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GURU JAMBHESHWAR UNIVERSITY OF SCIENCE & TECHNOLOGY, HISAR
(Established by State Legislature Act 17 of 1995)
'A+' Grade, NAAC Accredited State Govt. University

Acad./AC-III/BOS&R-34/2026/ 4736
Dated: 29/7/26

To

The Controller of Examinations
GJUS&T, Hisar.

Sub.

Approval of the scheme of examinations and syllabi of following programmes under NEP-2020 being run in University Teaching Departments and affiliated degree College(s) w.e.f. academic session mentioned against each:

1. Scheme of examinations and syllabi of 'Zoology' subject of B.Sc. Life Sciences – 1st to 6th semester w.e.f. academic session 2026-27 as per NEP-2020 being run in affiliated degree College(s)
2. Scheme of examinations (1st to 6th semester) and syllabi (1st and 2nd semester) of B.Sc. with Major in Zoology, under Scheme- "C" w.e.f. academic session 2026-27 as per NEP-2020 in affiliated degree College(s).
3. Scheme of examinations and syllabi of M.Sc. Zoology- (3rd and 4th semester) as per NEP-2020 w.e.f. academic session 2026-27 (Batch- 2025) being run in University Teaching Departments and affiliated degree College(s).

Sir,

I am directed to inform you that the Vice-Chancellor, on the recommendations of Dean, Faculty of Environmental and Bio Sciences & Technology, on dated 27.07.2026, is pleased to approve the scheme of examinations and syllabi of above said programme(s) academic session mentioned against each, under NEP-2020 being run by University Teaching Departments and affiliated degree College(s), under Section 11(5) of the University Act, 1995 in anticipation of approval of the Academic Council.

A copy of the scheme of examinations and syllabi of above said courses is enclosed herewith. You are therefore, requested to take further necessary action accordingly.

Yours faithfully

DA: As above

Dy. Supdt. (Academic)
for Assistant Registrar (Acad.)

Endst. No. Acad./AC-III/BOS&R-34/2026/ 4737-51

Dated: 29/7/26

A copy of the above is forwarded to the following for information and necessary action:-

1. Dean, Faculty of Environmental and Bio Sciences & Technology, GJUST, Hisar.
2. Chairperson, Department of Zoology, GJUST, Hisar. She is requested to get upload the scheme of examinations and syllabi of above said programme(s) being run by University Teaching Departments and affiliated degree College(s) on the website of the University on the priority basis.
3. Principals, concerned affiliated degree Colleges alongwith the copy of the scheme of examinations and syllabi of above said programme(s) being run by affiliated degree College(s).
4. OSD to Vice-Chancellor (for kind information of the Vice-Chancellor), GJUST, Hisar.
5. P.A. to Registrar (for kind information of the Registrar), GJUST, Hisar.

Dy. Supdt. (Academic)



Department of Zoology

Scheme of Examination and Syllabus for Under Graduate Programme

**Under Multiple Entry and Exit, Internship and
CBCS-LOCF as per NEP-2020
w.e.f. session 2026-27**

Subject: Zoology



**Guru Jambheshwar University of Science & Technology
Hisar-125001, Haryana
(A+ NAAC Accredited State Govt. University)**

Appl.
**Chairperson
Department of Zoology
GJUS&T, Hisar (Haryana)**



Guru Jambheshwar University of Science and Technology
Hisar-125001, Haryana
(‘A+’ NAAC Accredited State Govt. University)



Scheme of Examination and Syllabus for Under-Graduate Programme
For Affiliated Degree Colleges
According to National Education Policy-2020
(w.e.f. Session 2026-27)
Subject: Zoology

SEMESTER – I

Type of Course	Course Code	Nomenclature of Paper/Course	Credits	Contact Hours/Week	Internal Marks	External Marks	Total Marks	Duration of Exam (Hrs)
Discipline Specific Course (DSC)	C26ZOO101T/ C26MIN143T	Animal Diversity of Non-Chordates	3	3	20	50	70	2.5
	C26ZOO101P/ C26MIN143P	Animal Diversity of Non-Chordates Lab	1	2	10	20	30	3
Minor Course (MIC)	C24MIC143T	Introduction of Non-Chordates	2	2	15	35	50	2
Minor Course#	C26MIN143T/ C26ZOO101T	Animal Diversity of Non-Chordates	3	3	20	50	70	2.5
	C26MIN143P/ C26ZOO101P	Animal Diversity of Non-Chordates Lab	1	2	10	20	30	3
Multidisciplinary Course (MDC)	C26MDC129T	Domestic Animal Biology	2	2	15	35	50	2
	C26MDC129P	Domestic Animal Biology Lab	1	2	10	15	25	3
Skill Enhancement Course (SEC)	C24SEC131T	Apiculture	2	2	15	35	50	2
	C24SEC131P	Apiculture Lab	1	2	10	15	25	3
Value Added Course (VAC)	C24VAC105T	Biodiversity and Wildlife Management	2	2	15	35	50	2

SEMESTER – II

Type of Course	Course Code	Nomenclature of Paper/Course	Credits	Contact Hours/Week	Internal Marks	External Marks	Total Marks	Duration of Exam (Hrs)
Discipline Specific Course (DSC)	C26ZOO201T/ C26MIN243T	Animal Diversity of Chordates	3	3	20	50	70	2.5
	C26ZOO201P/ C26MIN243P	Animal Diversity of Chordates Lab	1	2	10	20	30	3
Minor Course (MIC)	C24MIC243T	Introduction of Chordates	2	2	15	35	50	2
Minor Course#	C26MIN243T/ C26ZOO201T	Animal Diversity of Chordates	3	3	20	50	70	2.5
	C26MIN243P/ C26ZOO201P	Animal Diversity of Chordates Lab	1	2	10	20	30	3
Multidisciplinary Course (MDC)	C26MDC229T	Basics of Human Systems	2	2	15	35	50	2
	C26MDC229P	Basics of Human Systems Lab	1	2	10	15	25	3
Skill Enhancement Course (SEC)	C24SEC231T	Fish Farming	2	2	15	35	50	2
	C24SEC231P	Fish Farming Lab	1	2	10	15	25	3
Value Added Course (VAC)	C24VAC105T	Biodiversity and Wildlife Management	2	2	15	35	50	2

#for Scheme C only

Charan Arora
Department of Zoology
GJUSET, Hisar (Haryana)

SEMESTER-III

Type of Course	Course Code	Nomenclature of Paper/Course	Credits	Contact Hours	Internal Marks	External Marks	Total Marks	Duration of Exam (Hrs)
Discipline Specific Course (DSC)	C24ZOO301T	Biomolecules and Mammalian Physiology	3	3	20	50	70	2.5
	C24ZOO301P	Biomolecules and Mammalian Physiology Lab	1	2	10	20	30	3
Minor Course (MIC)	C24MIC343T	Animal Taxonomy	3	3	20	50	70	2.5
	C24MIC343P	Animal Taxonomy Lab	1	2	10	20	30	3
Multidisciplinary Course (MDC)	C26MDC329T	Common Diseases and Their Pathogens	2	2	15	35	50	2
	C26MDC329P	Common Diseases and Their Pathogens Lab	1	2	10	15	25	3
Skill Enhancement Course (SEC)	C24SEC331T	Vermiculture and Vermicomposting	2	2	15	35	50	2
	C24SEC331P	Vermiculture and Vermicomposting Lab	1	2	10	15	25	3
Value Added Course* (VAC)	C24VAC307T	Ecology and Environment-I	2	2	15	35	50	2

#for Scheme C only

SEMESTER -IV

Type of Course	Course Code	Nomenclature of Paper/Course	Credits	Contact Hours	Internal Marks	External Marks	Total Marks	Duration of Exam (Hrs)
Discipline Specific Course (DSC)	C24ZOO401T	Cell Biology and Genetics	3	3	20	50	70	2.5
	C24ZOO401P	Cell Biology and Genetics Lab	1	2	10	20	30	3
Minor course (Vocational) [MIC(V)]	C24VOC443T	Animal Behaviour	2	2	15	35	50	2
	C24VOC443P	Animal Behaviour Lab	2	4	15	35	50	3
Value Added Course (VAC)	C24VAC307T	Ecology and Environment-I	2	2	15	35	50	2
Value Added Course (VAC)	C24VAC411T	Environmental Toxicology	2	2	15	35	50	2

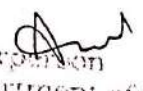

 Head of Institution
 (Signature of the Head of Institution)
 (Signature of the Head of Institution)

SEMESTER-V

Type of Course	Course Code	Nomenclature of Paper/Course	Credits	Contact Hours	Internal Marks	External Marks	Total Marks	Duration of Exam (Hrs)
Discipline Specific Course (DSC)	C24ZOO501T	Evolution and Developmental Biology	3	3	20	50	70	2.5
	C24ZOO501P	Evolution and Developmental Biology Lab	1	2	10	20	30	3
Minor course (Vocational) [MIC(V)]	C24VOC543T	Pest Management	2	2	15	35	50	2
	C24VOC543P	Pest Management Lab	2	4	15	35	50	3

SEMESTER-VI

Type of Course	Course Code	Nomenclature of Paper/Course	Credits	Contact Hours	Internal Marks	External Marks	Total Marks	Duration of Exam (Hrs)
Discipline Specific Course (DSC)	C24ZOO601T	Applied Zoology	3	3	20	50	70	2.5
	C24ZOO601P	Applied Zoology Lab	1	2	10	20	30	3
Minor course (MIC)	C24MIC643T	Basics of Endocrinology and Immunology	4	4	30	70	100	3
Minor course (Vocational) [MIC(V)]	C24VOC643T	Economic Zoology	2	2	15	35	50	2
	C24VOC643P	Economic Zoology Lab	2	4	15	35	50	3


 Chairperson
 Department of Zoology
 GRI/3867, Hisar (Haryana)

Programme Outcomes (PO)

PO1 Comprehensive understanding of the principles and practices of zoology which will make them able to work in the areas of research and development.

PO2 Students will gain knowledge to develop acquaintance of animal species around them and variations in their life cycles/biology and their interaction with the environment.

PO3 Students will be capable of using knowledge of subject and analytical methods in identifying and solving various complex situations of living forms and environment taking into consideration ethics and responsibilities.

PO4 Young students will be also be apprised about likeness between the physiological processes at the cellular and organismic levels.

PO5 Subject deals with animal kingdom, its structure, classification, habits & distribution of animals.

