

FACULTY OF LIFE SCIENCES

SYLLABUS

of

Zoology

for

B. Sc. Medical (Semester I-VI)

M. Sc. Zoology (Semester I-IV)

M. Sc. Chemistry (Semester II)

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

Session: 2021-22



The Heritage Institution
KANYA MAHA VIDYALAYA
JALANDHAR
(Autonomous)

KANYA MAHAVIDYALAYA, JALANDHAR (AUTONOMOUS)

SCHEME AND CURRICULUM OF EXAMINATIONS OF THREE YEAR DEGREE PROGRAM

Session-2021-22

SEMESTER I

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 2021-22)

ZOOLOGY

CELL BIOLOGY

Course Code: BSMM-1483 (I)

(THEORY)

Course Outcome

- CO1. Develop deeper understanding of what life is and how it functions at cellular level.
- CO2. Describe cellular membrane structure and function, fine structure and function of cell organelles.
- CO3. Perform a variety of molecular and cellular biology techniques

B.Sc. Medical (Semester-I) (Session 2021-22)

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 (4th 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 2021-22)

ZOOLOGY

BIODIVERSITY-I

(PROTOZOA TO ANNELIDA)

Course Code: BSMM-1483 (II)

(THEORY)

Course Outcome

- CO1: Familiar with the non-chordate world that surrounds us.
- CO2: Able to appreciate the process of evolution (unicellular cells to complex, multicellular organisms)
- CO3: Able to identify the invertebrates and classify them up to the class level with the basis of systematic
- CO4: Understand the basis of life processes in the non-chordates and recognize the economically important invertebrate fauna.

B.Sc. Medical (Semester-I) (Session 2021-22)

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 2021-22)

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 2021-22)

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

Guidelines for conduct of practical Examination:-

- | | | |
|----|---|---|
| 1. | Identify 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 chromatography/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 Pontobdella*

2. Study of the following permanent stained preparations:

- L.S. and T.S. *Sycon*, gemmules, spicules and spongin fibers of a sponge.
- T.S. *Hydra* (Testis and ovary region)
- T.S. *Fasciola* (Different regions)
- 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 2021-22)

ZOOLOGY

Ecology

Course Code: BSMM-2483 (I)

(THEORY)

Course Outcomes

After passing this course the student will be able to:

- CO1. Construct the food web.
- CO2. Familiarise with ecological adaptations.
- CO3. Know about the characteristics of population & biotic community.
- CO4. Know about the conservation of resources.

B.Sc. Medical (Semester–II) (Session 2021-22)

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 2021-22)

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. Familiarize with the non-chordate world that surrounds us.

CO2. Appreciate the process of evolution (unicellular cells to complex, multicellular organisms).

CO3. Identify the invertebrates and classify them up to the class level with the basis of systematic.

CO4. Understand the basis of life processes in the non-chordates and recognize the economically important invertebrate fauna.

B.Sc. Medical (Semester–II) (Session 2021-22)

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 2021-22)
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 2021-22)

ZOOLOGY

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

Course Code: BSMM-2483 (P)

(PRACTICAL)

Time: 3hrs.

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), Poecilocus (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.

Guidelines for conduct of practical Examination:-

- | | | |
|----|---|---|
| 1. | Identify 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-2021-22

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–IV (related to Biochemistry and Animal Physiology)	-	20		3

B.Sc. (Medical) (Semester–III) (Session 2021-22)

ZOOLOGY

EVOLUTION

Course Code: BSMM-3483(I)

(THEORY)

Course Outcome

- CO1. Familiar with ecological adaptations.
- CO2. Identify the contributions of various Evolutionists.
- CO3. Understanding the process and theories in evolutionary biology.
- CO4. Develop an interest in the debates and discussions taking place in the field of evolutionary biology.

B.Sc. (Medical) (Semester–III) (Session 2021-22)

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 (3rded), 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 2021-22)
ZOOLOGY
Biodiversity-III
(Chordates)
Course Code: BSMM-3483(II)
(THEORY)

Course Outcomes

- CO1. Describe the diversity in form, structure and habits of vertebrates.
- CO2. Explain general characteristics and classification of different classes of vertebrates.
- CO3. Positive attitude towards Biodiversity Conservation.

B.Sc. (Medical) (Semester–III) (Session 2021-22)

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 (9thed), 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 2021-22)
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 2021-22)
Practical-III (Related to Evolution and Biodiversity-III)

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 specimen upto order level. Write a short note on habitat, special features, feeding, habits and economic importance of the specimens. 8
3. Identify 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 : *Casuaris, Ardea, Anas, Milvus, Pavo, Eudynamis, 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 2021-22)

ZOOLOGY

BIOCHEMISTRY

Course Code: BSMM-4483 (I)

(THEORY)

Course Outcome

- CO-1. Familiar with various biochemical pathways.
- CO-2. Understand the chemical nature of life and life process.
- CO-3. Get an idea on structure and functioning of biologically important molecules.
- CO-4. Help to explore new developments in biochemistry.

B.Sc. Medical (Semester–IV) (Session 2021-22)

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 2021-22)

ZOOLOGY

Animal Physiology

Course Code: BSMM-4483 (II)

(THEORY)

Course Outcomes

- CO1. Understand the functioning of various systems.
- CO2. Apply the knowledge to lead a healthy life.
- CO3. Familiarize with various biochemical pathways.
- CO4. Compare the functioning of organ systems across the animal world.
- CO5. Learn more about human physiology and anatomy.

B.Sc. Medical (Semester–IV) (Session 2021-22)

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 O₂ and CO₂, 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. 3rd ed (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. 4th Ed (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 (6th 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 2021-22)

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 2021-22)

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-2021-22

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 2021-22)

ZOOLOGY

Course Title: Developmental Biology

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

Course Outcome

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

CO1: Identify the developmental stages.

CO2: Describe the key events in early and systematic embryological development.

CO3: Describe the process of gametogenesis.

CO4: Describe the chick development up to 96 hours of incubation and extra embryonic membranes.

CO5: Explain the theories of preformation, and concepts like growth, differentiation and reproduction.

