation of the eye
**Mesodermal derivatives**
Formation of somites
Osteogenesis
Formation of dorsal aorta Formation of Urogenital system
Development of heart and blood vessels
**Endodermal derivatives**
The pharynx
The digestive tube and its derivatives
The respiratory tube

**Unit–III**

**Organizer and axis specification**
Axis Specification: Invertebrates (Drosophilla) and Vertebrates(Amphibian/Zebra Fish )
Concept of Organizer and its Role
Nucleus and cytoplasmic interactions during development
Influence of extrinsic factors on genetic control

**UNIT-IV**

**Metamorphosis, Regeneration and Growth**
**Metamorphosis**

Metamorphosis in insects
Metamorphosis in amphibians

**Regeneration**

Stem cell mediated Regeneration in Flatworm Regeneration in Hydra
Regeneration in Salamander limbs
Compensatory regeneration of mammalian liver

**Concept of growth at cellular, subcellular and organ level**

**Suggested Reading Material:-**


- Balinsky, B.I. (1981).An Introduction to Embryology, Saunders, Philadelphia.
- Bellairs, R. (1971). Development Processes in Higher Vertebrates, University of Miami Press, Miami.
- Berrill. N.J. (1971). Developmental Biology. McGraw Hill, NewDelhi.
- Dawnpart, Developmental Biology.
- Gilbert, F. (1985, 95 & 2000). Developmental Biology, Sinaur.
- Goel, S. C. (1984). Principles and Animal Developmental Biology, Himalaya, Bombay.
- Grant, P. (1978). Biology of Developing System.
- Spratt, N. T. Jn. (1971). Developmental Biology, Wordsworth, Belmont, Co.
- Waddigton C. H. (1966). Principles of Development and Differentiation. MacMillan, New York.
- Miller, W.A. (1997). Developmental Biology. Springer Verlag, NewYork.


**Session 2022-24**
**Master of Science Zoology (Semester–IV)**
**Course Title: Biosystematics (Theory)**
**Course Code: MZOL-4485**

**COURSE OUTCOMES**

After completion of course the student will be able to:

- CO1 Evaluate the taxonomic characters and apply this for the identification and classification of living things.
- CO2 Apply the various taxonomic procedures for collection, preservation and identification of living organisms.
- CO3 Knowledge of different types of publications
- CO4: Knowledge about major and minor phyla

**Session 2022-24**
**Master of Science Zoology (Semester–IV)**
**Course Title: Biosystematics (Theory)**
**Course Code: MZOL-4485**

**L-T-P: 4-0-0** **Maximum marks: 50**

**Theory marks: 40**
**CA:10**

**Instructions for the Paper Setter:**
Eight questions of equal marks (8 marks each) are to be set, two in each of the four Sections (A- D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

## Unit–I

**Introduction**
Terms / Definitions
History/ Development of theories, kinds of classification
Importance of Biosystematics
**Material basis of Biosystematics**
**Different attributes or evidences**
Character kinds
Character weighing
**New aspects of Biosystematics**
Cytotaxonomy
Chemotaxonomy
Molecular taxonomy

## Unit–II

**Taxonomic Procedures**
Taxonomic collections, Preservation, Identification
Taxonomic keys (Different kind, salient features, merits and demerits) **International Code of Zoology/Nomenclature**
Nomenclature Principles, important rules, their interpretation and application in scientific nomenclature

## Unit–III

**Taxonomic Publications**
Scientific publications
Systematic publications
Contents of publications
**Taxonomic Hierarchy**
Species category and various concepts of species
Hierarchy of categories
Lower and higher categories
Subspecies and other sub specific categories
Decision at species and sub species level

## Unit–IV

**History of kingdom systems (resume of whittakar's system and other recent systems of classification)**

An outline of classification of kingdom Animalia
Salient features of minor phyla.

**Suggested Reading Material:**


- Gote, H.E. (1982), Animal Taxonomy, Edward Arnold.
- Jaffery, C. (1973), Biological Nomenclature, Edward Arnold.
- Kapoor, V.C. (1987), Theory and Practice of Animal Taxonomy, IPH Pb. New Delhi.
- Mayer, E. (1969), Principle of Systematic Zoology, McGraw Hill Book Co. London.
- Mayer, E. &Aschhok (1991), Principles of Systematics, McGraw Hill Book Co. London.
- Minell, A. (1993), Biological Systematics, The State of Art. Chapman & Hall, London.
- Quicke, D.L.J, (1996), Principles & Techniques of Contemporary Taxonomy, Blacky Academic & Professional, London, New York, Madras.
- Kitching, I.J., Forey, P.L. Humpheries, C.J. & William, D. 1998. Cladistics: Theory and Practice of Parsimony Analysis, Oxford University Press.
- Sebuh, Randall T. 2000, Biological Systematics: Principles & Applications Cornell University Press 256 pp.
- Winston, J. 1999. Describing Species Practical Taxonomic Procedure of Biologists. Columbia University Press, Lincoln, R.J. Dictionary of Ecology, Evolution and Systematics.


**Session 2022-24**
**Master of Science Zoology (Semester–IV)**
**Course Title: Practical VII Animal Behaviour and Wildlife Conservation**
**Course Code: MZOP-4486**

**COURSEOUTCOMES**

After passing this course the student will be able to:

- CO1Understanding of behavior of animals
- CO2 Understanding of wildlife

**Session 2022-24**
**Master of Science Zoology (Semester–IV)**
**Course Title:Practical VII (Animal Behaviour and Wildlife Conservation)**
**Course Code: MZOP-4486**

**L-T-P: 0-0-3**

**Maximum marks: 50**
**Practical marks: 40**
**CA:10**

**14.** To study the food preference in animals.

**15.** To investigate the locomotive, withdrawal and habituation behaviours.

**16.** To study the latent and operant learning.

**17.** To study the thigmotaxis response.

**18.** To study chemical communication in ants.

**19.** To study the phenomenon of geotaxis

**20.** To study the phototaxis to point source and different colours of light.

**21.** To study grooming behaviour.

**22.** To study web spinning habits in spiders.

**23.** **Use of videos to study the**

a) Tarsal response in butterfly/housefly.

b) Equilibrium study on housefly.

c) Effect of temperature on opercular movement in fish.