PO6 Understand the nature and basic concepts of cell biology, genetics, taxonomy, physiology, ecology and applied zoology etc.

PO7 Studying the subject, students will be able to understand how we function & interact with the world around us.

PO8 It also inculcates the spirit of resource conservation and love for nature that leads to save biodiversity and environment that is the need of the hour.

PO9 It induces entrepreneurship skills among students by imparting Knowledge of fish farming, apiculture, vermiculture and many more.

PO10 By studying Zoology, the students can be employed as life science scientist, marine biologists, educationists, wild life scientists, agriculture, forensic science and many more


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Zoology
Discipline Specific Course (DSC)
Animal Diversity of Non-Chordates (Semester-I)

Paper Code: C26ZOO101T/ C26MIN143T

Credits: 3

Contact hours/week: 3

Exam time: 2.5 Hrs

External Marks: 50

Internal Marks: 20

Total Marks: 70

Note: The examiner is required to set nine questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 2 marks each. In addition to this, eight more questions (each question of at least 2 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt five questions in all selecting one question from each unit in addition to compulsory Question No. 1. All questions will carry equal marks.

UNIT-I

Phylum Protozoa: General characters; classification up to classes; locomotion (pseudopodial, flagellar, and ciliary); reproduction (binary fission and conjugation); and the life cycle of *Plasmodium*.

Phylum Porifera: General characters; classification up to classes; canal systems (Ascon, Sycon, and Leucon); types of spicules and their formation.

UNIT-II

Phylum Coelenterata: General characters; classification up to classes; polymorphism in Siphonophores; coral reef types, formation, and ecological significance, threat factors to coral reefs and climate change impacts.

Phylum Platyhelminthes and Aschelminthes: General characters; classification up to classes; life cycles of *Taenia solium* and *Wuchereria bancrofti*; and parasitic adaptations in helminths.

UNIT-III

Phylum Annelida: General characters; classification up to classes; Metamerism and its evolutionary significance; structural diversity of larval forms (trochophore). Excretion mechanisms (Nephridial system).

Phylum Arthropoda: General characters; classification up to classes; vision in arthropods; types of metamorphosis in insects. Respiration types in arthropods.

UNIT-IV

Phylum Mollusca: General characters; classification up to classes; mechanism and significance of torsion and detorsion in Gastropoda; biological process of pearl formation.

Phylum Echinodermata: General characters; classification up to classes; the water-vascular system in Asteroidea; Larval forms of echinoderm and their developmental stages. Evolutionary affinities of Echinodermata with Chordates.


Chairperson
Department of Zoology
GJUS&T, Hisar (Haryana)

Animal Diversity of Non-Chordates Lab

Paper Code: C26ZOO101P/C26MIN143P

Credits: 1

Contact hours/week: 2

Exam time: 3 Hrs

External Marks: 20

Internal Marks: 10

Total Marks: 30

1. Systematic Position, Diagnostic Characters, and Ecological Importance of the Following Organisms:

Porifera: *Sycon*, *Hyalonema*, *Euplectella*.

Coelenterata: *Obelia*, *Physalia*, *Aurelia*, *Tubipora*, *Metridium*.

Helminths: *Taenia solium* and *Ascaris lumbricoides* (male and female dimorphism).

Annelida: *Aphrodite*, *Nereis*, *Heteronereis*, *Pheretima* (earthworm), *Hirudinaria* (leech).

Arthropoda: *Palaemon* (prawn), *Cancer* (crab), *Limulus*, *Palamnaeus* (scorpion), *Scolopendra* (centipede), *Julus* (millipede), *Periplaneta* (cockroach).

Mollusca: *Chiton*, *Dentalium*, *Pila*, *Unio*, *Sepia*, *Octopus*.

Echinodermata and Hemichordata: *Pentaceros*, *Ophiothrix*, *Echinus*, *Cucumaria*, *Balanoglossus*.

2. Permanent Slides:

Protozoa: *Amoeba*, *Euglena*, *Paramecium* (whole mount).

Porifera: Transverse section (T.S.) and longitudinal section (L.S.) of *Sycon*; spicules of *Porifera*.

Helminths: *Cysticercus* larva of *Taenia solium*; T.S. of male and female *Ascaris lumbricoides*.

Coelenterata: Permanent slide of *Obelia*.

Note: Students/Candidates are required to obtain minimum passing marks separately in practical component and theory as per the University rules.

Suggested Readings:

1. Anderson D.T. (1999) Invertebrate Zoology, Oxford University Press
2. Ayyar, E.K and Ananthakrishnan, T.1992. Manual of Zoology Vol.1, Invertebrates Part I and II, S.Viswanathan Printers and Publishers Pvt. Ltd. Madras.

Chairperson
Department of Zoology
GJUS&T, Hisar (Haryana)

3. Jordan, E.L and Verma, P.S. 2009. Invertebrate Zoology, S.Chand and Co. Ltd. New Delhi.
4. Kotpal, R.L. 2021. Zoology Invertebrates. Rastogi Publications, Meerut.
5. Lal S.S. (2019) Practical Zoology Invertebrates. Rastogi Publications, Meerut
6. Nair, N.C., Arumugam, N., Soundarapandian, N., Murugan, T.and Leelavathy, S.2010. A textbook of Invertebrates. Saras Publication, Nagercoil.
7. Rastogi V.B. 2021. Invertebrate Zoology. Kedar Nath Ram Nath, Meerut

Course Outcomes (CO):

At the end of the course, the students would be able to:

- CO 1 Recall the general characters, classification, diagnostic features, and systematic position of major invertebrate phyla and their representative organisms.
- CO 2 Explain the structural organization, life cycles, larval forms, locomotion, reproduction, and physiological processes of selected invertebrates.
- CO 3 Identify representative specimens, permanent slides, and anatomical structures based on their diagnostic characters, classification, and ecological importance.
- CO 4 Analyze the structural, functional, and evolutionary adaptations of different invertebrate groups, including their life cycles and developmental patterns.
- CO 5 Evaluate the ecological and evolutionary significance of key biological phenomena such as coral reef formation, parasitism, metamerism, torsion and detorsion, and the evolutionary affinities of Echinodermata with Chordata.

Mapping: C26ZOO101T/ C26MIN143T and C26ZOO101P/ C26MIN143P

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	M	S	M	S	W	M
CO2	S	M	S	M	S	S	W	S	M	M
CO3	S	S	M	M	S	S	S	S	S	S
CO4	S	S	M	S	S	M	M	M	M	S
CO5	M	S	M	M	S	S	M	S	S	S

S= strong M= medium W= weak

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Zoology
Minor Course (MIC)
Introduction of Non-Chordates (Semester-I)

Paper Code: C24MIC143T

Credits: 2

Contact hours/week: 2

Exam.Time: 2 Hrs

External Marks: 35

Internal Marks: 15

Total Marks: 50

Note: The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four more questions (each question may be of 2 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt three questions in all selecting one question from each unit consisting of 10 marks each in addition to compulsory Question No. 1.

UNIT- I

Phylum Protozoa: General characters and classification of Protozoa with their ecological and economic importance.

Phylum Porifera: General characters and classification of Porifera with their ecological and economic importance.

Phylum Coelentrata: General characters and classification of Coelentrata with their ecological and economic importance.

Phylum Platyhelminthes and Aschelminthes: General characters and classification of Helminthes with their ecological and economic importance.

UNIT- II

Phylum Annelida: General characters and classification of Annelida with their ecological and economic importance.

Phylum Arthropoda: General characters and classification of Arthropods with their ecological and economic importance.

Phylum Mollusca: General characters and classification of Mollusca with their ecological and economic importance.

Phylum Enchinodermata: General characters and classification of Echinoderms with their ecological and economic importance.

Phylum Hemichordata: General Characters of Hemichordates with examples.

Suggested Readings:

1. Jordan, E.L and Verma, P.S. 2009. Invertebrate Zoology, S.Chand and Co. Ltd. New Delhi.
2. Ayyar, E.K and Ananthakrishnan, T.1992. Manual of Zoology Vol.1 Invertebrates Part I and II, S.Viswanathan Printers and Publishers Pvt. Ltd. Madras.

Chandrasekhar
Department of Zoology
University of Haryana

3. Kotpal R.L. 2021. Zoology Invertebrates. Rastogi Publications, Meerut.
4. Nair, N.C., Arumugam, N., Soundarapandian, N., Murugan, T., and Leelavathy, S. 2010. A textbook of Invertebrates. Saras Publication, Nagercoil.
5. Rastogi V.B. 2021. Invertebrate Zoology. Kedar Nath Ram Nath, Meerut
6. Lal S.S. 2019. Practical Zoology Invertebrates. Rastogi Publications, Meerut
7. Anderson D.T. (1999) Invertebrate Zoology, Oxford University Press
8. Edward, E., Ruppert, Robert, D. and Barnes (1994). Invertebrate Zoology; Saunders College Pub.

Course Outcomes (CO):

At the end of the course, the students would be able to:

CO1 Understand about phylum Protozoa and Porifera

CO2 Understand about phylum Coelenterata and Helminthes **CO3** Understand about phylum Annelida and Arthropoda

CO4 Understand about phylum Mollusca, Echinodermata and Hemichordates.

CO5 Identifying the characters and classification of Non-Chordates

Mapping: C24MIC143T

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	M	S	M	M	S	W	M
CO2	M	S	M	S	S	M	M	S	M	M
CO3	S	S	S	M	S	S	S	S	S	S
CO4	S	M	S	M	S	M	M	S	M	S
CO5	S	S	M	M	M	M	W	M	S	S

S= strong M= medium W= weak


Chairperson
Department of Zoology
GUJUS&T, Hisar (Haryana)

Zoology
Minor Course (MIN)
Animal Diversity of Non-Chordates (Semester-I)

Paper Code: C26MIN143T/ C26ZOO101T

Credits: 3

Contact hours/week: 3

Exam time: 2.5 Hrs

External Marks: 50

Internal Marks: 20

Total Marks: 70

Note: The examiner is required to set nine questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 2 marks each. In addition to this, eight more questions (each question of at least 2 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt five questions in all selecting one question from each unit in addition to compulsory Question No. 1. All questions will carry equal marks.

UNIT-I

Phylum Protozoa: General characters; classification up to classes; locomotion (pseudopodial, flagellar, and ciliary); reproduction (binary fission and conjugation); and the life cycle of *Plasmodium*.

Phylum Porifera: General characters; classification up to classes; canal systems (Ascon, Sycon, and Leucon); types of spicules and their formation.