CO6: Explain the principles and process of fertilization and cleavage.

B.Sc. Medical (Semester–V) (Session 2021-22)

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 upto 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 Miami Press, 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. Waddington CH. (1966), Principles of Development and Differentiation, MacMillan, New York.
10. Miller, W.A. (1997), Developmental Biology Springer Verlag, New York.

B.Sc. Medical (Semester–V) (Session 2020-21)

ZOOLOGY

Course Title: Genetics

Course Code: BSMM-5483 (II)

(THEORY)

Course Outcome

Upon successful completion, students will have the knowledge and skills to:

CO1: Comprehensive, detailed understanding of the chemical basis of heredity.

CO2: Comprehensive and detailed understanding of genetic methodology and how quantification of heritable traits in families and populations provides insight into cellular and molecular mechanisms.

CO3: Understanding of how genetic concepts affect broad societal issues including health and disease, food and natural resources, environmental sustainability, etc.

CO4: Understanding the role of genetic mechanisms in evolution.

CO5: The knowledge required to to design, execute, and analyze the results of genetic experimentation in animal and plant model systems.

CO6: Explain the key concepts in population,

CO7: Evolutionary and quantitative **genetics** including: the basis of **genetic** variation; heritability; Hardy-Weinberg Equilibrium, roles of migration, mutation

CO8: The ability to evaluate conclusions that are based on genetic data.

CO9: Insight into the mathematical, statistical, and computational basis of genetic analyses.

B.Sc. Medical (Semester–V) (Session 2020-21)

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(twelfth 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(6th edition)
4. P.S Verma and V.K Aggarwal ,Genetics(9th edition) S.Chand publications.
5. Veer BalaRastogi, Genetics (4th edition) ,Knrn publications.
6. Prof P. K. Gupta(5th 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 2021-22)

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 2021-22)
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, KanyaMahaVidyalaya, Jalandhar.

Guidelines 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 capsules etc.).
 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 of frog-upto tadpole, chick-upto 96 hr.

11. Preparation of 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 2021-22)

ZOOLOGY

MEDICAL ZOOLOGY

Course Code: BSMM-6483 (I)

(THEORY)

Course Outcome

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

- CO-1. To study and understand the scope and branches of Medical Zoology.
- CO-2. To aware the students for various parasites and diseases which spreads in human with the help of study of host-parasite relationship.
- CO-3. To increase awareness for the health in students.
- CO-4. Understand the various disease-causing vectors like Mosquitoes
- CO-5. To aware about the typhoid, cholera likes disease.
- CO-6. Provides basics knowledge about immune system and allows the student to create insight as how to improve their immune system and good health.
- CO-7. Types of immunity, antigens-antibodies and their properties
- CO-8. Complement system, MHC's and immune response.

B.Sc. Medical (Semester–VI) (Session 2021-22)

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 stephensi*, *A. culicifacies*, Yellow fever, Dengue, Dengue haemorrhagic fever and Chikungunya. (*Aedes aegypti*, *A. albopictus*); Filariasis (*Culex pipiens fatigans*) *Mansonia* sp. Japanese Encephalitis (*C. tritaeniorhynchus*); Plague (*Yersinia pestis*) 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. and Silvertown, R.E. (1985) Introduction to Medical Laboratory Technology, (6th ed), Butlerworth and Co. Ltd.
2. Chatterjee, K.D. (2019), Parasitology, Protozoology and Helminthology (13th ed).
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), MacMillan Publishing Co., New York.
6. Kubly, 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 2021-22)

ZOOLOGY

MEDICAL LABORATORY TECHNOLOGY

Course Code: BSMM-6483 (II)

(THEORY)

Course Outcome

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

- CO-1. Apply knowledge and **technical** skills associated with **medical lab technology**.
- CO-2. Perform routine **clinical laboratory** procedures within acceptable quality control parameters in haematology, chemistry, immunochemistry, and microbiology.
- CO-3. Perform basic laboratory techniques on biological specimens.
- CO-4 Comply with safety regulations and universal precaution.
- CO-5. Apply basic scientific principles in learning new techniques and procedures.

B.Sc. Medical (Semester–VI) (Session 2021-22)
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 2021-22)

ZOOLOGY

PRACTICAL–VI (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
- CO5: Students will learn about various histotechniques, handling and processing of tissue specimens as well as staining procedures.
- CO6: Understanding of estimation of protein & sugar

B.Sc. Medical (Semester–VI) (Session 2021-22)
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: 2021-22

Master of Science (Zoology) Semester -I							
Course Code	Course Name	Course Type	Marks				Examination time (in Hours)
			Total	Ext.		CA	
				L	P		
MZOL-1481	Functional Organization of Animals – I	C	100	80	-	20	3
MZOL-1482	Animal Ecology	C	100	80	-	20	3
MZOL-1483	Cell Biology	C	100	80	-	20	3
MZOM-1134	Computer Programming & Data Processing	C	50	25	15	10	3+3
MZOP-1485	Practical-I (Functional Organization of Animals-I)	C	50	-	40	10	4
MZOP-1486	Practical- II (Ecology and Cell Biology)	C	50	-	40	10	4
Total			450				

Master of Science (Zoology) Session 2021-22

(Semester-I)

Course Code: MZOL-1481

Course Title: FUNCTIONAL ORGANIZATION OF ANIMALS– I

COURSE OUTCOMES

After passing this course the student will be able to:

- CO1: Understand the physiological mechanisms.
- CO2: Familiarize with the physiology of digestive and respiratory system of chordates & non-chordates.
- CO3: Understand the blood composition, types, groups and circulatory system.
- CO4: Understand the physiology of excretory system.
- CO5: Come to know the physiology of reproductive system.

Master of Science (Zoology) Session 2021-22

(Semester-I)

Course Code: MZOL-1481

**Course Title: FUNCTIONAL ORGANIZATION OF ANIMALS– I
(THEORY)**

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

Nutrition & 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

Osmoregulation and Excretion

Osmoconformers and osmoregulators, hyperosmotic, hyposmotic and isosmotic mediums, Excretion and metabolic waste products – an introduction.