**24.** To study animal behaviour patterns using photographs.

**25.** To mark the following on map

a. World hotspots

b. National parks in India.

**26.** Assignment on Wildlife project.

**Session 2022-24**
**Master of Science Zoology (Semester–IV)**
**Course Title: Practical VIII Genetics and Biosystematics**
**Course Code: MZOP-4487**

## COURSEOUTCOMES

Afterpassing thiscoursethe student willbeableto:

- CO1 Understanding of pedigree analysis and preparation of family charts.
- CO2 Knowledge of isolation of DNA from human blood and buccal cells.
- CO3 Understanding of cell division.
- CO4 Understanding of inheritance of morphogenetic human characters.
- CO5 Knowledge of collection, preservation and nomenclature of animals.

**Session 2022-24**
**Master of Science Zoology (Semester–IV)**
**Course Title: Practical VIII (Genetics and Biosystematics)**
**Course Code: MZOP-4487**

**L-T-P: 0-0-3**

**Maximum marks: 50**
**Practical marks: 40**
**CA:10**

1. To prepare and study the karyotype of human cell from meta phase pictures.
2. To study the pedigree analysis of a family.
3. To study blood groups in human beings.
4. Demonstration of Barr body in the oral epithelium of human beings.
5. To study different stages of mitosis in root tips of *Allium cepa.*
6. To study permanent slides of:-
    a. Mitosis in bone marrow cells of rat.
    b. Stages of meiosis in testis of rat/grasshopper/*Allium cepa.*
    c. Polytene chromosomes in third instar larvae of *Zaprionus paravittiger*.
7. To study dermatoglyphics with palms of hands and fingertips.
8. To study inheritance of morphogenetic human characters.
9. Isolation of DNA from plant tissues.
10. Numericals on Mendelian laws of inheritance and linkage.
11. Serum extraction from blood.
12. ELISA & RIA, Rocket Immuno-electrophoresis.
13. Demonstration of various kinds of equipment required for collection and preservation of animals.
14. Videos of Methods of collection and preservation.
15. Kinds of keys and their use at higher and lower category levels.

**Session 2022-24**
**Master of Science Zoology (Semester–IV)**
**Course Title: Project**
**Course Code: MZOP-4488**

## COURSEOUTCOMES

After passing this course the student will be able to:

- CO1Express their innovative ideas and creativity on any scientific phenomenon & develop interest in research aptitude.
- CO2 Explore field work and research work.
- CO3Learn how to design an experiment and various research strategies.

**Session 2022-24**
**Master of Science Zoology (Semester–IV)**
**Course Title: Project**
**Course Code: MZOP-4488**

**L-T-P: 3-0-3**

**Maximum marks: 50**
**Practical marks: 40**
**CA:10**

Students will Students can opt for any one from the following and will submit a detail report after successful completion:

(a) Review on a research topic
(b) Small Research Project
(c) Hands on Training in any Industry/Research Lab

Marks will be given on the basis of presentation and viva delivered by student.

# KANYA MAHAVIDYALAYA, JALANDHAR (AUTONOMOUS)

## SCHEME AND CURRICULUM OF EXAMINATIONS OF TWO-YEAR DEGREE PROGRAM

## Session- 2022-23

| **Masters of Science (Chemistry)** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **SEMESTER II** | | | | | | | |
| **PaperNo.** | **C/S/I/ V/E** | **PaperTitle** | **Marks** | | | | **Examination time (in Hours)** |
| | | | **Total** | **Ext.** | | **CA** | |
| | | | | **L** | **P** | | |
| MCHL-2057 | C | Biology for Chemists | 25 | 20 | - | 5 | 2 |

**M. Sc. Chemistry (Semester-II) (Session-2022-23)**
**BIOLOGY FOR CHEMISTS**

**COURSE CODE: MCHL-2057**

**(For Non-Medical Students)**

**(Theory)**

## Course Outcomes

After passing this course the student will be able to:

- CO1 Gain knowledge about the biomolecules and cell structure.
- CO2 Understand different types of tissues.
- CO3 Understand Mendelian laws, structure of DNA and gene expression.
- CO4 Understand Whittaker's system of classification and structure of virus.

**M. Sc. Chemistry (Semester-II) (Session-2022-23)**
**BIOLOGY FOR CHEMISTS**

**COURSE CODE: MCHL-2057**

**(For Non-Medical Students)**

**(Theory)**

**Time: 2 Hrs.** **Max. Marks: 25**

**(Theory: 20, CA: 5)**

**Note: The students are allowed to use Non-Programmable Calculator.**

**Instructions for the Paper Setter**

Eight questions of equal marks (4 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from unit I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

## UNIT-I

**The Organization of Life**

Biologically important molecules: Carbohydrates, lipids, proteins and nucleic acids.

The life of cells – The cell theory, general characteristics of cells, difference between prokaryotic and eukaryotic cells, difference between plant and animal cells, cell organelles.

## UNIT-II

Tissues, organs and organ systems: Animal tissues; epithelial tissues, connective tissues, muscle tissue, nervous tissue and neoplasias; plant tissue: meristematic tissue, permanent tissues.