UNIT-II

Phylum Coelenterata: General characters; classification up to classes; polymorphism in Siphonophores; coral reef types, formation, and ecological significance, threat factors to coral reefs and climate change impacts.

Phylum Platyhelminthes and Aschelminthes: General characters; classification up to classes; life cycles of *Taenia solium* and *Wuchereria bancrofti*; and parasitic adaptations in helminths.

UNIT-III

Phylum Annelida: General characters; classification up to classes; Metamerism and its evolutionary significance; structural diversity of larval forms (trochophore). Excretion mechanisms (Nephridial system).

Phylum Arthropoda: General characters; classification up to classes; vision in arthropods; types of metamorphosis in insects. Respiration types in arthropods.

UNIT-IV

Phylum Mollusca: General characters; classification up to classes; mechanism and significance of torsion and detorsion in Gastropoda; biological process of pearl formation.

Phylum Echinodermata: General characters; classification up to classes; the water-vascular system in Asteroidea; Larval forms of echinoderm and their developmental stages. Evolutionary affinities of Echinodermata with Chordates.

Chairperson
Department of Zoology
GJUS&T, Hissar (Haryana)

Animal Diversity of Non-Chordates Lab

Paper Code: C26MIN143P/ C26ZOO101P

Credits: 1

Contact hours/week: 2

Exam time: 3 Hrs

External Marks: 20

Internal Marks: 10

Total Marks: 30

1. Systematic Position, Diagnostic Characters, and Ecological Importance of the Following Organisms:

Porifera: *Sycon*, *Hyalonema*, *Euplectella*.

Coelenterata: *Obelia*, *Physalia*, *Aurelia*, *Tubipora*, *Metridium*.

Helminths: *Taenia solium* and *Ascaris lumbricoides* (male and female dimorphism).

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2. Permanent Slides:

Protozoa: *Amoeba*, *Euglena*, *Paramecium* (whole mount).

Porifera: Transverse section (T.S.) and longitudinal section (L.S.) of *Sycon*; spicules of *Porifera*.

Helminths: *Cysticercus* larva of *Taenia solium*; T.S. of male and female *Ascaris lumbricoides*.

Coelenterata: Permanent slide of *Obelia*.

Note: Students/Candidates are required to obtain minimum passing marks separately in practical component and theory as per the University rules.

Suggested Readings:

1. Anderson D.T. (1999) Invertebrate Zoology, Oxford University Press
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Chairperson
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GJUS&T, Hisar (Haryana)

3. Jordan, E.L and Verma, P.S. 2009. Invertebrate Zoology, S.Chand and Co. Ltd. New Delhi.
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5. Lal S.S. (2019) Practical Zoology Invertebrates. Rastogi Publications, Meerut
6. Nair, N.C., Arumugam, N., Soundarapandian, N., Murugan, T.and Leelavathy, S.2010. A textbook of Invertebrates. Saras Publication, Nagercoil.
7. Rastogi V.B. 2021. Invertebrate Zoology. Kedar Nath Ram Nath, Meerut

Course Outcomes (CO):

At the end of the course, the students would be able to:

- CO 1 Recall the general characters, classification, diagnostic features, and systematic position of major invertebrate phyla and their representative organisms.
- CO 2 Explain the structural organization, life cycles, larval forms, locomotion, reproduction, and physiological processes of selected invertebrates.
- CO 3 Identify representative specimens, permanent slides, and anatomical structures based on their diagnostic characters, classification, and ecological importance.
- CO 4 Analyze the structural, functional, and evolutionary adaptations of different invertebrate groups, including their life cycles and developmental patterns.
- CO 5 Evaluate the ecological and evolutionary significance of key biological phenomena such as coral reef formation, parasitism, metamerism, torsion and detorsion, and the evolutionary affinities of Echinodermata with Chordata.

Mapping: C26MIN143T/ C26ZOO101T and C26MIN143P/ C26ZOO101P

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	M	S	M	S	W	M
CO2	S	M	S	M	S	S	W	S	M	M
CO3	S	S	M	M	S	S	S	S	S	S
CO4	S	S	M	S	S	M	M	M	M	S
CO5	M	S	M	M	S	S	M	S	S	S

S= strong M= medium W= weak

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Zoology
Multidisciplinary Course (MDC)
Domestic Animal Biology (Semester-I)

Paper Code: C26MDC129T

Credits: 2

Contact hours/week: 2

Exam time: 2 Hrs

External Marks: 35

Internal Marks: 15

Total Marks: 50

Note: The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four more questions (each question may be of 2 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt three questions in all selecting one question from each unit consisting of 10 marks each in addition to compulsory Question No. 1.

Unit-I

Introduction to Livestock; Importance of Cattle, Buffalo, Sheep, Goats, and Poultry; Breeds of Livestock in India; Housing and Feeding of Farm Animals; Basic Principles of Animal Breeding and Management.

Unit-II

Milk, Meat and Egg Production; Livestock-Based Rural Economy; Common Diseases of Farm Animals; Vaccination and Disease Prevention; Clean Milk Production and Animal Welfare.

Domestic Animal Biology Lab

Paper Code: C26MDC129P

Credits: 1

Contact hours/week: 2

Exam time: 3 Hrs

External Marks: 15

Internal Marks: 10

Total Marks: 25

1. Identification of common livestock breeds.
2. Study of livestock housing systems.
3. Preparation of balanced feed charts for farm animals.
4. Visit to a dairy farm, poultry farm or livestock farm.
5. Study of common livestock diseases and vaccination schedules.
6. Survey of livestock resources in a village/local area.

Note: Students/Candidates are required to obtain minimum passing marks separately in practical component and theory as per the University rules.

Suggested Readings:

1. Banerjee, G. C. (2018). *A textbook of animal husbandry* (8th ed.). Oxford & IBH Publishing Co. Pvt. Ltd.
2. Ghosh, N. (2018). *Fundamentals of animal husbandry*. PHI Learning Pvt. Ltd.
3. ICAR. (2011). *Handbook of animal husbandry* (4th ed.). Indian Council of Agricultural Research.

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4. Sastry, N. S. R., Thomas, C. K., & Singh, R. A. (2019). *Farm animal management and poultry production* (5th ed.). Vikas Publishing House Pvt. Ltd.
5. Sreekumar, T. (2017). *Livestock production management*. New India Publishing Agency.

Course Outcomes (CO):

At the end of the course, the students would be able to:

- CO1:** Identify the importance of livestock and the major breeds of cattle, buffalo, sheep, goats, and poultry found in India.
- CO2:** Explain the principles of animal breeding, housing, feeding, and management of farm animals.
- CO3:** Apply appropriate livestock management practices to improve the health, productivity, and welfare of farm animals.
- CO4:** Analyze the contribution of livestock to milk, meat, and egg production and its role in the rural economy.
- CO5:** Evaluate disease prevention strategies, including vaccination, clean milk production, and animal welfare practices for sustainable livestock management.

Mapping: C26MDC129T and C26MDC129P

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	M	S	S	M	S	M	S
CO2	S	M	S	M	S	S	W	M	M	S
CO3	M	S	M	M	S	S	M	S	S	S
CO4	M	S	M	M	S	M	M	S	M	M
CO5	S	M	S	W	M	M	S	S	S	S

S= strong M= medium W= weak

Signature

Zoology
Skill Enhancement Course (SEC)
Apiculture (Semester-I)

Paper Code: C24SEC131T

Credits: 2

Contact hours/week: 2

Exam time: 2 Hrs

External Marks: 35

Internal Marks: 15

Total Marks: 50

Note: The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four more questions (each question may be of 2 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt three questions in all selecting one question from each unit consisting of 10 marks each in addition to compulsory Question No. 1.

Unit-I

Apiculture meaning, definition, scope and history, Status of Apiculture Industry in India, Classification and Life Cycle of Honey Bee, Identification of Indigenous and exotic Honey bee species.

Cultivable species of Honey Bee with reference to India, Social organization of honey bees: the castes- queen, drone and workers, Nesting behavior of Honey bees, Bee foraging, Seasonal management, swarming in Honey bees, waggle dance, defense in honey bees, Diseases and Enemies of Bees, Control and Preventive measures.

Unit-II

Role of Bees in cross pollination in horticulture and agriculture, Methods of Artificial Bee keeping, Equipments used in Bee keeping Industry, Methods of extraction of Honey and other products.

Products of Apiculture Industry and their Uses (Honey, Bee Wax, Royal Jelly, Bee Venom, Propolis and Pollen), Bee Keeping Industry: Present and future Prospects of apiculture as self-employment venture, Economics of Apiculture: Expenditure, Net Income, and Additional benefits.

Apiculture Lab

Paper Code: C24SEC131P

Credits: 1

Contact hours/week: 2

Exam Time: 3 Hrs

External Marks: 15

Internal Marks: 10

Total Marks: 25

Practical

1. Identification of different bee species
2. Training of Bee keeping in artificial boxes


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3. Demonstration of Modern Bee Keeping Equipment and Methods.
4. Training of methods of Extraction of Honey (Indigenous and Modern)
5. Field visit to Honey Bee farm/Unit
6. Report of field visit,

Note: Students/Candidates are required to obtain minimum passing marks separately in practical component and theory as per the University rules.

Suggested Reading:

1. Prost P. J. (1962). Apiculture. Oxford and IBH, New Delhi.
2. Bisht D.S. (2004). Agricultural Development in India, Anmol Pub. Pvt. Ltd.
3. Singh S. (1964). Beekeeping in India, Indian council of Agricultural Research, New Delhi
4. Mehrotra, K.N. and Bisht, D.S. (1981). Twenty-five years of apiculture research at IARI. I. Apiculture in relation to agriculture.
5. The Social Behavior of the Bees, 1974: By Missioner C.D.

Course Outcomes (CO):

At the end of the course, the students would be able to:

CO1 Understand the significance of honey bees and Apiculture

CO2 Acquire knowledge about different species and castes of the honey bees

CO3 Manage beehives for honey production and pollination, and learn various products of honey bees and value addition in these products,

CO4 Aware about economic importance of honey bees, and use of Apiculture for employment, self-employment and conservation of nature

CO5 Gain practical knowledge about various methods of bee keeping and extraction of honey thus create scope for entrepreneurship

Mapping: C24SEC131T and C24SEC131P

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	W	S	S	M	S	M	S
CO2	S	S	W	M	S	M	M	M	S	M
CO3	M	M	M	W	M	W	W	S	S	W
CO4	S	M	S	W	M	M	W	S	S	M
CO5	S	M	S	W	W	W	W	S	S	M

S= strong M= medium W= weak

Zoology

Value added course (VAC)

Biodiversity and Wildlife Management (Semester-I/II)

Paper Code: C24VAC105T

Credit: 2

Contact hours/week: 2

Exam time: 2Hrs

External Marks: 35

Internal Marks: 15

Total Marks: 50

Note: The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four more questions (each question may be of 2 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt three questions in all selecting one question from each unit consisting of 10 marks each in addition to compulsory Question No. 1.