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

Osmoregulation in non-chordates, adaptation to different environments / habitats. Development and adult structural organization of chordate kidney: nephron, the functional unit.

Reproduction

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:

1. Barrington, E. U. W. (1967), Invertebrates Structure and Functions. Houghton Mifflin Co. Boston.
2. Barth, R. H. and Broshears, R. E (1982), The Invertebrate world. Holt Saunder, Japan.
3. Brusca, R. C. and Brusca, G. J. (2003), Invertebrates second edition. Sinauer Associates, Inc. Publishers, Sunderland, Massachusetts.
4. Cooper, G. M. (2004), The Cell: A Molecular Approach IIIrd edition, ASM Press, Washington, D.C.
5. Engemann, J. G. and Hegner, R. W. (1981), Invertebrate Zoology (3rd ed.) Macmillan, New York.
6. Gardiner, M. S. (1972), The Biology of Invertebrates, McGraw Hill, New York.
7. Hill, R. W., Wyse, G. K. and Anderson, N. (2004), Animal physiology. Sinauer Associate, INC. Pub. Saunderland, Massachusettes, USA.
8. Hoar, W. S. (1984), General and Comparative Physiology. Prentice Hall of India Pvt. Limited, New Delhi, India.
9. Karp, G.(2005), Cell and Molecular Biology; concepts and experiments (4th ed.),Hoboken, John Willy and Sons, New York.
10. Meglitsch, P. A. and Schran, F. R. (1991), Invertebrate Zoology 3rd Ed. Oxford University Press, New York.
11. Pechenik, A. Jan. (2000), Biology of the invertebrates, Fourth Edition, McGraw Hill Book Co. Singapore.

12. Prosser, C.L. (1984), Comparative Animal Physiology. Satish Book Enterprise Books seller & Publishers, Agra.
13. Purves, W. K., Oriane, G. H., Space, H. C. and Salava, D. (2001), Life – The Science of Biology 6th ed., Sinauer Assoc. Inc., USA.
14. Randall, D., Burggren, K.L. and French, K. (2002), Eckert Animal Physiology: Mechanisms and Adaptations. W.H. Freeman and Company, New York.
15. Ruppert, E. E. and Barnes, R. D. (2004), Invertebrate Zoology 7th ed. Saunders Publ., Philadelphia.
16. Willmer, P. Stone, G. and Johnston, I (2000). Environmental Physiology of Animals, Blackwell Science.
17. Withers, P.C. (1992), Comparative Animal Physiology Saunder College Publishing, New York.

Master of Science (Zoology) (Session 2021-22)
(Semester-I)
Course Code: MZOL-1482
Course Title: ANIMAL ECOLOGY
(THEORY)

COURSE OUTCOMES

After passing this course the student will be able to:

- CO1 Demonstrate and Understand the ecological relationships between organisms and their environment.
- CO2 Present an overview of diversity of life forms in an ecosystem.
- CO3 Explain and identify the role of the organism in energy transfers.
- CO4 Describe the Habitat ecology and Resource ecology.
- CO5 Understand the Environmental Pollution and their management.

Master of Science (Zoology) (Session 2021-22)
(Semester-I)
Course Code: MZOL-1482
Course Title: ANIMAL ECOLOGY
(THEORY)

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 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

Resource, Food, its distribution, relative and absolute shortages 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 Ecdysis

Unit – IV

Applied Ecology

Anthropogenic interferences

Bio monitoring of environment using animal species

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

Ecological basis of pest regulation (in brief)

Bio Geography

Zoo Geographical regions

Island ecology. (endemicity)

Suggested Reading Material:

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

Master of Science (Zoology) (Session 2021-22)
(Semester-I)
Course Code: MZOL-1483
Course Title: CELL BIOLOGY
(THEORY)

COURSE OUTCOMES

After passing this course the student will be able to:

- CO1 Describe the ultra-structure and functions of cell organelles.
- CO2 Understand DNA replication, RNA and protein synthesis and come to know protein synthesis can be controlled at the level of transcription and translation.
- CO3 Understand cell signaling and cellular communication.
- CO4 Understand the types and applications of stem cells.

Master of Science (Zoology) (Session 2021-22)

(Semester-I)

Course Code: MZOL-1483

Course Title: CELL BIOLOGY

(THEORY)

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

Cell – a unit of structure and function, cell theory.

General Properties of the Cell

Size, shape, number, life span and death. Cell types: Prokaryotes and eukaryotes Stem cells.

Organization of Prokaryote Cell

Mycoplasma, Bacteria, Cyanobacteria (Blue Green Algae). Structure and importance of their study.

From Prokaryotes to Eukaryotes

Events leading to origin of eukaryotic cells. Endo symbiotic theory and recent views.

Structure of Cell Membrane

General properties of cell membrane, chemical composition. The concept of unit membrane.

Various Lipoprotein models including fluid mosaic model.

Unit – II

Golgi Complex

Structure and Function of : Cisternae, vacuoles and vesicles.

Functions Role in secretion, cell wall formation, packaging of intracellular products and other functions

GERL concept.

Mitochondria

Elaboration of the plasma membrane and multi enzyme complex, outer and inner membranes, cristae, matrix, inner and outer compartments,

Location of enzyme complexes of TCA cycle (and ATP generation)

Electron transport chain, semi autonomous nature (mitochondrial DNA, RNA, ribosomes and protein synthesis)

Endoplasmic Reticulum

Extension of cell membrane, cisternae, Site of location

Compartmentalization of enzymes and metabolites and their associated functions.

Unit – III

Ribosomes

A complex of ribonucleoproteins,

Dynamics of association - disassociation of ribosomes into polysomes, microsomes, Site of protein synthesis (initiation, elongation, translocation and termination phases of protein synthesis)

Central dogma.

Lysosomes

Polymorphic single membrane structure, site of proteolytic activity for intracellular digestion

Phagocytosis, increase in lysosomal activity with age Lipofuscin pigments, diseases associated with lysosomes.

Peroxisomes and Glyoxisomes

Single membrane structure; site of enzyme complexes involved in hydrogen peroxide, metabolism, gluconeogenesis (conversion of non carbohydrate into carbohydrates) Glyoxylate pathway, microperoxisomes.