## UNIT-III

**Genetics**

The basic principle of heredity: Mendals law, monohybrid cross, dihybrid cross.

DNA – Double helix structure and replication.

Genes expression: Transcription and translation, genetic code.

## UNIT-IV

### The Diversity of Life

The classification of Living things – Criteria of classification, Whittaker's systems of classification, their characteristics with are example of each.

Viruses, structure of Viruses.

### Book Recommended:


1. Cord Biology - South Western Educational Publications, Texas, 200

# KANYA MAHAVIDYALAYA, JALANDHAR (AUTONOMOUS)

**SCHEME AND CURRICULUM OF EXAMINATIONS OF THREE YEAR DEGREE PROGRAM**

## Session-2022-23

| Bachelor of Science (Bio-Technology) Semester I | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Course Name** | **Program Name** | **Course Code** | **Course Type** | **Marks** | | | | | **Examination time (in Hours)** |
| | | | | **Total** | **Paper** | **Ext.** | | **CA** | |
| | | | | | | **L** | **P** | | |
| Cell Biology | B.Sc. (Biotechnology) | BBTM-1483 | C | 60 | Cell Biology (Theory) | 30 | - | 12 | 3 |
| | | BBTM-1483(P) | | | Cell Biology (Practical) | - | 18 | | 3 |

**Bachelor of Science (Bio-Technology) Semester-I**

**Session: 2022-23**

**Course Code: BBTM-1483**

**Course Title: Cell Biology**

**(Theory)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

- **CO1**. Understanding the basic unit of life – cell and broad classification of cell types.
- **CO2**. Understanding the structure and functions of cell organelles.
- **CO3**: Understand Cell Division and Cell Cycle.
- **CO4.** Understanding the biological membranes along with membrane transport mechanism.

**Bachelor of Science (Bio-Technology) Semester-I**

**Session: 2022-23**

**Course Code: BBTM-1483**

**Course Title: Cell Biology**

**(Theory)**

**Time: 3 Hrs.** **Max. Marks: 60**

**Theory: 30**

**Practical: 18**

**CA: 12**

**Instructions for the Paper Setter**

Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section.

**Unit-I**

Cell as a basic unit of living systems. The cell theory Broad Classification of Cell Types: PPLO's, bacteria, eukaryotic microbes, plant and animal cells. A detailed classification of cell types within an organism. Cell, tissue, organ and organism as different levels of organizations of otherwise genetically similar cells.

**Unit-II**

Structure and function of cell organelles, ultrastructure of cell membrane, cytosol, Golgi bodies, endoplasmic reticulum (rough and smooth), ribosomes, cytoskeletal structures (actin, microtubules etc.), Mitochondria, chloroplasts, lysosomes, peroxysomes, nucleus (nuclear membrane, nucleoplasm, nucleolus, chromatin).

**Unit-III**

Cell Division and Cell Cycle: mitosis, meiosis, stages of cell cycle, binary fission, amitosis and its regulation. Cell-cell interaction, Cell locomotion (amoeboid, flagellar and ciliar).

**Unit-IV**

Biological Membranes: Supramolecular architecture of membranes; Solute transport across membranes; Model membranes and Liposomes.

**Books Recommended:**


1. De-Robertis, F.D.P. and De-Robertis Jr. E.M.F. (2017) Cell and Molecular Biology, Saunders, Philadelphia.
2. Lodish, Berk, Kaiser, Krieger, Scott, Bretscher, Ploegh and Matsudaira (2007) Molecular Cell Biology 6th Edition, W.H.Freemen& Co Ltd.
3. Geoffrey, M. Cooper & Robert E. Hausman (2013) The Cell: A molecular approach 6th Edition, Sinauer Associates.
4. Alberts, Johnson, Lewis, Raff, Roberts and Walter (2008) Molecular Biology of the Cell, 5$^{th}$ Edition, Garland Science.

**Bachelor of Science (Bio-Technology) Semester-I**

**Session: 2022-23**

**Course Code: BBTM-1483(P)**

**Course Title: Cell Biology**

**(Practical)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

- **CO1.** Perform a variety of molecular and cellular biology techniques.
- **CO2**. Describe cellular membrane structure and function, fine structure and function of cell organelles.

**Bachelor of Science (Bio-Technology) Semester-I**

**Session: 2022-23**

**Course Code: BBTM-1483 (P)**

**Course Title: Cell Biology**

**(Practical)**

**Time: 3 Hrs.** **Practical Marks: 18**

**Instructions for the practical Examiner:** Question paper is to be set on the spot jointly by the internal and external examiners. Two copies of the same may be submitted for the record to COE Office, Kanya MahaVidyalaya, Jalandhar.

1. Study of Cells:

(a) Prokaryotic cells: Lactobacillus, E. coli. Blue green algae.

(b) Eukaryotic cells: Testicular material (for studies of spermatogenesis)

2. Study of electron micrographs of various cell organelles-plasma membrane, Mitochondria, Golgi complex, Lysosomes, Endoplasmic Reticulum (smooth and granular), Cilia, Centrioles, inclusions like glycogen, lipids, etc.
3. Preparation of Permanent Slides: Principles and procedures- Section cutting of tissues and staining of tissues with Haematoxylin/eosin method.
4. Study of permanent slides of various tissues (gut region, liver, lung, spleen, kidney, pancreas, testis, ovary, tongue, skin etc.).
5. Preparation of Buccal Smear for microscopic examination.
6. Barr body observation in human squamous epithelial cells.
7. Microtomy of Plant Tissue specimens (Stem & Root)

**Books Recommended:**


1. Shah, V.C., Bhatavdekar, J., Chinoy, N.J. and Murthy, S.K. (1988). Essential techniques in Cell Biology.Anand Book Depot, Ahemadabad.
2. Celis, J.E. (1998) Cell Biology: A Laboratory handbook. Vol. 1-3. Academic Press, UK.