Unit-I

Concept of Bio-Diversity and Wildlife, Levels of Biodiversity, Pattern and distribution of Wildlife in India, Wildlife zones of India, Techniques of animal counts (Examples of Tiger count).

Conservation of biodiversity: in-situ and ex-situ, Concept of Protected Area Systems, Important Protected Areas of India (Biosphere reserve, National Park & Wildlife sanctuaries).

Unit-II

Red Data Book and its uses, IUCN Categories of wildlife species, Climate change and loss of biodiversity.

Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, Wildlife Tourism, Biosphere Reserves concept and Indian Biosphere Reserves, Location & Significance.

Suggested Readings:

1. Hosetti, B. Band Venkateshwarlu, M. Trends in wildlife biodiversity conservation and management.
2. Mathur R. Wildlife conservation and management.
3. Hosetti B. B. Concepts of Wildlife management.
4. Techniques for wildlife Census in India by W.A. Rogers (A field manual); Wildlife Institute of India, Dehradun.
5. Majupuria T. C. Wildlife Wealth of India, Tecpress Services, L.P., 487/42-SOL-Wattenslip, Pratunam Bangkok, 10400, Thailand.
6. Ali, S. and Ripley, S.D. Handbook of Birds of India, Pakistan 10-Vols. Oxford University Press, Bombay.

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G.U.S.T., Hapur (Haryana)

7. Prater S. H. The Book of Indian Animals, BNHS-Publication, Bombay.
8. Saharia, V.B. Wildlife in India, Natraj Publishers, Dehradun.
9. Gee E.P. The Wildlife of India.

Course Outcomes (CO):

At the end of the course, the students would be able to:

- CO1 Understand about wildlife zones of India.
- CO2 Explain the concept of protected area system.
- CO3 Understand about IUCN categories.
- CO4 Explain the mechanism of biodiversity threats.
- CO5 Understand about understanding of wildlife management methods.

Mapping C24VAC105T

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	W	S	M	M	S	M	S
CO2	M	M	S	W	S	W	W	S	M	S
CO3	W	M	S	W	M	W	M	S	W	M
CO4	M	M	S	W	S	W	M	S	M	M
CO5	S	M	S	W	M	W	S	S	S	S

S= strong M= medium W= weak


 Assistant Professor (Zoology)
 Department of Zoology (Madyana)

Zoology
Discipline Specific Course (DSC)
Animal Diversity of Chordates (Semester-II)

Paper Code: C26ZOO201T/ C26MIN243T

Credits: 3

Contact hours/week: 3

Exam time: 2.5 Hrs

External Marks: 50

Internal Marks: 20

Total Marks: 70

Note: The examiner is required to set nine questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 2 marks each. In addition to this, eight more questions (each question of at least 2 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt five questions in all selecting one question from each unit in addition to compulsory Question No. 1. All questions will carry equal marks.

UNIT-I

Chordates: Basic characters of chordates; Theory of origin of Chordates, Brief classification and evolutionary relationship of chordates.

Protochordates: General characteristics and Classification of Urochordata and Cephalochordate, Retrogressive metamorphosis in urochordates, Pharynx and feeding mechanism in *Amphioxus*.

Cyclostomes: General characteristics and outline classification of cyclostomes up to classes, General characters, morphology and economic importance of *Myxine* and *Petromyzon*

UNIT-II

Pisces: General characteristics and classification of Chondrichthyes and Osteichthyes up to order. Migration, Osmoregulation, Parental care, scales, fins and Weberian apparatus in fishes

UNIT-III

Amphibia: General characteristics and classification up to order; Parental care and neoteny in Amphibians

Reptiles: General characteristics and classification up to order; Biting mechanism, poison apparatus in snakes, Key for identification of Poisonous and non-poisonous snakes. Extinct reptiles.

UNIT-IV

Aves: General characteristics and classification up to order; Ratitae (Flightless Birds), *Archaeopteryx* as missing link. Flight adaptations, Modifications of Beak, Feet and Palate in Birds, Migration in birds.

Mammals: General characteristics and classification up to orders; Origin of mammals. Adaptive radiations in mammals and dentition in mammals.


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Animal Diversity of Chordates Lab

Paper Code: C26ZOO201P/C26MIN243P

Credits: 1

Contact hours/week: 2

Exam time: 3 Hrs

External Marks: 20

Internal Marks: 10

Total Marks: 30

1. Classification up to orders, habit, habitats, external characters and economic importance (if any) of following animals:

Urochordata: *Herdmania, Branchiostoma*

Cyclostomata: *Petromyzon*

Pices: *Sphyrna, Pristis, Torpedo, Labeo, Exocoetus, Anguilla*

Amphibia: *Ichthyophis/Ureotyphlus, Salamandra, Bufo, Hyla*

Reptiles: *Chelone, Chamaeleon, Draco, Vipera, Naja, Crocodylus*

Birds: Any three common birds from different orders

Mammals: Bat, *Funambulus, Loris*.

2. Study of the following permanent slides:

Tornaria larva,

T.S. Amphioxus (through different regions)

Different types of scales.

3. Key for Identification of Poisonous and Non-Poisonous Snakes
4. A visit to Biodiversity parks/Protected areas/National Park/Wildlife Sanctuary or Zoo and/or Zoological Museum.
5. Preparation of an "Animal Album" containing photographs, cut-outs, and appropriate write-ups on the above-mentioned taxa. Different taxa/topics may be assigned to different groups of students for this purpose.

Note: Students/Candidates are required to obtain minimum passing marks separately in practical component and theory as per the University rules.

Suggested Readings:

1. Barrington E.J.W. The Biology of Hemichordata and Protochordata. Oliver and Boyd, Edinburgh.
2. Jordan, E.L. and Verma. Chordate Zoology.
3. Kent C.G. Comparative anatomy of vertebrates.
4. Kotpal R.L. Modern Textbook of Zoology
5. Lal S. S. Practical Zoology Vertebrate
6. Walters, H.E. and Sayles, L.D. Biology of vertebrates. MacMillan & Co., New York.

Ch. A. W.
Department of Zoology
University of Maryana

Course Outcomes (CO):

At the end of the course, the students would be able to:

CO 1. Recall the general characters, classification, and evolutionary relationships of major chordate groups including protochordates, cyclostomes, fishes, amphibians, reptiles, birds, and mammals.

CO 2. Explain the structural organization and physiological adaptations in chordates, including locomotion, feeding, respiration, osmoregulation, reproduction, migration, and parental care.

CO 3. Identify representative chordates and their diagnostic features, including identification of poisonous and non-poisonous snakes using key characteristics.

CO 4. Analyze the evolutionary trends and adaptive radiations among chordates, including origin theories and transitions between major vertebrate groups.

CO 5. Evaluate the functional and evolutionary significance of key adaptations such as flight in birds, venom apparatus in reptiles, neoteny in amphibians, Weberian apparatus in fishes, and dentition in mammals.

Mapping: C26ZOO201T/ C26MIN243T and C26ZOO201P/ C26MIN243P

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	M	S	S	M	S	W	M
CO2	M	S	M	S	S	S	W	M	S	S
CO3	M	S	M	M	S	S	M	S	M	M
CO4	S	M	S	M	S	S	S	S	W	S
CO5	S	S	M	M	S	S	M	S	M	S

S= strong M= medium W= weak

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Department of Zoology
GJUSBT, Hissar (Haryana)

Zoology
Minor course (MIC)
Introduction of Chordates (Semester-II)

Paper Code: C24MIC243T

Credit: 2

Contact hours/week: 2

Exam time: 2Hrs

External Marks: 35

Internal Marks: 15

Total Marks: 50

Note: The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four more questions (each question may be of 2 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt three questions in all selecting one question from each unit consisting of 10 marks each in addition to compulsory Question No. 1.

UNIT I

Chordates: Salient features of chordates, Principles of classification, Origin and evolutionary tree of chordates.

Protochordates: Urochordata & Cephalochordates: Systematic position, distribution, ecology, morphology and affinities.

Cyclostomata: General characters and classification upto order level, Ecological significance of cyclostomes.

Pisces: General characters and classification up to sub-classes with examples emphasizing their biodiversity, Scales & Fins.

UNIT- II

Amphibia: General Characters and Classification upto order level, Parental Care and Neoteny in Amphibia.

Reptilia: General Characters and Classification upto order level, Extinct reptiles, Poisonous apparatus in snakes.

Aves: General Characters and classifications upto order level. Flight/Aerial adaptation in birds, *Archaeopteryx* as missing link.

Mammals: General Characters and classification up to order level, Adaptive radiations of mammals, dentition in mammals.

Suggested Readings:

1. Kotpal R. L. Modern Textbook of Zoology
2. Jordan, E.L. and Verma. Chordate Zoology.
3. Barrington, E. J. W. The Biology of Hemichordata and Protochordata. Oliver and Boyd, Edinburgh.
4. Walters, H.E. and Sayles, L.D. Biology of vertebrates. MacMillan & Co., New York.
5. Kent C.G. Comparative anatomy of vertebrates.
6. Lal S. S. Practical Zoology Vertebrate.

Course Outcomes (CO):

At the end of the course, the students would be able to:

CO1 Describe unique characters of Protochordates.

CO2 Describe unique characters of Pisces.

CO3 Describe unique characters of Amphibians & Reptiles.

CO4 Describe unique characters of Birds & Mammals.

CO5 Identifying the characters and classification of Chordates.


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Department of Zoology
(Dr. S. S. Yadava)

Mapping: C24MIC243T

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	M	S	M	M	S	W	M
CO2	M	S	M	S	S	M	M	S	S	S
CO3	S	S	S	M	S	S	S	S	M	M
CO4	S	M	S	M	S	M	M	S	W	S
CO5	S	S	M	M	M	M	W	M	M	S

S= strong M= medium W= weak

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Zoology
Minor Course (MIN)
Animal Diversity of Chordates (Semester-II)

Paper Code: C26MIN243T/ C26ZOO201T

Credits: 3

Contact hours/week: 3

Exam time: 2.5 Hrs

External Marks: 50

Internal Marks: 20

Total Marks: 70

Note: The examiner is required to set nine questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 2 marks each. In addition to this, eight more questions (each question of at least 2 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt five questions in all selecting one question from each unit in addition to compulsory Question No. 1. All questions will carry equal marks.