Cytoskeleton

Actin filament, Myosin, Intermediate filament, microtubules.

Unit – IV

Cell Surface Modifications

Glycocalyx, villi, microvilli, caveolae.

Cytoplasmic Inclusions

Inert storage materials, glycogen, starch, lipids, metabolic crystals

Nucleus

Nuclear membrane, pores, chromatin, (euchromatin & heterochromatin), nucleolus, Eukaryote chromosomes structure (DNA, Histone and other proteins, Nucleosome and solenoid concept). Kinetochore, centromere and gene structure.

Cell Continuity Phases of Cell cycle Mitosis and Meiosis

Suggested Reading Material:

1. Alberts, B. Bracy, P. Lewis, J. Raff, M. Roberts K and Watson, J. (eds) (1994). Molecular Biology of the Cell, Garland Publishing, New York.
2. Avers, C. J. (1976). Cell Biology, Van Nostrand Reinhold, New York.
3. Cooper, G. M. (2004). The cell, A Molecular Approach ASM press, Washington, D.C.
4. Chandra Roy, S and DE Kumar, K. (2001) Cell Biology. New Central Book Agency (P) Ltd. Kolkata.
5. Darnell, J. Lodish, H. and Baltimore, D. (2004). Molecular Cell Biology, 2nd edition, Freeman, New York.
6. Derobertis, E. D. P. and Derobertis, E.M.F. (1987). Essentials of Cell and Molecular Biology. Hold Saunders – Philadelphia.
7. Dewitt., W. (1977). Biology of the Cell – An evolutionary approach, Saunders – Philadelphia.
8. Holtzman, E. and Novikoff, A. B. (1984). Cells and Organelles. Saunder – Philadelphia.
9. Hopkins, C. L. (1978). Structure and Functions of Cells. Saunders – Philadelphia.
10. Karp, G. (1984). Cell Biology 4th Edition, McGraw Hill, New York.
11. Karp G. (1999). Cell and Molecular Biology. Concepts and Experiments, 2nd Edition John Wiley and Sons, Inc. New York, Brisbane, Toronto.
12. Loewy, A. G., Siekevitz, P, Menningee, J. R., and Allant, J. A. N. (1991). Cell Structure and Functions. An integrated Approach 3rd edition. Saunders College Publishing, Philadelphia, London.
13. Pollard. T.D. and Earnshaw, W.C. (2002) Cell Biology. Saunders, Philadelphia London. New York, St. Luis Sydney, Toronto.
14. Powar, C. B. (1990). Cell Biology. Himalaya Publishing House, Bombay.
15. Sadava, D. E. (1993). Cell Biology – Organelle, Structure and Fucntions. H. Jones and Bartlett-Boston.
16. Sheeler, P. and Binachi, D. E. (1983). Cell Biology, John Wiley, New York.
17. Smith & Wood (1992). Cell Biology, Chapman & Hall, London, New York.
18. Wolfe, S. L. (1983). Introduction of Cell Biology, Woodworth Belmont.

Master of Science (Zoology) (Session 2021-22)
(Semester-I)
Course Code: MZOP-1485
Course Title: Practical-I (Functional Organization of Animals-I)
(PRACTICAL)

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

Master of Science (Zoology) (Session 2021-22)
(Semester-I)
Course Code: MZOP-1485
Course Title: Practical-I (Functional Organization of Animals-I)
(PRACTICAL)

Time: 3 hrs.

Max. Marks: 50

Theory: 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:

- Mouth parts : honey bee, housefly, cockroach, butterfly, mosquito, and bug.
- Salivary glands.
- Blood of animals.
- Radula of Pila and jaws of Leech

2. 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 & vertebrates.
- Reproductive organs in Hydra, Flatworm, Earthworm, Cockroach, Pila, Fish, Frog, Lizard, Bird and Rat.

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

Master of Science (Zoology) (Session 2021-22)
(Semester-I)
Course Code: MZOP-1486
Course Title: Practical-II (Ecology and Cell Biology)
(PRACTICAL)

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.

Master of Science (Zoology) (Session 2021-22)
(Semester-I)
Course Code: MZOP-1486
Course Title: Practical-II (Ecology and Cell Biology)
(PRACTICAL)

Time: 3 hrs.

Max. Marks: 50

Theory: 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.

Microscopy:

Principles of compound, phase contrast, electron microscopy. Use and care of Light compound microscope.

Lens aberrations

Study of Cells: 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.).

Cytochemical techniques:

Study carbohydrates, nucleic acids, proteins, lipids and enzymes.

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

Scheme of Studies and Examination
Master of Science (Zoology) Session: 2021-22 SEMESTER II

Master of Science (Zoology) Semester -II							
Course Code	Course Name	Course Type	Marks				Examination time (in Hours)
			Total	Ext.		CA	
				L	P		
MZOL-2481	Functional Organization of Animals – II	C	100	80	-	20	3
MZOL-2482	Applied Zoology- I (Invertebrates)	C	75	60	-	15	3
MZOL-2483	Evolution	C	50	40	-	10	3
MZOL-2334	Biostatistics	C	50	40	-	10	3
MZOS-2485	Seminar	C	50	40	-	10	3
MZOP-2486	Practical-III (Functional Organization of Animals-II)	C	50	-	40	10	4
MZOP-2487	Practical- IV (Evolution and Applied Zoology-I)	C	50	-	40	10	4
Total			425				

Master of Science (Zoology) (Session 2021-22)
(Semester–II)
Course Code: MZOL-2481
Course Title: Functional Organization of Animals –II
(THEORY)

COURSE OUTCOMES

After passing this course the student will be able to:

- CO1 Describe the specializations and evolution of skin.
- CO2 Describe the physiology of nervous system of human beings.
- CO3 Understand the physiology of sense organs, muscles and endocrine system.

Master of Science (Zoology) (Session 2021-22)
(Semester–II)
Course Code: MZOL-2481
Course Title: Functional Organization of Animals –II
(THEORY)

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

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 fibre 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 Electoreceptors) Additional special sensory organ

Suggested Reading Material.