# KANYA MAHAVIDYALAYA, JALANDHAR (AUTONOMOUS)

**SCHEME AND CURRICULUM OF EXAMINATIONS OF THREE YEAR DEGREE PROGRAM**

## Session-2022-23

| Bachelor of Science (Bio-Technology) Semester II | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Course Name** | **Program Name** | **Course Code** | **Course Type** | **Marks** | | | | | **Examination time (in Hours)** |
| | | | | **Total** | **Paper** | **Ext.** | | **CA** | |
| | | | | | | **L** | **P** | | |
| Zoology-I | B.Sc. (Biotechnology) | BBTM-2484 | C | 60 | Zoology-I (Theory) | 30 | - | 12 | 3 |
| | | BBTM-2484 (P) | | | Zoology-I (Practical) | - | 18 | | 3 |

**Bachelor of Science (Bio-Technology) Semester-II**

**Session: 2022-23**

**Course Code: BBTM-2484**

**Course Title: Zoology-I**

**(Theory)**

## COURSE OUTCOMES

After passing this course the student will be able to:

- CO1 Understand the general classification of Kingdom Animalia.
- CO2 Understand the digestive system, respiratory system of man.
- CO3 Understand the excretory and circulatory system of man.
- CO4 Understand the skeletal system, neural integration and endocrine system of man.

**Bachelor of Science (Bio-Technology) Semester-II**

**Session: 2022-23**

**Course Code: BBTM-2484**

**Course Title: Zoology-I**

**(Theory)**

**Time: 3 Hrs.**

**Max. Marks: 60**

**Theory: 30**

**Practical: 18**

**CA: 12**

**Instructions for the Paper Setters:** Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

**Unit-1**

**Introduction to Animal Kingdom and its diversification:**

Overview and General classification of Kingdom Animalia, General Characteristics of each group upto class level with an example.

**Unit-2**

**Digestive System**: The alimentary canal and associated glands of Man. Digestion of dietary constituents, regulation of digestive processes and absorption. Extra and intracellular digestion, enzymatic digestion and symbiotic digestion.

**Respiratory System**: Respiratory system of man, Transport of O2 and CO2, Oxygen dissociation curve of haemoglobin, Bohr effect, chloride shift, Haldane effect and control of breathing.

**Unit-3**

**Circulatory System**: General plan of circulation in Man, structure of human heart. Origin and regulation of heart beat, Electrocardiogram, Cardiac output and Blood pressure, Composition and functions of blood and lymph, Blood clotting, blood groups including Rh-factor.

**Excretory system**: Structure of Kidney and nephron. Urine formation and osmoregulation.

**Unit-4**

**Skeletal system**: Ultrastructure, chemical and physical basis of skeletal muscle contraction.

**Neural Integration**: Structure and functions of brain, Structure of neuron, resting membrane potential, Origin and propagation of impulse along the axon, synapse and myoneural junction.

**Endocrine System**: Structure and physiology of thyroid, parathyroid, adrenal, hypothalamus, pituitary, pancreas and gonads of man.

**Suggested Readings:**

1. Sobti, R.C. & Nigam, S.K. (2002). Structural & function biology of chordates, VishalPublishers, Jalandhar.

2. Sobti, R.C. & Sharma, V.L. (2005). Basics of Biotechnology: Introduction of LifeSciences. Vishal Publishers, Jalandhar.

3. Sobti, R.C. (2005). Introduction to Biotechnology, Part-2, Concepts Tools andApplication, Vishal Publishers.

**Bachelor of Science (Bio-Technology) Semester-II**

**Session: 2022-23**

**Course Code: BBTM-2484 (P)**

**Course Title: Zoology-I**

**(Practical)**

# COURSE OUTCOMES

After passing this course the student will be able to:

- CO1 Understand the estimation of blood haemoglobin
- CO2 Familiarize with the various systems of human such as digestive, arterial, venous and urinogenital systems.
- CO3 The students will be able to record blood pressure and blood groups.

**Bachelor of Science (Bio-Technology) Semester-II**

**Session: 2022-23**

**Course Code: BBTM-2484 (P)**

**Course Title: Zoology-I**

**(Practical)**

**Time: 3 Hrs.** **Max. Marks: 18**

**Note:** The question paper will be set by the examiner based on the syllabus.

1. Study the following system of Human with the help of charts / models /videos:

   Digestive, Arterial, Venous and Urinogenital systems.

2. Analysis of food stuff for the presence of starch, protein and fats.

3. Determination of blood groups of human blood samples.

4. Recording of blood pressure of man.

5. Estimation of hemoglobin content.

6. Make a temporary preparation of the following:

   Blood smear of mammals.

7. Visit to clinical laboratory / hospital for demonstration of ECG, ECHO, X-ray, ultrasound, CT-scan and MRI.

# KANYA MAHAVIDYALAYA, JALANDHAR (AUTONOMOUS)

**SCHEME AND CURRICULUM OF EXAMINATIONS OF THREE YEAR DEGREE PROGRAM**

## Session-2022-23

| Bachelor of Science (Bio-Technology) Semester IV | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Course Name** | **Pogram Name** | **Course Code** | **Course Type** | **Marks** | | | | | **Examination time (in Hours)** |
| | | | | **Total** | **Paper** | **Ext.** | | **CA** | |
| | | | | | | **L** | **P** | | |
| Zoology II | B.Sc. (Biotechnology) | BBTM-4486 | C | 60 | Zoology II (Theory) | 30 | - | 12 | 3 |
| | | BBTM-4486 (P) | | | Zoology II (Practical) | - | 18 | | 3 |

**Bachelor of Science (Bio-Technology) Semester-IV**

**Session: 2022-23**

**Course Code: BBTM-4484**

**Course Title: Zoology-II**

**(Theory)**

## Course Outcomes

After passing this course the student will be able to:

- CO1 Understand evolution of Prokaryotes and Eukaryotes.
- CO2 Understand the process and theories in evolutionary biology.
- CO3 Aware the students about various pathogenic protozoans and helminths and diseases caused by them in humans.
- CO4 Understand diseases caused by arthropod vectors and their control measures.