UNIT-I

Chordates: Basic characters of chordates; Theory of origin of Chordates, Brief classification and evolutionary relationship of chordates.

Protochordates: General characteristics and Classification of Urochordata and Cephalochordate, Retrogressive metamorphosis in urochordates, Pharynx and feeding mechanism in *Amphioxus*.

Cyclostomes: General characteristics and outline classification of cyclostomes up to classes, General characters, morphology and economic importance of *Myxine* and *Petromyzon*

UNIT-II

Pisces: General characteristics and classification of Chondrichthyes and Osteichthyes up to order. Migration, Osmoregulation, Parental care, scales, fins and Weberian apparatus in fishes

UNIT-III

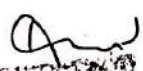
Amphibia: General characteristics and classification up to order; Parental care and neoteny in Amphibians

Reptiles: General characteristics and classification up to order; Biting mechanism, poison apparatus in snakes, Key for identification of Poisonous and non-poisonous snakes. Extinct reptiles.

UNIT-IV

Aves: General characteristics and classification up to order; Ratitae (Flightless Birds), *Archaeopteryx* as missing link. Flight adaptations, Modifications of Beak, Feet and Palate in Birds, Migration in birds.

Mammals: General characteristics and classification up to orders; Origin of mammals. Adaptive radiations in mammals and dentition in mammals.


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Zoology
Department

Animal Diversity of Chordates Lab

Paper Code: C26MIN243P/ C26ZOO201P

Credits: 1

Contact hours/week: 2

Exam time: 3 Hrs

External Marks: 20

Internal Marks: 10

Total Marks: 30

1. Classification up to orders, habit, habitats, external characters and economic importance (if any) of following animals:

Urochodata: *Herdmania, Branchiostoma*

Cyclostomata: *Petromyzon*

Pices: *Sphyrna, Pristis, Torpedo, Labeo, Exocoetus, Anguilla*

Amphibia: *Ichthyophis/Ureotyphlus, Salamandra, Bufo, Hyla*

Reptiles: *Chelone, Chamaeleon, Draco, Vipera, Naja, Crocodylus*

Birds: Any three common birds from different orders

Mammals: Bat, *Funambulus, Loris*.

2. Study of the following permanent slides:

Tornaria larva,

T.S. Amphioxus (through different regions),

Different types of scales.

3. Key for Identification of Poisonous and Non-Poisonous Snakes
4. A visit to Biodiversity parks/Protected areas/National Park/Wildlife Sanctuary or Zoo and/or Zoological Museum.
5. Preparation of an "Animal Album" containing photographs, cut-outs, and appropriate write-ups on the above-mentioned taxa. Different taxa/topics may be assigned to different groups of students for this purpose.

Note: Students/Candidates are required to obtain minimum passing marks separately in practical component and theory as per the University rules.

Suggested Readings:

1. Barrington E.J.W. The Biology of Hemichordata and Protochordata. Oliver and Boyd, Edinburgh.
2. Jordan, E.L. and Verma. Chordate Zoology.
3. Kent C.G. Comparative anatomy of vertebrates.
4. Kotpal R.L. Modern Textbook of Zoology
5. Lal S. S. Practical Zoology Vertebrate
6. Walters, H.E. and Sayles, L.D. Biology of vertebrates. MacMillan & Co., New York.


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G. B. Pant University of Agriculture and Technology
Pantnagar, U.S. Nagar, Varanasi

Course Outcomes (CO):

At the end of the course, the students would be able to:

CO 1. Recall the general characters, classification, and evolutionary relationships of major chordate groups including protochordates, cyclostomes, fishes, amphibians, reptiles, birds, and mammals.

CO 2. Explain the structural organization and physiological adaptations in chordates, including locomotion, feeding, respiration, osmoregulation, reproduction, migration, and parental care.

CO 3. Identify representative chordates and their diagnostic features, including identification of poisonous and non-poisonous snakes using key characteristics.

CO 4. Analyze the evolutionary trends and adaptive radiations among chordates, including origin theories and transitions between major vertebrate groups.

CO 5. Evaluate the functional and evolutionary significance of key adaptations such as flight in birds, venom apparatus in reptiles, neoteny in amphibians, Weberian apparatus in fishes, and dentition in mammals.

Mapping: C26MIN243T/ C26ZOO201T and C26MIN243P/ C26ZOO201P

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	M	S	S	M	S	W	M
CO2	M	S	M	S	S	S	W	M	S	S
CO3	M	S	M	M	S	S	M	S	M	M
CO4	S	M	S	M	S	S	S	S	W	S
CO5	S	S	M	M	S	S	M	S	M	S

S= strong M= medium W= weak



Page 1

Zoology
Multidisciplinary Course (MDC)
Basics of Human Systems (Semester-II)

Paper Code: C26MDC229T

Credits: 2

Contact hours/week: 2

Exam time: 2 Hrs

External Marks: 35

Internal Marks: 15

Total Marks: 50

Note: The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four more questions (each question may be of 2 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt three questions in all selecting one question from each unit consisting of 10 marks each in addition to compulsory Question No. 1.

Unit-I

Introduction to Human Physiology; Organization of the Human Body; Digestive System and Nutrition; Respiratory System and Breathing; Circulatory System and Blood; Excretory System and Maintenance of Health.

Unit-II

Nervous System and Sense Organs; Endocrine System and Hormones; Human Reproductive Health; Lifestyle Disorders (Obesity, Diabetes and Hypertension); Personal Hygiene, Exercise and Healthy Living.

Basics of Human Systems Lab

Paper Code: C26MDC229P

Credits: 1

Contact hours/week: 2

Exam time: 3 Hrs

External Marks: 15

Internal Marks: 10

Total Marks: 25

1. Measurement of pulse rate and blood pressure.
2. Study of blood groups through charts/models.
3. Calculation of Body Mass Index (BMI).
4. Recording respiratory rate before and after exercise.
5. Preparation of a balanced diet chart.
6. Awareness project on healthy lifestyle and disease prevention.

Note: Students/Candidates are required to obtain minimum passing marks separately in practical component and theory as per the University rules.

Suggested Readings:

1. Hall, J. E. (2021). *Guyton and Hall textbook of medical physiology* (14th ed.). Elsevier.
2. Jain, A. K. (2022). *Textbook of physiology* (8th ed.). Avichal Publishing Company.
3. Marieb, E. N., & Hoehn, K. (2023). *Human anatomy & physiology* (12th ed.). Pearson.

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G.D. Goenka University (Gurgaon)

4. Sembulingam, K., & Sembulingam, P. (2023). *Essentials of medical physiology* (9th ed.). Jaypee Brothers Medical Publishers.
5. Tortora, G. J., & Derrickson, B. H. (2021). *Principles of anatomy and physiology* (16th ed.). John Wiley & Sons.

Course Outcomes (CO):

At the end of the course, the students would be able to:

- CO1:** Identify the organization of the human body and the structure of major organ systems.
- CO2:** Explain the functions of the digestive, respiratory, circulatory, excretory, nervous, endocrine, and reproductive systems.
- CO3:** Apply the principles of nutrition, personal hygiene, exercise, and healthy lifestyle practices to promote overall health and well-being.
- CO4:** Analyze the physiological basis of common lifestyle disorders such as obesity, diabetes, and hypertension and their impact on human health.
- CO5:** Evaluate strategies for maintaining health through balanced nutrition, regular physical activity, disease prevention, and healthy living practices.

Mapping: C26MDC229T and C26MDC229P

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	M	S	M	M	S	W	M
CO2	S	M	M	M	S	M	M	S	S	S
CO3	S	S	S	S	S	S	S	S	M	M
CO4	M	S	S	M	S	M	M	S	W	S
CO5	S	S	M	W	M	M	W	M	M	S

S= strong

M= medium

W= weak


 Chairperson
 Department of Zoology
 MUSEAT, Meerut (Haryana)

Zoology
Skill Enhancement Course (SEC)
Fish Farming (Semester-II)

Paper Code: C24SEC231T
Credit: 2
Contact hours/week: 2
Exam time: 2Hrs

External Marks: 35
Internal Marks: 15
Total Marks: 50

Note: The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four more questions (each question may be of 2 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt three questions in all selecting one question from each unit consisting of 10 marks each in addition to compulsory Question No. 1.

Unit-I

General introduction: Definition of Fish, Fisheries, Aquaculture and Pisciculture, Significance of fish farming. Production, Utilization and Demand of Fish in India, General description of Capture and Culture Fisheries.

Culture fisheries and its types, Criteria for the selection of fish species for farming Important culturable Fishes in India, Identification of commercially important fish species, Basics of induced breeding in fishes.

Unit-II

Pond fish culture: Types, Design and construction of fish farming ponds, Maintenance of fish culture ponds, Ecology of Fish Pond ecosystem: Water quality (Physico-chemical and Biological) and Soil quality, Weeds of fish farming ponds and their control. Nutrition of cultured fishes: Natural, supplementary and artificial feed, Nutrient composition and common dietary ingredients, By products of fish farming Industry, Methods of Fish harvesting and marketing, Common fish diseases and their control.

Fish Farming Lab

Paper Code: C24SEC231P
Credit: 1
Contact hours/week: 2
Exam time: 3 Hrs

External Marks: 15
Internal Marks: 10
Total Marks: 25

Practical

1. Identification of important fishes
2. Identification of developmental stages of fishes
3. Analysis of physical and chemical properties of water: (Temperature, pH, turbidity, salinity, total solids, dissolved oxygen, free carbon-di-oxide, hardness, Chlorides)
4. Study of aquatic weeds.
5. Study of crafts and gears.
6. Visit to fish farm and/or fish market and preparation of report.


Chairperson
Department of Zoology
University of Delhi (Haryana)

Note: Students/Candidates are required to obtain minimum passing marks separately in practical component and theory as per the University rules.