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

16. Willmer, P., Stone, G. and Johnston, I (2000). Environmental Physiology of Animals, Blackwell Science.
17. Withers, P.C. (1992), Comparative Animal Physiology. Saunder College Publishing New York

Master of Science (Zoology) (Session 2021-22)
(Semester–II)
Course Code: MZOL-2482
Course Title: Applied Zoology –I
(THEORY)

COURSE OUTCOMES

After passing this course the student will be able to:

- CO1 Describe the Taxonomy, Morphological sex differences in larva and adult of beneficial and harmful insects.
- CO2 Understand the culture of mulberry plants, mulberry silk and silk gland.
- CO3 Know the culture methods of *B.mori* and *Apis*.
- CO4 Understand the diseases and pests of *B.mori* and plants.
- CO5 Study the quality of silk and marketing strategies of silk.
- CO6 Know the culture and harvesting methods of Lac.
- CO7 Describe the insect species and host plants of Lac.
- CO8 Know the culture methods of honeybee and prawn.

Master of Science (Zoology) (Session 2021-22)

(Semester–II)

Course Code: MZOL-2482

**Course Title: Applied Zoology –I
(THEORY)**

Time: 3 hrs.

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

Arthropods (Important Species and their Economic Importance)

Diplopods and chilopods Arachnids (other than plant pests)

Insects (other than insect pests of crops, parasites of man and domestic animals) As pollinators

In Biological pest management As source of food

Venomous insects

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

Crustaceans (Important species and their Economic Importance)

Crab, lobsters, copepods. **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

Molluscs (Economically important species)

Eulamellibranchs Gastropods Cephalopods **Pearl Culture**

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

Unit – IV

Economic Importance of Protozoans

Important Parasitic species, diseases caused, prevention and cure.

Annelids

Leeches

Vermiculture; species of worms, conditions for efficient vermiculture (domestic and commercial level), Economics of Vermiculture

Helminthes

Liver flukes Cestodes/ tapeworms

Roundworms (Animal and plant parasitic Nematodes)

Echinoderms Sea cucumbers Star Fish

Suggested Reading Material

1. Bhamrah, H. S. & Juneja, K. (2001), An Introduction to Mollusca. Anmol Publications Pvt., Ltd. New Delhi.
2. Bhatnagar, R. K. and Palta, R. K. (2003), Earthworm ; Vermiculture and Vermicomposting , Kalyani Publishers India.
3. Carter, G. A. (2004) Beekeeping , Biotech Books, New Delhi.
4. Fennermore, P. G. and Prakash, A. (1992), Applied Entomology, Wiley Eastern Ltd. New Delhi.
5. Ghorai, N. (1995), Lac Culture in India. International Books and Periodicals, New Delhi.
6. Jhingran , V. G. (1991) Fish and Fisheries of India, Hindustan Publishing Company India.
7. Kumar, A. and Nigam, P. M. (1989), Economic and Applied Entomology EMKAY Publishing Co. New Delhi.

8. Mishra, R. C. (1995), Honey Bees & their Management in India. ICAR, New Delhi.
9. Mustafa, S. (1990) Applied and Industrial Zoology. Associated Publishing Company, New Delhi.
10. Shukla, G. S. & Upadhaya, V. B. (1991-92), Economic Zoology, Rastogi Publications, Meerut.
11. Sathe, T. V. and Jadhav, A. D. (2001) Sericulture and Pest Management, Daya Publishing House, New Delhi.
12. Shimizu, M. (1972) Handbook of Silkworm Rearing (Agricultural Techniques Manual- Fuji Publishing Co. Ltd , Tokyo, Japan.
13. Singh, S. (1962), Bee Keeping in India, I. C. A. R. Publications, New Delhi.
14. Sobti, R. C. (1992), Medical Zoology, Nagin Chand & Co. Jalandhar.
15. Srivastava, P. A. (1977), Economic Zoology, Commercial Publication Bureau, Kanpur.
16. Ullal, S.R. and Narsimhanna, M. N. (1981), A Handbook of Practical Sericulture, Central Silk Board, Bombay.
17. Venkatanarasiah, P. (1992), Sericulture in India, Ashish Publishing House, New Delhi.

Master of Science (Zoology) (Session 2021-22)

(Semester–II)

Course Code: MZOL-2483

Course Title: Evolution

(THEORY)

COURSE OUTCOMES

After passing this course the student will be able to:

- CO1: Understand that many of the organisms that inhabit the Earth today are different from those that inhabited it in the past.
- CO2: Understand that the four propositions underlying Darwin's theory of evolution through natural selection are:
 - (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
- CO3: Explain adaptation, providing examples from several different fields of biology.
- CO4: Explain how the molecular record provides evidence for evolution.
- CO5: Understand the Human origin and evolution.

Master of Science (Zoology) (Session 2021-22)

(Semester–II)

Course Code: MZOL-2483

Course Title: Evolution

(THEORY)

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

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 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 Causes of extinction

Major extinctions

Unit-IV

Quantative and Molecular Aspects of Evolution

Hardy- Weinberg law Selection pressure Mutation pressure Genetic drift Migration

Meiotic drive Brief account of:

Evolution of genome in viruses, prokaryotes and eukaryotes Evolution of sexual reproduction,
Molecular clocks

Future Course of Evolution

Suggested Reading Material

1. Avers, C. J.(1989). Evolution Process and Pattern in Evolution Oxford University, Press, New York, Oxfor.
2. Ayala, F. J. and Valentine J. W. (1979). Evolving the theory and Process of Organic Evolution, Benjamin Cumming.
3. Brookfield, A. P. (1986). Modern aspects of Evolution. Hutchinson London, Melbourne.
4. Gallow, P. (1983). Evolutionary principles. Chapman and Hall.
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 edition), Oxford University Press.
8. Minkoff, E. C. (1983), Evolutionary Biology, Addison Wesley Pub. Co., London.
9. Wen-Hsiung Li (1997), Molecular Evolution, Sinauer associates Inc.Pub. USA.

Master of Science (Zoology) (Session 2021-22)

(Semester–II)

Course Code: MZOS-2485

Course Title: Seminar

(THEORY)

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.