**Bachelor of Science (Bio-Technology) Semester-IV**

**Session: 2022-23**

**Course Code: BBTM-4484**

**Course Title: Zoology-II**

**(Theory)**

**Time: 3 Hrs.** **Max. Marks: 60**

**Theory: 30**

**Practical: 18**

**CA: 12**

**Instructions for the Paper Setters:**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

**Unit-1**

**Origin of Life on Earth**: Origin of earth and primitive earth conditions, Theories of origin of life (Theory of Extraterrestrial contact- Import of life through meteorites, Special creation theory, Oparin Haldane Theory, Abiogenesis , Evidences against theory of spontaneous generation of life, Biogenesis, Theory of chemical evolution, Miller & Urey Experiment).

Evolution of Prokaryotes and Eukaryotes (unicellularity to multicellularity).

**Unit-2**

**Evolution**: Definition, Scope and History, Theories of Evolution (Lamarckism, Darwinism, Hugo de Vries and Modern theory of Evolution).

Geological time scale.

**Unit-3**

**Introduction to Parasitology** (pertaining to various terminologies in use).
Brief account of Life history, mode of infection and pathogenicity of the following pathogens with reference to man, prophylaxis and treatment.

**Pathogenic Protozoans:** Entamoeba, Trypanosoma, Giardia and Plasmodium.
**Pathogenic Helminths:** Tape Worm, Ascaris and Ancylostoma.

**Unit-4**

**Arthropod vectors of human diseases**: Malaria, Yellow fever, Dengue haemorragic fever, Filariasis, Plague and Epidemic typhus.

Distribution and control of the above mentioned vectors.

**Books:**


1. Sobti, R.C. & Nigam, S.K. (2002). Structural & function biology of chordates, Vishal Publishers, Jalandhar.
2. Sobti, R.C. & Sharma, V.L. (2005). Basics of Biotechnology: Introduction of Life Sciences. Vishal Publishers, Jalandhar.
3. Sobti, R.C. (2005). Introduction to Biotechnology, Part-2, Concepts Tools and Application, Vishal Publishers.

**Bachelor of Science (Bio-Technology) Semester-IV**

**Session: 2022-23**

**Course Code: BBTM-4484 (P)**

**Course Title: Zoology-II**

**(Practical)**

**Course outcomes**

After passing this course the student will be able to:

- CO1 Aware the students for various parasites and diseases which spreads in human with the help of study of host-parasite relationship.
- CO2 Aware about the typhoid, cholera likes disease.
- CO3 Understand the evolutionary phenomena.

**Bachelor of Science (Bio-Technology) Semester-IV**

**Session: 2022-23**

**Course Code: BBTM-4484 (P)**

**Couse Title: Zoology-II**

**(Practical)**

**Time: 3 Hrs**. **Max. Marks: 18**

Note. The question paper will be set by the examiner based on the syllabus.

1. Study of Evolutionary phenomenon with the help of charts / models /videos:

**Homology, Analogy and Mimicry.**

2. Study of the skeleton of human.

3. Study of the following prepared slides: histology of man (compound tissues).

4. Study of following prepared slides/specimen :

**Pathogenic Protozoans:**Entamoeba, Trypanosoma, Giardia and Plasmodium.

**Pathogenic Helminths:** Tape Worm, Ascaris and Ancylostoma.

**Arthropod vectors of human diseases:** Anopheles, Culex, Aedes Mosquitoes, Rat flea.

**Books:**


1. Sobti, R.C. & Nigam, S.K. (2002). Structural & function biology of chordates, Vishal Publishers, Jalandhar.
2. Sobti, R.C. & Sharma, V.L. (2005). Basics of Biotechnology: Introduction of Life Sciences. Vishal Publishers, Jalandhar.
3. Sobti, R.C. (2005). Introduction to Biotechnology, Part-2, Concepts Tools and Application, Vishal Publishers.

# KANYA MAHA VIDYALAYA, JALANDHAR (AUTONOMOUS)

**SCHEME AND CURRICULUM OF AND EXAMINATION OF THREE YEAR DEGREE PROGRAMME**

**(Session 2022-2023)**

| B. Sc. (Home Science) Semester VI | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Course Code** | **Course Name** | **Course Type** | **Marks** | | | | **Examination time (in Hours)** |
| | | | **Total** | **Ext.** | | **CA** | |
| | | | | **L** | **P** | | |
| BHSM-6487 | Applied Zoology and Food Microbiology | C | 100 | 60 | 20 | 20 | 3+3 |

# B.Sc. Home Science (Semester–VI) (Session 2022-23)

## APPLIED ZOOLOGY AND FOOD MICROBIOLOGY

**Course Code: BHSM-6487**

**(THEORY)**

**Course Outcomes**

- CO1. To study useful and harmful insects.
- CO2. Learn about sources of food contamination and control of stored food pest.
- CO3. Knowledge about Beneficial effects of microorganisms.
- CO4. Understand the microbiology of food spoilage, Contamination and control of different food products

# B. Sc. Home Science (Semester–VI) (Session 2022-23)

## APPLIED ZOOLOGY AND FOOD MICROBIOLOGY

**Course Code: BHSM-6487**

**(THEORY)**

**Max. Time: 3 Hrs.** **Max Marks: 100**

**Theory: 60**

**Practical: 20**

**CA: 20**

**Instruction for the Paper Setter.**

- Eight questions of equal marks are to be set; two in each of the four Sections (A-D).Questions of Sections A- D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four).
- Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

## UNIT-I

Elementary study of the following harmful insects Mosquito (Culex, anopheles, beg bugs and louse).