Suggested Reading:

1. APHA (1995) Standard Methods of Examination of Water and Wastewater. American Public Health Association, AWWA, WCPF, Washington DC.
2. Bardach, J. E., Ryther and McLarney, Wo (1972) Aquaculture, New York: Wiley-Interscience. 896pp
3. Gupta, S.K. and Gupta, P.C. (2006) General & Applied Ichthyology: Fish and Fisheries. S Chand Publications, New Delhi
4. Jhingran V. G. (1983) Fish and Fisheries of India. Hindustan Publishing Corporation (India) 954 pp
5. Khanna, S.S. and Singh, H.R. (2014). Text book of Fish Biology and Fisheries 3rd ed. (PB) Narendra Publishing House, India

Course Outcomes (CO):

At the end of the course, the students would be able to:

CO1 Create awareness about food security, significance of protein in diet and will learn the skills to develop business enterprise

CO2 Learn about various methods and significance of fish farming

CO3 Learn identification of fish species using classical morphological methods **CO4** Acquainted about bye products of fish farming industry and fish health

CO5 Develop capability of identifying different species of fishes and will be trained for analysis of water quality and fish culture in ponds

Mapping: C24SEC231T and C24SEC231P

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	W	W	M	W	W	M	W	S	S	S
CO2	S	S	S	M	S	M	M	S	S	S
CO3	S	M	M	W	S	W	W	M	M	S
CO4	M	W	S	W	W	M	M	S	S	M
CO5	M	W	S	W	M	W	M	S	S	S

S= strong M= medium W= weak


Chairperson
Department of Zoology
GJUSAT, Meer (Haryana)

Zoology
Discipline Specific Course

Biomolecules and Mammalian Physiology (Semester-III)

Paper Code: C24ZOO301T

Credits: 3

Contact hours/week: 3

Exam time: 2.5 Hrs

External Marks: 50

Internal Marks: 20

Total Marks: 70

Note: The examiner is required to set nine questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 2 marks each. In addition to this, eight more questions (each question of at least 2 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt five questions in all selecting one question from each unit in addition to compulsory Question No. 1. All questions will carry equal marks.

UNIT-I

Introduction, classification, structure, function and general properties of proteins. Nomenclature, classification and mechanisms of enzyme action; factors affecting enzyme activity, inhibition of enzymes. Vitamins and Minerals. Transport through bio-membranes (Active and Passive), osmotic pressure, hydrogen ion concentration and buffers.

UNIT-II

Introduction, classification, structure, function and general properties of carbohydrates and lipids. Digestion of proteins, carbohydrates, lipids. Muscles: ultra-structure of skeletal muscle, neuromuscular junction. Bio-chemical and physical events during muscle contraction, single muscle twitch, tetanus, muscle fatigue, muscle tone, oxygen debt., Cori's cycle, single unit smooth muscles, their physical and functional properties.

UNIT-III

Circulation: Origin, conduction and regulation of heart beat; cardiac cycle. Composition and functions of blood & lymph; Mechanism of coagulation of blood, coagulation factors; anticoagulants, haemopoiesis. Respiration: Exchange of respiratory gases, transport of gases, lung air volumes, oxygen dissociation curve of haemoglobin, Bohr's effect, Hamburger's phenomenon (Chloride shift), Myoglobin. Excretion: Patterns of excretory products viz. Ammonotelic, ureotelic, uricotelic, ornithine cycle; Urine formation, composition of Urine, counter-current mechanism of urine formation, osmoregulation, micturition.

UNIT-IV

Neural Integration: Nature, origin and propagation of nerve impulse along with medullated & non-medullated nerve fiber, conduction of nerve impulse across synapse, synaptic delay and synaptic fatigue, Neurotransmitter. Functions of different endocrine glands, hormonal disorders. Reproduction: Spermatogenesis, Capacitation of spermatozoa, oogenesis, ovulation, formation of corpus luteum, oestrous-anoestrous cycle, Menstrual cycle in human, fertilization, implantation and gestation, parturition.

Biomolecules and Mammalian Physiology Lab

Paper Code: C24ZOO301P

Credits: 1

Contact hours/week: 2

Exam time: 3 Hrs

External Marks: 20

Internal Marks: 10

Total Marks: 30

1. Qualitative tests for identification of simple sugars, disaccharides and polysaccharides.
2. Study of human salivary amylase activity: Effect of temperature, pH, Concentration.
3. Estimation of abnormal constituents of urine (Albumin, sugar, ketone bodies).



4. Use of Kymograph unit & respirometer.
5. Haematin crystal preparation.
6. Estimation of Hb.
7. DLC of Man/RBC count/WBC count.
8. Study of permanent slides of endocrine glands
9. Blood antigens and antibodies: Blood group testing

Note: Students/Candidates are required to obtain minimum passing marks separately in practical component and theory as per the University rules.

Suggested Readings:

1. Agarwal R A, Srivastava A. K., Kumar K. Animal Physiology and Biochemistry; S Chand Publishing; Twenty Third edition, 1978.
2. Vasantika Kashyap (2021) A Text-Book of Animal Physiology and Biochemistry; Kedar Nath Ram Nath Publisher
3. Arumugam N, Fatima D, Narayanan L.M. (2016) Animal Physiology and Biochemistry; Saras Publication
4. Moyes C, Schulte P (2015). Principles of Animal Physiology, Pearson; 3rd edition
5. Satyanarayana (2021). Biochemistry, Elsevier; 6th edition

Course Outcome (CO):

At the end of the course, the students would be able to:

- CO1 Students will be able to understand and explain the mechanism that works to keep the human body functioning.
- CO2 Students will be able to explain the interaction and interdependence of physiological and biochemical processes.
- CO3 It will make the students understand the appropriate functioning of each body system in animals and mechanism of working.
- CO4 Students will be able to explain the mechanism of action of hormones and related molecules involved in various physiological processes
- CO5 Students will be able to understand and perform biological and analytical techniques in labs to explain biological activities

Mapping: C24ZOO301T and C24ZOO301P

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	W	M	W	W	W	S	M	W	W	W
CO2	S	W	M	S	W	M	M	W	W	M
CO3	S	W	M	M	W	M	S	W	W	W
CO4	M	W	W	M	W	M	W	W	W	W
CO5	M	M	W	S	W	M	W	W	W	M

S= strong

M= medium

W= weak

Ch. An.
Department of Zoology
GNDU, B. P. Maryana

Zoology
Minor Course (MIC)
Animal Taxonomy (Semester-III)

Paper Code: C24MIC343T

Credits: 3

Contact hours/week: 3

Exam time: 2.5 Hrs

External Marks: 50

Internal Marks: 20

Total Marks: 70

Note: The examiner is required to set nine questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 2 marks each. In addition to this, eight more questions (each question of at least 2 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt five questions in all selecting one question from each unit in addition to compulsory Question No. 1. All questions will carry equal marks.

UNIT I

Fundamental concept of taxonomy Introduction to taxonomy: Stages of Taxonomy, objectives of biological classification, Importance and application of biosystematics in zoology, principles and rules of taxonomy, ICZN regulation.

UNIT II

Historical perspectives of biosystematics: Taxonomic stages: alpha, beta and Gamma taxonomy, Taxonomic Hierarchy, Taxonomic characters, Neo taxonomy.

UNIT III

Taxonomic procedure Study methods: Collection, preservation and identification, evaluation of taxonomic characters, morphological, embryological, cytogenetical, biochemical, numeral components of classification.

UNIT IV

Concept of speciation Varieties, subspecies, siblings, species and races. Concept of taxon, holotype, paratype, topotype. Molecular basis of taxonomy, Phylogenetic principle. Concept and applications.

Animal Taxonomy Lab

Paper Code: C24MIC343P

Credits: 1

Contact hours/week: 2

Exam time: 3 Hrs

External Marks: 20

Internal Marks: 10

Total Marks: 30

1. Demonstration for the preparation and use of different types of taxonomic keys.
2. Construction of cladogram, dendrograms and phylograms.
3. Construction of dichotomous key
4. Classify different animal kingdom up to order
5. Study of museum specimens and slides with emphasis on evolutionary and adaptive significance.
6. Softwares used to study animal taxonomy.

Suggested Readings:

1. G.G. Simpson, Principle of animal taxonomy, Oxford ISH Publishing Company.
2. E. Mayer, Elements of Taxonomy.
3. M. Kato. The Biology of Biodiversity, Springer.
4. E.O. Wilson, Biodiversity, Academic Press, Washington

Course Outcome (CO):

At the end of the course, the students would be able to:
CO1 Students will be able to attain knowledge of taxonomy which helps in classifying and identifying biodiversity
CO2 Students will understand animal relationships by making phylogenetic trees.



CO3 It will help to understand the overall biodiversity of the world and their application in all the fields of biological sciences.

CO4 Students will be able to acquire, analyse and understand the significance of Biosystematics

CO5 Students will be able to learn the practical knowledge of general organisation, affinities and systematic position of animals.

Mapping: C24MIC343T and C24MIC343P

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	W	W	W	S	S	M	W	W	S
CO2	M	W	W	W	W	M	W	W	W	M
CO3	W	W	M	W	M	M	W	M	W	S
CO4	W	W	M	W	W	W	W	W	W	M
CO5	M	W	M	W	S	M	M	W	W	M

S= strong

M= medium

W= weak


Chairman
(Biology
(Hons))

Zoology
Multidisciplinary Course [MDC]

Common Diseases and Their Pathogens (Semester-III)

Paper Code: C26MDC329T

Credits: 2

Contact hours/week: 2

Exam time: 2 Hrs

External Marks: 35

Internal Marks: 15

Total Marks: 50

Note: The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four more questions (each question may be of 2 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt three questions in all selecting one question from each unit consisting of 10 marks each in addition to compulsory Question No. 1.

Unit-I

Introduction to pathogens; Types of pathogens (Bacteria, Viruses, Fungi, Protozoa); Modes of disease transmission through air, water, food and insects; Personal hygiene and sanitation; Importance of immunity

Unit-II

Tuberculosis, Typhoid, Cholera, Malaria, Dengue, Influenza and COVID-19; Symptoms, causes and preventive measures; Vaccination and immunization; Role of public health awareness in disease control.

Common Diseases and Their Pathogens Lab

Paper Code: C26MDC329P

Credits: 1

Contact hours/week: 2

Exam time: 3 Hrs

External Marks: 15

Internal Marks: 10

Total Marks: 25

1. Study of common pathogens through charts and models.
2. Identification of disease vectors such as mosquito and housefly.
3. Preparation of awareness posters on disease prevention.
4. Survey on common diseases in the local community.
5. Study of vaccination programmes in India.