Master of Science (Zoology) (Session 2021-22)

(Semester–II)

Course Code: MZOS-2485

Course Title: Seminar

Time: 3 hrs.

Max. Marks: 50

Theory: 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 50 marks (10 for material, 15 for presentation, 5 for discussion and 10 for the seminar based paper at the end of the semester).

Master of Science (Zoology) Semester–II

Session- 2021-22

Course Code- MZOP-2486

Course Title- PRACTICAL –III (Functional Organizations of Animals-II)

(PRACTICAL)

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

Master of Science (Zoology) Semester–II

Session- 2021-22

Course Code- MZOP-2486

Course Title- PRACTICAL –III (Functional Organizations of Animals-II)

(PRACTICAL)

Time: 3 hrs.

Max. Marks: 50

Theory: 40

CA: 10

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

Master of Science (Zoology) Semester–II

Session- 2021-22

Course Code- MZOP-2487

Course Title- PRACTICAL IV (Evolution and Applied Zoology-I)

(PRACTICAL)

COURSE OUTCOMES

After passing this course the student will be able to:

- CO1 Know the Animals of evolutionary importance, fossils, analogous and homologous organs, Mimicry and Colouration.
- CO2 Acquaint with the applied aspects of Zoology i.e. sericulture, lac culture, 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

Master of Science (Zoology) Semester–II

Session- 2021-22

Course Code- MZOP-2487

Course Title- PRACTICAL IV (Evolution and Applied Zoology-I)

(PRACTICAL)

Time: 3 hrs.

Max. Marks: 50

Theory: 40

CA: 10

- Calculations for regression, correlation and variance of gene frequency and genetic equilibrium (taking pea pods).
- Examination of the principle of natural selection as a process related to evolution in a population (using coloured marbles /beads).
- Comparison of skeletons for listing evolutionary trends.
- Comparison of molluscan shells to depict polyphyletic origin.
- Comparison of homologous and analogous structures (e.g. insect antenna, legs, limbs of vertebrate etc.).
- Demonstration of kinds of mimicry in various groups of animals.
- Mapping of geographic distribution of some birds, insects, fish etc.
- Study of various evolutionary phenomenon using slides / photographs.
- Study of fossils.
- Preparation of Phylogenetic tree using some Priority weight characters with the help of 8 – 10 animals from various categories.
- 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. Practical involving animal material will be conducted using models/charts/e-resources. Minor modifications in the curriculum are allowed subject to availability of resources.

Scheme of Studies and Examination

Master of Science (Zoology) Session: 2021-22

Master of Science (Zoology) Semester -III							
Course Code	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	C	75	60	-	15	3
MZOP-3485	Practical-V (Research Techniques and Applied Zoology-II)	C	50	-	40	10	4
MZOP-3486	Practical- VI (Developmental Biology and Biochemistry)	C	50	-	40	10	4
Total			475				

Master of Science (Zoology) Semester–III

Session- 2021-22

Course Code- MZOL-3481

Course Title- Research Techniques and methodology

(THEORY)

COURSE OUTCOMES

After passing this course the student will be able to:

- CO1 Understanding the theoretical principles and applications of immunological techniques.
- CO2 Understanding of the theoretical principles of centrifugation techniques and the scope of their applications.
- CO3 Understanding of the theoretical principles of electrophoretic and some electroanalytical techniques and their applications.
- CO4 Explain the theoretical principles and applications of a range of chromatographic techniques.
- CO5 Understanding of physical, chemical, biological principles behind techniques used to separate macromolecules.
- CO6 Understanding purification methods for isolating macromolecules in scientific research

Master of Science (Zoology) Semester–III

Session- 2021-22

Course Code- MZOL-3481

Course Title- Research Techniques and methodology

(THEORY)

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

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.

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) Semester–III

Session- 2021-22

Course Code- MZOL-3482

Course Title- Developmental Biology

(THEORY)

COURSE OUTCOMES

After passing this course the student will be able to:

- CO1: To impart knowledge regarding basic concepts of differentiation and growth, differential gene expression as well as cytoplasmic determinants to the students.
- CO2: To develop detailed understanding of essential events of developmental biology through proper explanation of gametogenesis, fertilization, blastula formation, gastrulation as well as embryological induction as part of early embryonic development.
- CO3: To provide adequate explanation to the students regarding concepts of late embryonic developmental events including fate map, germ layers development, extra-embryonic membranes, embryo implantation and significance of placental formation.
- CO4: To give adequate information to the students regarding post embryonic development especially, metamorphosis, regeneration and ageing processes.
- CO5: To make the students aware about modern implications of developmental biology by impartment of knowledge regarding in-vitro fertilization

Master of Science (Zoology) Semester–III

Session- 2021-22

Course Code- MZOL-3482

Course Title- Developmental Biology

(THEORY)

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, vitellogenesis Egg 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 during cleavage

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 and amphibians

Regeneration in Platyhelminthes and Coelenterates Histomorphological changes in regeneration of tail in Amphibians and Reptiles, 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. Waddington 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) Semester–III

Session- 2021-22

Course Code- MZOL-3483

Course Title- Biochemistry

(THEORY)

COURSE OUTCOMES

After passing this course the student will be able to:

- CO1 Students will understand the synthesis of proteins, lipids, nucleic acids, and carbohydrates and their role in metabolic pathways along with their regulation at the epigenetic, transcriptional, translational, and post-translational levels including RNA and protein folding, modification, and degradation. Regulation by non-coding RNAs will be tied to the developmental and physiological functioning of the organism.
- CO2 Students will analyze structural-functional relationships of genes and proteins from bacteria to eukaryotes using genomic methods based on evolutionary relationships.
- CO3 Demonstrate an understanding of the chemistry, structure and function of biological molecules
- CO4 Explain biological mechanisms, such as the processes and control of bioenergetics and metabolism as chemical reactions
- CO5 Demonstrate an understanding of the principles, and have practical experience of, a wide range of biochemical techniques (e.g. basic molecular biology, cell biology and microbiology methods, Spectrophotometry, the use of standards for quantification, enzyme kinetics; macromolecular purification, chromatography and electrophoresis)
- CO6 To analyze the biochemical data (e.g. in enzyme kinetics, molecular structure analysis and biological databases)

Master of Science (Zoology) Semester–III

Session- 2021-22

Course Code- MZOL-3483

Course Title- Biochemistry

(THEORY)

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, V_{max} and K_m and their significance.. Reversible and Irreversible inhibition, Regulatory enzymes.