Elementary study of economically important insects – honeybee, silk moth, lac and earthworm.

## UNIT-II

Sources of food contamination, food poisoning Symptoms & control.

Control of pest cereals pulses and stored products such as rice weevil lesser grain and borer.

## UNIT-III

Introduction to microbiology and its relevance to food standards & safety. General morphology and Characteristics of micro-organism-bacteria Virus protozoa.

Beneficial effects of micro-organism.

- Role of bacteria in milk and milk products industry.
- Soil fertility (Nitrogen Cycle)

- Economic Importance of moulds, Aspergillus Penicillium and yeast.

## UNIT-IV

Microbiology of different food spoilage & Contamination & control of cereals and their products sugar and its products, vegetable and fruits, Meat and its products fish and other sea foods egg and poultry, milk and its products & canned foods.

## Reference Books:


1) Text Book of Zoology P.S. Dhami, Pardeep Publication.
2) Food Microbiology Frazier, William C and West off Dannis C. Tata McGraw will Publish Company Ltd.

# B. Sc. Home Science (Semester–VI) (Session 2022-23)

## APPLIED ZOOLOGY AND FOOD MICROBIOLOGY

**Course Code: BHSM-6487**

**(Practical)**

### Course Outcomes

CO1. To make the students aware about economically important specimens (preserved).

CO2. Familiarize about the basic microflora.

# B.Sc. Home Science (Semester–VI) (Session 2022-23)

## APPLIED ZOOLOGY AND FOOD MICROBIOLOGY

### Course Code: BHSM-6487 (Practical)

**Time: 3 Hrs.** **Marks: 20**

**Instructions for the Practical Examiners:** Question paper is to set on the spot jointly by the Internal and External Examiners. Two copies of the same should be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar

1. Identification of insects (same as theory).
2. Identification and economic importance of Honey bee, silk moth, lac and earthworm.
3. Identification of pest with their morphological note (same as theory).
4. Identification of slides of following microbes-bacteria, Virus, protozoa.

# Kanya Maha Vidyalaya Jalandhar

## Scheme and curriculum of Examinations of three year degree program

### Environmental Studies (COMPULSORY PAPER)

## Semester-III (session 2022-23)

**B.Sc. (Medical) / B.Sc. (Non Medical) / B.Sc. (Computer Science) / B.Com. / BBA/ B.Sc. (Home Science) / BCA/B.Sc(IT)/ B.Sc. (BT)/ B.Sc (Hons.) Physics/ B.Com (Hons.)/ BSc Economics.**

**(semester-III)**

| Course Code | Course Title | Course Type | Marks | | | | Examination time (in Hours) |
|---|---|---|---|---|---|---|---|
| | | | Total | Theory | Field work | CA | |
| AECE-3221 | Environmental studies (compulsory) | AECC | 100 | 60 | 20 | 20 | 3 |

***AECC- Ability enhancement compulsory course**

**B.Sc. (Medical) / B.Sc. (Non Medical) / B.Sc. (Computer Science) / B.Com. / BBA/ B.Sc. (Home Science) / BCA/B.Sc(IT)/ B.Sc. (BT)/ B.Sc (Hons.) Physics/ B.Com (Hons.)/BSc. Economics**

**Semester- III**

## COURSE OUTCOMES:

**AECE-3221**- Environmental Studies

After passing this course students will be able to:

CO1: Understand the concept and need of environmental education.

CO2: Understand the role of an individual in conservation of natural resources.

CO3: Learn about role of major Eco system and their conservation.

CO4: Develop desirable attitude,value and respect for protection of Biodiversity.

CO5: Learn about the control measure of pollution and solid waste management.

CO6: Understand the role of different agencies in the protection of environment.

CO7: Knowledge regarding welfare programmes and Human rights.

CO8: Knowledge about the applied value of environmental studies.

**B.Sc. (Medical) / B.Sc. (Non Medical) / B.Sc. (Computer Science) / B.Com. / BBA/ B.Sc. (HomeScience) / BCA/B.Sc(IT)/ B.Sc. (BT)/ B.Sc (Hons.) Physics/ B.Com (Hons.)/Bsc. Economics**

**Semester-III**

**(session 2022-23)**

# Environmental studies (COMPULSORY PAPER)

**Course Code: AECE-3221**

**(Theory)**

**Time: 3Hrs.** **Max. Marks: 100**

**Theory: 60**

**Project Report: 20**

**CA: 20**

**Instructions for the Paper Setter:**

The question paper should carry 60 marks.

The structure of the question paper being:

**Part-A**, Short answer pattern – 20 marks

Attempt any five questions out of seven. Each question carries 4 marks. Answer to each question should not exceed 2 pages

**Part-B**, Essay type with inbuilt choice – 40 marks

Attempt any five questions out of eight. Each question carries 8 marks. Answer to each question should not exceed 5 pages.

## Unit 1

**The multidisciplinary nature of environmental studies**

Definition, scope and importance, Need for public awareness

## Unit 2

**Natural Resources: Renewable and non-renewable resources:**

Natural resources and associated problems.

(a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.