Note: Students/Candidates are required to obtain minimum passing marks separately in practical component and theory as per the University rules.

Suggested Readings:

1. Ananthanarayan, R., Paniker, C. K. J., Arti Kapil, Kaveri K. N., & Ghosh, P. (2023). *Ananthanarayan and Paniker's textbook of microbiology* (12th ed.). Universities Press.
2. Chakraborty, P. (2022). *Microbiology* (3rd ed.). New Central Book Agency.
3. Park, K. (2023). *Park's textbook of preventive and social medicine* (27th ed.). M/s Banarsidas Bhanot Publishers.
4. Sastry, A. S., & Bhat, S. K. (2021). *Essentials of medical microbiology* (3rd ed.). Jaypee Brothers Medical Publishers.
5. Sood, R. (2021). *Textbook of medical laboratory technology* (2nd ed.). Jaypee Brothers Medical Publishers.

Course Outcomes (CO):

At the end of the course, the students will be able to:

CO1: Identify the major types of pathogens, their characteristics, and the common modes of disease transmission.

CO2: Explain the causes, symptoms, transmission, and preventive measures of common infectious diseases, including tuberculosis, typhoid, cholera, malaria, dengue, influenza, and COVID-19.



CO3: Apply the principles of personal hygiene, sanitation, vaccination, and immunization to prevent the spread of infectious diseases.

CO4: Analyze the role of immunity and public health interventions in the prevention and control of communicable diseases.

CO5: Evaluate the effectiveness of disease prevention strategies, including vaccination, hygiene practices, and public health awareness programs, in promoting community health.

Mapping: C26MDC329T and C26MDC329P

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	M	S	M	M	S	W	M
CO2	S	M	M	M	S	M	M	S	S	S
CO3	S	S	S	S	S	S	S	S	M	M
CO4	M	S	S	M	S	M	M	S	W	S
CO5	S	S	M	W	M	M	W	M	M	S

S= strong

M= medium W= weak

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Zoology
Skill Enhancement Course (SEC)
Vermiculture and Vermicomposting (Semester-III)

Paper Code: C24SEC331T

Credits: 2

Contact hours/week: 2

Exam time: 2 Hrs

External Marks: 35

Internal Marks: 15

Total Marks: 50

Note: The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four more questions (each question may be of 2 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt three questions in all selecting one question from each unit consisting of 10 marks each in addition to compulsory Question No. 1.

Unit-I

Vermiculture: Introduction, definition, history, general characters of Annelida, systematic position of earthworm, habits and habitat of earthworm, diversity of earthworms, collection of earthworms, preservation of earthworms.

Vermitechnology: Role of earthworm in maintenance of soil structure and their role as recycling, reduce, reuse, restore (4r's), choosing right species of earthworm.

Unit-II

Earthworm biology and rearing: Key to identify the species of earthworm, life cycle of *Eisenia fetida*, *Lampito mauritii* and their role on ecology, an ecofriendly approach to sustainable agriculture
Vermicomposting (methods and products): Preparation of vermibed, small scale earthworm farming for home garden, large scale commercial composting, properties of vermicompost and vermiwash, application on crop plants economic development and self-employment.

Vermiculture and Vermicomposting Lab

Paper Code: C24SEC331P

Credits: 1

Contact hours/week: 2

Exam time: 3 Hrs

External Marks: 15

Internal Marks: 10

Total Marks: 25

1. Key to identify different types of earthworms.
2. Collection of some native earthworms and identification.
3. Study of systematic position, habits, habitat and external feature of earthworm
4. Study of life stages of *Eisenia fetida*, *Eudrilus eugeniae*, *Lampito mauritii*
5. Preparation of vermibeds, maintenance of vermicompost and climatic conditions.
6. Field visit of Vermicomposting unit.
7. Report of field visit.

Note: Students/Candidates are required to obtain minimum passing marks separately in practical component and theory as per the University rules.

Suggested Reading:

1. Dash, M. C. (2012). Charles Darwin's Plough Tool for Vermitechnology. I.K. International Publishing House Pvt Ltd. New Delhi, India.
2. Tripathi, G (2003). Vermireources Technology Discovery Publishing House, New Delhi.
3. Rajnesh Kumar Sharma and Poonam Bhardwaj (2018). Green Farming- Earthworms and Vermitechnology. RAR Publication, New Delhi.



Course Outcome (CO):

At the end of the course, the students would be able to:

CO1 Student will get the knowledge of composting.

CO2 The student will get the knowledge of biodiversity of local earthworms.

CO3 The student can generate income by supplying worms, vermiwash and vermicompost.

CO4 It leads towards organic farming and healthy food.

CO5 Student will be trained to identify Earthworms and their use in small vermicompost bin for converting the home waste.

Mapping: C24SEC331T and C24SEC331P

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	W	M	W	M	S	M	W	S	S
CO2	S	W	M	W	S	S	M	M	S	S
CO3	M	W	W	W	W	M	W	W	S	M
CO4	W	W	W	W	W	W	W	W	M	M
CO5	M	W	W	W	W	W	W	W	S	S

S= strong

M= medium

W= weak

Zoology
Value Added Course [VAC]
Ecology and Environment -I (Semester-III/IV)

Paper Code: C24VAC307T

Credits: 2

Contact hours/week: 2

Exam time: 2 Hrs

External Marks: 35

Internal Marks: 15

Total Marks: 50

Note: The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four more questions (each question may be of 2 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt three questions in all selecting one question from each unit consisting of 10 marks each in addition to compulsory Question No. 1.

Unit-I

Environmental components: biotic and abiotic components and their interactions. Concept of habitat and niche; Major terrestrial biomes; Biogeographical zones of India.

Population and Community ecology: Characteristics of a population; life history strategies (r and K selection); concept of metapopulation – demes and dispersal, Species Interactions: Types of interactions, interspecific competition, Community Ecology: Nature of communities; community structure and attributes; levels of species diversity and its measurement; edges and ecotones

Unit-II

Ecosystem and Ecological Succession: Ecosystem: structure and function; energy flow and mineral cycling (C,N,P); primary production and decomposition; structure and function of some Indian ecosystems: terrestrial and aquatic. Ecological Successions: Types; mechanisms; changes involved in succession; concept of climax.

Applied Ecology and Conservation Biology: Environmental pollution; biodiversity: status, monitoring and documentation; biodiversity management approaches; Principles of conservation and its management; Project Tiger, Biosphere reserves.

Suggested Reading:

1. H.R. Singh & Neeraj Kumar (2014) "Ecology and Environmental Science" Vishal Publishing Co.
2. P D Sharma (2017) "Ecology and Environment" Rastogi Publications
3. Eugene Odum (2017) "Fundamentals of Ecology" Cengage India Private Limited Publishers, Noida
4. Pranav Kumar and Usha Mina (2021) "Fundamentals of Ecology and Environment" 3rd Edition, Pathfinder Academy
5. N. Arumugam "Concepts of Ecology" Saras Publication

Course Outcome (CO):

At the end of the course, the students would be able to:

CO1 Students will be able to describe interactions and relation between abiotic and biotic factors.

CO2 Students will be able to describe about ecosystem and Biogeochemical cycles.

CO3 Students will be able to describe about population characteristics & biodiversity.

CO4 Students will be able to understand the causes of different types of pollution.

CO5 Students will be able to practical approaches of natural resources and their conservation.

Mapping: C24VAC307T

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	W	M	S	M	M	M	S
CO2	M	W	W	W	W	S	W	M	W	M
CO3	S	M	M	W	M	S	S	S	M	S
CO4	S	W	S	W	W	M	W	M	M	W
CO5	S	M	S	W	M	S	S	S	M	S

S= strong M= medium W= weak

Chris 
 Date: _____
 C. 24VAC307T

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 (Name)

Zoology
Discipline Specific Course
Cell Biology and Genetics (Semester-IV)

Paper Code: C24ZOO401T

Credits: 3

Contact hours/week: 3

Exam time: 2.5 Hrs

External Marks: 50

Internal Marks: 20

Total Marks: 70

Note: The examiner is required to set nine questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 2 marks each. In addition to this, eight more questions (each question of at least 2 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt five questions in all selecting one question from each unit in addition to compulsory Question No. 1. All questions will carry equal marks.

UNIT I

General structure of animal cell., Plasma Membrane: Fluid mosaic model, various modes of transport across the membrane, mechanism of active and passive transport, endocytosis and exocytosis., Endoplasmic reticulum (ER): types and functions. Golgi complex: Structure, associated enzymes and role of golgi-complex in animal cell.

UNIT II

Ribosomes: Types, biogenesis and role in protein synthesis, Lysosomes: Structure, enzymes and their role; polymorphism, Mitochondria: Structure, Mitochondria as semiautonomous body, biogenesis, functions of mitochondria., Cilia and Flagella: Structure and Functions, Ultrastructure and functions of Nucleus: Nuclear membrane, nuclear lamina, nucleolus, fine structure of chromosomes, nucleosome concept and role of histones, euchromatin and heterochromatin

UNIT III

Introduction and Mendel's Laws of Inheritance, Linkage and recombination: Cell Cycle, crossing-over and chiasma formation. Sex determination and its mechanism: male and female heterozygous systems, genetic balance system; role of Y-chromosome, male haploidy, cytoplasmic and environmental factors, role of hormones in sex determination. Sex linked inheritance: Haemophilia and colour blindness in man, eye colour in Drosophila, Non-disjunction of sex-chromosome in Drosophila, Sex-linked and sex-influenced inheritance. Extra chromosomal and cytoplasmic inheritance: Kappa particles in Paramecium, Shell coiling in snails, Milk factor in mice

UNIT IV

Multiple allelism: Eye colour in Drosophila; A, B, O blood group in man. Human genetics: Human karyotype, Chromosomal abnormalities involving autosomes and sex chromosomes, monozygotic and dizygotic twins. Inborn errors of metabolism (Alkaptonuria, Phenylketonuria, Albinism, sickle-cell anaemia). Applied genetics: Genetic counselling, pre-natal diagnosis, DNA-finger printing, transgenic animals.

Cell Biology and Genetics Lab

Paper Code: C24ZOO401P

Credits: 1

Contact hours/week: 2

Exam time: 3 Hrs

External Marks: 20

Internal Marks: 10

Total Marks: 30

1. Cell division: Prepared slides of stages of mitosis and meiosis.
2. Salivary gland and polytene chromosomes of Drosophila/ Chironomus.
3. Temporary squash preparations of onion root tip/grasshopper testis for the study of mitosis.
4. Blood antigens and antibodies: Blood group testing.