Unit–II

Brief introduction to Bioenergetics 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

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) Semester–III

Session- 2021-22

Course Code- MZOL-3484

Course Title- Applied Zoology- II (Vertebrates)

(THEORY)

COURSE OUTCOMES

After passing this course the student will be able to:

- CO1 Understand the concept of Fish culture, poultry, dairy farming, and wool industry.
- CO2 Understanding of Pharmaceutical products from animals.
- CO3 Understanding of problems associated to economically important animals.
- CO4 Skill development for small scale industry

Master of Science (Zoology) Semester–III

Session- 2021-22

Course Code- MZOL-3484

Course Title- Applied Zoology- II (Vertebrates)

(THEORY)

Time: 3 hrs.

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) Semester–III

Session- 2021-22

Course Code- MZOP-3485

Course Title- PRACTICAL- V (RESEARCH TECHNIQUES AND APPLIED ZOOLOGY-II)

(PRACTICAL)

COURSE OUTCOMES

After passing this course the student will be able to:

- CO1 Understanding of various scientific research techniques
- CO2 Estimation of protein content, DNA/RNA
- CO3 Understanding of economically important animals rearing, use of their products and awareness of small scale industry

Master of Science (Zoology) Semester–III

Session- 2021-22

Course Code- MZOP-3485

Course Title- PRACTICAL- V (RESEARCH TECHNIQUES & APPLIED ZOOLOGY-II)

(PRACTICAL)

Time: 3 hrs.

Max. Marks: 50

Theory: 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 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

Visit 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) Semester–III

Session- 2021-22

Course Code- MZOP-3486

Course Title- PRACTICAL- VI (DEVELOPMENTAL BIOLOGY AND BIOCHEMISTRY)

(PRACTICAL)

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
- CO3 Understanding of techniques related to protein, lipids and carbohydrates estimation

Master of Science (Zoology) Semester–III

Session- 2021-22

Course Code- MZOP-3486

Course Title- PRACTICAL- VI (DEVELOPMENTAL BIOLOGY AND BIOCHEMISTRY)
(PRACTICAL)

Time: 3 hrs.

Max. Marks: 50

Theory: 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

Scheme of Studies and Examination

Master of Science (Zoology) Session: 2021-22

Master of Science (Zoology) Semester -IV							
Course Code	Course Name	Course Type	Marks				Examination time (in Hours)
			Total	Ext.		CA	
				L	P		
MZOL-4481	Animal Behaviour and Wildlife Conservation	C	100	80	-	20	3
MZOL-4482	Animal Genetics and 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 Conservation)	C	50	-	40	10	4
MZOP-4486	Practical - VIII (Genetics and Biosystematics)	C	50	-	40	10	4
MZOP-4487	Project Report	C	Satisfactory/ Unsatisfactory				
Total			450				

Master of Science (Zoology) Semester–IV
Session-2021-22
Course Code: MZOL-4481
Course Title: Animal Behaviour and Wildlife Conservation
(Theory)

COURSE OUTCOMES

After passing this course the student will be able to:

- CO1 Demonstrate knowledge of key concepts in animal behaviour
- CO2 Understanding and identify behaviors in a variety of taxa
- CO3 Designing and implementing experiments to test hypothesis relating to animal behaviour
- CO4 Completely discuss the evolutionary origins of various behaviors
- CO5 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
- CO6 Adaptive significance of behaviour, emphasizing animal communication, social behavior, territoriality, sexual selection and mating systems
- CO7 Demonstrate skills in the collection of behavioural data in the field.
- CO8 Understanding and awareness for wildlife conservation
- CO9 Knowledge of conservation of threatened animal species

Master of Science (Zoology) Semester–IV

Session-2021-22

Course Code: MZOL-4481

Course Title: Animal Behaviour and Wildlife Conservation

(Theory)

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

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

Social Behaviour

Unit–II

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 statutory bodies for protecting wildlife

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

Status of Wildlife in Punjab

Unit–IV

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 Reservoirs in 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 Survey of India, Calcutta.
28. Tirvedi, P.R. and Singh, U. K. (1996), Environmental Laws of Wildlife.

Master of Science (Zoology) Semester–IV

Session-2021-22

Course Code: MZOL-4482

**Course Title: Animal Genetics and Biotechnology
(Theory)**

COURSE OUTCOMES

After passing this course the student will be able to:

- CO1: describe the basic principles and techniques in genetic manipulation and genetic engineering.
- CO2: describe gene transfer technologies for animals and animal cell lines.
- CO3: Learn different techniques for animal research
- CO4: To understand genetic material, processes related to hereditary, problems associated with genes
- CO5: have Knowledge of microorganism

Master of Science (Zoology) Semester–IV

Session-2021-22

Course Code: MZOL-4482

Course Title: Animal Genetics and Biotechnology

(Theory)

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, Heterochromatin 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 hybridization.

Unit–II

Mutations

Introduction and classification of mutation

Molecular basis of mutation

Radiation and chemical induced 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, DNAfoot printing.

In situ hybridization, RFLP.

Practical applications of gene cloning.