(b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

(c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

(d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

(e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies.

(f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

- Role of an individual in conservation of natural resources.
- Equitable use of resources for sustainable lifestyles.

## Unit 3

**Ecosystems**

- Concept of an ecosystem
- Structure and function of an ecosystem
- Producers, consumers and decomposers
- Energy flow in the ecosystem
- Ecological succession
- Food chains, food webs and ecological pyramids
- Introduction, types, characteristic features, structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, ocean estuaries)

## Unit 4

**Biodiversity and its conservation**

- Introduction – Definition: genetic, species and ecosystem diversity
- Biogeographical classification of India
- Value of biodiversity: consumptive use, productive use, social, ethical aesthetic and option values

- Biodiversity at global, national and local levels
- India as a mega-diversity nation
- Hot-spots of biodiversity
- Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts
- Endangered and endemic species of India
- Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity

## Unit 5

**Environmental Pollution**

Definition

- Causes, effects and control measures of Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear pollution
- 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

## Unit 6

**Social Issues and the Environment**

- From unsustainable to sustainable development
- Urban problems and related to energy
- Water conservation, rain water harvesting, watershed management
- Resettlement and rehabilitation of people; its problems and concerns. Case studies.
- Environmental ethics: Issues and possible solutions
- Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.
- Wasteland reclamation
- Consumerism and waste products
- Environmental Protection Act, 1986
- Air (Prevention and Control of Pollution) Act, 1981
- Water (Prevention and control of Pollution) Act, 1974
- Wildlife Protection Act
- Forest Conservation Act

- Issues involved in enforcement of environmental legislation
- Public awareness

## Unit 7

**Human Population and the Environment**

- Population growth, variation among nations
- Population explosion – Family Welfare Programmes
- Environment and human health
- Human Rights
- Value Education
- HIV / AIDS
- Women and Child Welfare
- Role of Information Technology in Environment and Human Health
- Case Studies

## Unit 8

**Field Work**

- Visit to a local area to document environmental assets river/forest/grassland/hill/mountain
- Visit to a local polluted site – Urban / Rural / Industrial / Agricultural
- Study of common plants, insects, birds
- Study of simple ecosystems-pond, river, hill slopes, etc

**References:**

1. Bharucha, E. 2005. Textbook of Environmental Studies, Universities Press, Hyderabad.

2. Down to Earth, Centre for Science and Environment, New Delhi.

3. Heywood, V.H. & Waston, R.T. 1995. Global Biodiversity Assessment, Cambridge House, Delhi.

4. Joseph, K. & Nagendran, R. 2004. Essentials of Environmental Studies, Pearson Education (Singapore) Pte. Ltd., Delhi.

5. Kaushik, A. & Kaushik, C.P. 2004. Perspective in Environmental Studies, New Age International (P) Ltd, New Delhi.

6. Rajagopalan, R. 2011. Environmental Studies from Crisis to Cure. Oxford University Press, New Delhi.

7. Sharma, J. P., Sharma. N.K. & Yadav, N.S. 2005. Comprehensive Environmental Studies, Laxmi Publications, New Delhi.

8. Sharma, P. D. 2009. Ecology and Environment, Rastogi Publications, Meerut.

9. State of India's Environment 2018 by Centre for Sciences and Environment, New Delhi

10. Subramanian, V. 2002. A Text Book in Environmental Sciences, Narosa Publishing House, New Delhi

# Scheme and curriculum of Examinations of three year degree program

## Environmental Studies (COMPULSORY PAPER)

## Semester-IV (session 2022-23)

| BA/BA.JMC/ B.sc FD/BA hons.English Semester-IV | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Course Code** | **Course Title** | **Course Type** | **Marks** | | | | **Examination time (in Hours)** |
| | | | **Total** | **Ext.** | | **CA** | |
| | | | | **Theory** | **Field work** | | |
| AECE- 4221 | Environmental studies | AECC | 100 | 60 | 20 | 20 | 3 |

***AECC- Ability enhancement compulsory course**

**BA /BA.JMC/ /B.sc FD/BA.hons. English**
**Semester- IV**

## COURSE OUTCOMES:

### **AECE-4221**- Environmental Studies

After passing this course students will be able to:

CO1: Understand the concept and need of environmental education.

CO2: Understand the role of an individual in conservation of natural resources.

CO3: Learn about role of major Eco system and their conservation.

CO4: Develop desirable attitude, value and respect for protection of Biodiversity.

CO5: Learn about the control measure of pollution and solid waste management.

CO6: Understand the role of different agencies in the protection of environment.

CO7: Knowledge regarding welfare programmes and Human rights.

CO8: Knowledge about the applied value of environmental studies.

**B.A / B.A. (JMC) / B.Sc. (FD) /B.A (Hons.) in English**
**(session 2022-23)**

# Environmental Studies (COMPULSORY PAPER)

**Course Code: AECE-4221**
**(Theory)**

**Time: 3 Hrs** **Max. Marks: 100**
**Theory: 60**
**Project report: 20**
**CA: 20**

**Instructions for the Paper Setter**

The question paper should carry 60 marks.

The structure of the question paper being:

**Part-A**, Short answer pattern – 20 marks

Attempt any five questions out of seven. Each question carries 4 marks. Answer to each question should not exceed 2 pages

**Part-B**, Essay type with inbuilt choice – 40 marks

Attempt any five questions out of eight. Each question carries 8 marks. Answer to each question should not exceed 5 pages.

## Unit 1

**The multidisciplinary nature of environmental studies**

Definition, scope and importance, Need for public awareness

## Unit 2

**Natural Resources: Renewable and non-renewable resources:**

Natural resources and associated problems.

(a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.