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., Fritsch, 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-2021-22

Course Code: MZOL-4483

Course Title: Concepts of Immunology

(THEORY)

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
- CO3 Define the basic mechanisms that regulate immune responses and maintain tolerance
- CO4 Explain the cellular and molecular aspects of lymphocyte activation, homeostasis, differentiation, and memory.
- CO5 Understand the molecular basis of complex, cellular processes involved in inflammation and immunity, in states of health and disease
- CO6 Describe basic and state-of-the-art experimental methods and technologies
- CO7 Integrate knowledge of each subsystem to see their contribution to the functioning of higher-level systems in health and disease

Master of Science (Zoology) Semester–IV

Session-2021-22

Course Code: MZOL-4483

Course Title: Concepts of Immunology

(THEORY)

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, aetiology, 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, Gower 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- 2021-22

Course Code: MZOL-4484

Course Title: Biosystematics

After passing this course the student will be able to:

- CO1 Understand the patterns and processes of evolution above the species level
- CO2 Appreciate the differences between the three methods of phylogenetic analysis: evolutionary systematics, phenetics, cladistics.
- CO3 Classify using scientific names and the hierarchy.
- CO4 have knowledge of preparing scientific reports
- CO5 Understanding of taxonomic classification

Master of Science (Zoology) Semester–IV

Session- 2021-22

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. Sebh, 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- 2021-22

Course Code: MZOP-4485

Course Title: PRACTICAL-VII (Animal Behaviour and Wild Life Conservation)

(PRACTICAL)

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- 2021-22

Course Code: MZOP-4485

Course Title: PRACTICAL-VII (Animal Behaviour and Wild Life Conservation)

(PRACTICAL)

Time: 3 hrs.

Max. Marks: 50

Theory: 40

CA: 10

1. To study the influence of temperature on development and population built 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 in Earthworm 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) *Drosophila / 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- 2021-22

Course Code: MZOP-4486

Course Title: PRACTICAL-VIII (Animal Genetics and Biosystematics)

(PRACTICAL)

COURSE OUTCOMES

After passing this course the student will be able to:

- 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

Master of Science (Zoology) Semester–IV

Session- 2021-22

Course Code: MZOP-4486

Course Title: PRACTICAL-VIII (Animal Genetics and Biosystematics)

(PRACTICAL)

Time: 3 hrs.

Max. Marks: 50

Theory: 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.

Master of Science (Zoology) Semester–IV

Session- 2021-22

Course Code: MZOP-4487

Course Title: Project

This non credit compulsory course has been introduced to make students learn how to design an experiment and what are various research strategies. The students can opt for any one from the following and will submit a detail report after successful completion.

KANYA MAHAVIDYALAYA, JALANDHAR (AUTONOMOUS)
SCHEME AND CURRICULUM OF EXAMINATIONS OF TWO YEAR
DEGREE PROGRAM

Scheme for M. Sc. (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-2021-22)
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

1. Biologically important molecules: Carbohydrates, lipids, proteins and nucleic acids.
2. 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

3. 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

4. The basic principle of heredity: Mendals law, monohybrid cross, dihybrid cross.
5. DNA – Double helix structure and replication.
6. Genes expression: Transcription and translation, genetic code.

UNIT-IV

The Diversity of Life

7. The classification of Living things – Criteria of classification, Whittaker's systems of classification, their characteristics with are example of each.
8. 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-2021-22

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: 2021-22

Course Code: BBTM-1483

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: 2021-22

Course Code: BBTM-1483

Cell Biology

(Theory)

Time: 3 Hours

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.Freeman& 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, 5th Edition, Garland Science.

Bachelor of Science (Bio-Technology) Semester-I

Session: 2021-22

Course Code: BBTM-1483(P)

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: 2021-22

Course Code: BBTM-1483 (P)

Cell Biology

(Practical)

Time: 3 Hours

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, Ahmedabad.
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-2021-22

SEMESTER II									
Zoology-I	B.Sc. (Biotechnology)	BBTM-2484	C	60	Zoology-I (Theory)	30	-	12	3
		BBTM-2484 (P)			Zoology-I (Practical)	-	18		3

B.Sc. Biotechnology (Semester-II) (Session: 2021-22)

Zoology-I

Course Code: BBTM-2484

(Theory)

COURSE OUTCOMES

After passing this course the student will be able to:

- CO1 Understand the general classification of Animal Kingdom.
- CO2 Familiarize with the various classes of animal Kingdom.
- CO3 Understand the digestive system, respiratory system, excretory and circulatory system of man..
- CO4 Come to know the various effects viz. bohr effect, haldane effect etc.
- CO5 Understand the skeletal system, neural integration and endocrine system of man.

B.Sc. Biotechnology (Semester-II) (Session: 2021-22)

Zoology-I

Course Code: BBTM-2484

(Theory)

Time: 3 Hrs.

Max. Marks: 60

Theory: 30

Practical: 18

CA: 12

Periods: 4

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- I

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- II

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- III

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- IV

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.

B.Sc. Biotechnology (Semester-II) (Session: 2021-22)

Zoology-I Lab

Course Code: BBTM-2484 (P)

(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.

B.Sc. Biotechnology (Semester-II) (Session: 2021-22)

Zoology-I

Course Code: BBTM-2484

(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-2021-22

B. Sc. Biotechnology Semester IV									
Course Name	Pogram Name	Course Code	Course Type	Marks					Exami nation 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

B.Sc. Biotechnology (Semester-IV) (Session: 2021-22)

Zoology-II

Course Code: BBTM-4486

(Theory)

Course Outcomes

- Identify the contributions of various Evolutionists.
- Understanding the process and theories in evolutionary biology.
- To aware the students for various parasites and diseases which spreads in human with the help of study of host-parasite relationship.
- To increase awareness for the health in students.

B.Sc. Biotechnology (Semester-IV) (Session: 2021-22)

Zoology-II

Course Code: BBTM-4486

(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.

Section–A

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).

Section–B

Evolution: Definition, Scope and History, Theories of Evolution (Lamarckism, Darwinism, Hugo de Vries and Modern theory of Evolution).

Geological time scale.

Section–C

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.

Section-D

Arthropod vectors of human diseases: Malaria, Yellow fever, Dengue haemorrhagic 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.

B.Sc. Biotechnology (Semester-IV) (Session: 2021-22)

Zoology-II

Course Code: BBTM-4486 (P)

(Practical)

Course outcomes

- To aware the students for various parasites and diseases which spreads in human with the help of study of host-parasite relationship.
- To aware about the typhoid, cholera likes disease.
- Understanding of evolutionary phenomena.

B.Sc. Biotechnology (Semester-IV) (Session: 2021-22)

Zoology-II

Course Code: BBTM-4486 (P)

(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.