(b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

(c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

(d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

(e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies.

(f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

- Role of an individual in conservation of natural resources.
- Equitable use of resources for sustainable lifestyles.

**Unit 3**

**Ecosystems**

- Concept of an ecosystem
- Structure and function of an ecosystem
- Producers, consumers and decomposers
- Energy flow in the ecosystem
- Ecological succession
- Food chains, food webs and ecological pyramids
- Introduction, types, characteristic features, structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, ocean estuaries)

**Unit 4**

**Biodiversity and its conservation**

- Introduction – Definition: genetic, species and ecosystem diversity
- Biogeographical classification of India
- Value of biodiversity: consumptive use, productive use, social, ethical aesthetic and option values
- Biodiversity at global, national and local levels
- India as a mega-diversity nation
- Hot-spots of biodiversity
- Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts
- Endangered and endemic species of India
- Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity

**Unit 5**

**Environmental Pollution**

- Definition
- Causes, effects and control measures of Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear pollution
- 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

**Unit 6**

**Social Issues and the Environment**

- From unsustainable to sustainable development
- Urban problems and related to energy
- Water conservation, rain water harvesting, watershed management
- Resettlement and rehabilitation of people; its problems and concerns. Case studies.
- Environmental ethics: Issues and possible solutions
- Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.
- Wasteland reclamation
- Consumerism and waste products
- Environmental Protection Act, 1986
- Air (Prevention and Control of Pollution) Act, 1981
- Water (Prevention and control of Pollution) Act, 1974
- Wildlife Protection Act
- Forest Conservation Act

Issues involved in enforcement of environmental legislation

Public awareness

**Unit 7**

**Human Population and the Environment**

- Population growth, variation among nations
- Population explosion – Family Welfare Programmes
- Environment and human health
- Human Rights
- Value Education
- HIV / AIDS
- Women and Child Welfare
- Role of Information Technology in Environment and Human Health

- Case Studies

## Unit 8

**Field Work**

- Visit to a local area to document environmental assets river/forest/grassland/hill/mountain
- Visit to a local polluted site – Urban / Rural / Industrial / Agricultural
- Study of common plants, insects, birds
- Study of simple ecosystems-pond, river, hill slopes, etc

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## Scheme of Studies and Examination

## Semester- IV (Session 2022-23)

### Environmental Studies (COMPULSORY PAPER)

**B.Voc (RM, MSP, Animation, TDAT, NEH, Beauty & Wellness,Artificial intelligence and data science,hospitality and tourism)**
**(SEMESTER-IV)**

| Course Code | Course Title | Course Type | Hours/ week | Credits L-T-P | Marks | | | | Examination time (in Hours) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Total | Ext. | | CA | |
| | | | | | | Theory | Field work | | |
| AECE-4221 | Environmental studies | C | 4 | 4-0-0 | 100 | 60 | 20 | 20 | 3 |

***C- compulsory course**

## B. Voc (RM, MSP, Animation, TDAT, NEH, Beauty & Wellness, Artificial intelligence and data science, hospitality and tourism)

## SEMESTER -IV

## COURSE OUTCOMES:

### **AECE-4221**- Environmental Studies

After passing this course students will be able to:

CO1: Understand the concept and need of environmental education.

CO2: Understand the role of an individual in conservation of natural resources.

CO3: Learn about role of major Eco system and their conservation.

CO4: Develop desirable attitude,value and respect for protection of Biodiversity.

CO5: Learn about the control measure of pollution and solid waste management.

CO6: Understand the role of different agencies in the protection of environment.

CO7: Knowledge regarding welfare programmes and Human rights.

CO8: Knowledge about the applied value of environmental studies.

# B. Voc (RM, MSP, Animation, TDAT, NEH, Beauty & Wellness, Artificial intelligence and data science, hospitality and tourism)

## Semester-IV (Session 2022-23)

## Environmental Studies (compulsory paper)

**Course Code: AECE-4221**

**(Theory)**

**Time: 3 Hrs** **Max. Marks: 100**

**Credit: 4-0-0** **Theory: 60**

**Project report: 20**

**CA: 20**

**Instructions for the Paper Setter**

The question paper should carry 60 marks.

The structure of the question paper being:

**Part-A**, Short answer pattern – 20 marks

Attempt any five questions out of seven. Each question carries 4 marks. Answer to each question should not exceed 2 pages

**Part-B**, Essay type with inbuilt choice – 40 marks

Attempt any five questions out of eight. Each question carries 8 marks. Answer to each question should not exceed 5 pages.

**Unit 1**

**The multidisciplinary nature of environmental studies**

Definition, scope and importance, Need for public awareness

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Natural resources and associated problems.

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(c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

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## Unit 3

**Ecosystems**

- Concept of an ecosystem
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**Biodiversity and its conservation**

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- Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity

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- Role of an individual in prevention of pollution
- Pollution case studies
- Disaster management: floods, earthquake, cyclone and landslides

## Unit 6

**Social Issues and the Environment**

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- Urban problems and related to energy
- Water conservation, rain water harvesting, watershed management
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- Air (Prevention and Control of Pollution) Act, 1981
- Water (Prevention and control of Pollution) Act, 1974
- Wildlife Protection Act
- Forest Conservation Act

Issues involved in enforcement of environmental legislation

Public awareness

## Unit 7

**Human Population and the Environment**

- Population growth, variation among nations
- Population explosion – Family Welfare Programmes
- Environment and human health
- Human Rights
- Value Education
- HIV / AIDS
- Women and Child Welfare
- Role of Information Technology in Environment and Human Health
- Case Studies

**Unit 8**

**Field Work**

- Visit to a local area to document environmental assets river/forest/grassland/hill/mountain
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