5. Preparation of Human Karyotype and Idiogram.
6. Barr Body and Drum stick slide Preparations.

Note: Students/Candidates are required to obtain minimum passing marks separately in practical component and theory as per the University rules.

Suggested Readings:

1. Molecular Cell, Biology, J. Darnell, H. Lodish and D. Baltimore Scientific American Book, Inc., USA.
2. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology by P. S. Verma and V.K. Aggarwal
3. Molecular Biology of the Cell, B. Alberts, D. Bray, J. Lewis, M. Raff, K. Roberts and J.D. Watson. Garland Publishing Inc., New York.
4. Cell Biology and Genetics by P.K. Gupta
5. Cell Biology and Genetics by Veer Bala Rastogi.
6. Principles of Genetics by M. Gardner, J. Simmons, D. P. Snustad
7. Genetics by D. P. Snustad, J. Simmons

Course Outcome (CO):

At the end of the course, the students would be able to:

- CO1** Students will understand the nature and basic concept of cell biology and genetics.
CO2 Students will be able to apply the knowledge of internal structure of cell and their role in many metabolic functions of organism.
CO3 Students will have acquaintance with the basic causes associated with inborn errors and other genetic disorder and will be able to give counseling to general people.
CO4 Students will be able to explain the concept of gene interactions, Sex linked inheritance and their role in medical sciences.
CO5 Students will be able to conduct the morphometric analysis of chromosomes and demonstrate cell division.

Mapping: C24ZOO401T and C24ZOO401P

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	M	M	M	S	M	W	M	M
CO2	M	W	W	S	W	S	W	W	W	S
CO3	M	M	M	S	M	S	S	W	M	S
CO4	M	W	M	S	W	S	W	W	M	S
CO5	M	M	S	S	M	S	S	W	M	S

S= strong M= medium W= weak

[Signature]
 Chairperson
 Department of Biology
 G.O.P. [unclear] Karyotype]

Zoology
Minor course (Vocational) [MIC(V)]
Animal Behaviour (Semester-IV)

Paper Code: C24VOC443T

Credits: 2

Contact hours/week: 2

Exam time: 2 Hrs

External Marks: 35
Internal Marks: 15
Total Marks: 50

Note: The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four more questions (each question may be of 2 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt three questions in all selecting one question from each unit consisting of 10 marks each in addition to compulsory Question No. 1.

UNIT I

Concept of Animal Behaviour; Mile-Stones in the history of animal behaviour and scope. Stereotyped and acquired behaviour patterns: Tropisms, Taxes, Reflexes, Instincts, learning & reasoning; Perception of the environment: Mechanical, Electrical, chemical, olfactory, auditory, visual. Social behaviour: Aggregations and society; Advantages of group living; Types of social organization in animals, Group selection, kin selection, altruism, reciprocal altruism, Territoriality. Social behaviour of termites, ants and primates. Concept of learning: law of learning, types of learning – Habituation, trial & error learning, latent learning, Insight, Imprinting, Classical conditioning & Instrumental learning. Concept of Migratory behaviour.

UNIT II

Behaviour Ecology: Habitat selection. Various means of communication in animals: Chemical, Visual, auditory, touch etc. Hormones and animal Behaviour: Hormones important to behavioural regulation; Genetic basis of behaviour Aggressive behaviour; sexual attraction and sexual behaviour. Pheromones and animal behaviour: types of pheromones, role of pheromones in animal behaviour; pheromones of social insects. Ecological adaptation. Chronobiology: Introduction to chronobiology; Various terminology used in chronobiology; Biological Rhythms and Biological clocks; Types of biological rhythms: Lunar rhythms, circadian rhythms; Circannual rhythms; Epicycles, Tidal rhythms, Sleep Disorders, Insomnia, chronotherapy.

Animal Behaviour Lab

Paper Code: C24VOC443P

Credits: 2

Contact hours/week: 4

Exam time: 3 Hrs

External Marks: 35
Internal Marks: 15
Total Marks: 50

1. To study nests and nesting habits of the birds and social insects.
2. To study the behavioural responses of wood lice to dry and humid conditions.
3. To study geotaxis behaviour in earthworm.
4. To study the phototaxis behaviour in insect larvae.
5. Visit to Forest/ Wild life Sanctuary/Biodiversity Park/Zoological Park to study behavioural activities of animals and prepare a short report.
6. Study and actogram construction of locomotor activity of suitable animal models.
7. Study of circadian functions in humans (daily eating, sleep and temperature patterns).

Note: Students/Candidates are required to obtain minimum passing marks separately in practical component and theory as per the University rules.



Suggested Readings:

1. Alcock J. 2013. Animal Behaviour, Sinauer Associate Inc., USA.
2. Chaki K C; Kundu G & Sarkar S. - Introduction to General Zoology; Vol. 2, NCBA, Kolkata
3. Chattopadhyay S. 2012. Life: Evolution, Adaptation, Ethology. 3rd Edn. Books and Allied, Kolkata.
4. Drickamer LC, Vessey SH. 2001. Animal Behaviour. McGraw-Hill
5. Dujatkin LA. 2014. Principles of Animal Behaviour. 3rd Edn. W.W.Norton and Co.
6. Dunlap JC, Loros JJ, DeCoursey PJ. 2004. Chronobiology Biological Timekeeping. Sinauer Assoc.
7. Kumar V. 2002. Biological Rhythms. Narosa Publishing House, New Delhi.

Course Outcome (CO):

At the end of the course, the students would be able to:

CO1 Students will be able to describe origin of animal behaviour and its perception with environment.

CO2 Students will be able to describe biological clock and concepts of learning.

CO3 Students will be able to describe different types of social behaviour in animals.

CO4 Students will be able to describe effects of various stimuli on animal behaviour.

CO5 Students will be able to describe to understand how animal behaviour plays a key role to in interaction the biotic and abiotic world

Mapping: C24VOC443T and C24VOC443P

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	W	S	S	M	M	W	S
CO2	W	M	W	W	W	M	M	W	W	W
CO3	M	M	W	W	M	M	S	M	W	M
CO4	W	M	M	W	W	W	W	M	W	W
CO5	W	M	M	W	S	S	M	S	W	W

S= strong

M= medium

W= weak

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zoology
(2 years)

Zoology
Value Added Course [VAC]
Environmental Toxicology (Semester-IV)

Paper Code: C24VAC411T

Credits: 2

Contact hours/week: 2

Exam time: 2 Hrs

External Marks: 35

Internal Marks: 15

Total Marks: 50

Note: The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four more questions (each question may be of 2 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt three questions in all selecting one question from each unit consisting of 10 marks each in addition to compulsory Question No. 1.

Unit-I

Toxicology: Concept, scope and goals; Divisions of toxicology; Toxicological interactions; Factors influencing toxicity; Dose - response relationship.

Ecotoxicology: objectives, principles and scope; Fate of toxic substances; Toxicity testing methods; Ethical issues in toxicology.

Unit-II

Xenobiotics: concept and classification; Absorption of xenobiotics, membrane barriers, binding and storage; Excretion of xenobiotics; Biotransformation: Mechanism; Bioaccumulation, bioconcentration and biomagnifications.

Toxicants as public health hazard Food additives; Impact of pesticides on human health; Impact of heavy metals on human health; Automobile emissions; Occupational diseases: Evaluation and control of occupational health hazards.

Suggested Reading:

1. Ecotoxicology: The study of pollutants in ecosystems. 3rd Ed. Elsevier by Moriarty, F.
2. Environment concerns and strategies. Ashish Pub. House, NDL by T.N. Khushoo.
3. Environmental biology. Akashdeep Pub. House by R.R. Trevedi Gurdccp Raj.
4. Textbook: A Textbook of Modern Toxicology. Third Edition by E. Hodgson (Ed.). John Wiley & Sons, Inc. (Posted on the D2L content page.)
5. Principles of Environmental Toxicology by I. C. Shaw and J. Chadwick; Taylor & Francis Ltd.
6. Introduction to Toxicology, 3rd Ed. Taylor & Francis, London by Timbrell, J.

Course Outcome (CO):

At the end of the course, the students would be able to:

CO1 Students will be able to awareness about toxic agents, their different routes of exposure and their effects on humans and their livestock will be appraised.

CO2 Students will be able to gain the knowledge about mode of transformation of toxicants.

CO3 Students will be able to create skilled personnel in the field of environment protection and research.

CO4 Students will be able to understand of ill-health and diseases that are related to exposure to chemicals in human everyday life.

CO5 Students will be able to identify relationships between chemical exposure and effects on physiological systems.

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Mapping: C24VAC411T

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	W	M	M	W	W	M
CO2	S	S	S	M	W	M	M	W	W	M
CO3	M	M	S	M	W	M	M	W	S	S
CO4	M	S	S	M	W	M	M	W	M	M
CO5	S	M	M	S	W	S	M	W	W	W

S= strong M= medium W= weak

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Zoology
Discipline Specific Course
Evolution and Developmental Biology (Semester-V)

Paper Code: C24ZOO501T

Credits: 3

Contact hours/week: 3

Exam time: 2.5 Hrs

External Marks: 50

Internal Marks: 20

Total Marks: 70

Note: The examiner is required to set nine questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 2 marks each. In addition to this, eight more questions (each question of at least 2 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt five questions in all selecting one question from each unit in addition to compulsory Question No. 1. All questions will carry equal marks.

UNIT I

Major events in history of life, Lamarckism, Darwinism, Neo- Darwinism, Artificial selection, biological species concept: Advantages and limitations, Modes of speciation: Allopatric, Sympatric.

UNIT II

Organic variations, Isolating mechanism, natural selection and its types, Macro – evolutionary principles, Mass extinction and role of extinction in evolution, phylogeny of horse.

UNIT III

Introduction and scope of development briefly Gametogenesis: Spermatogenesis and Oogenesis (mammals), Vitellogenesis in birds, Fertilization: external (amphibian) and internal (mammals). Cleavage and pattern of cleavage.

UNIT IV

Fate map, types of morphometric movements, fate of germ layers. Neurulation of frog embryo, Implantation of embryo in human, different types of placenta, formation of human placenta and function.

Evolution and Developmental Biology Lab

Paper Code: C24ZOO501P

Credits: 1

Contact hours/week: 2

Exam time: 3 Hrs

External Marks: 20

Internal Marks: 10

Total Marks: 30

1. Study of homology and analogy from suitable specimens/pictures.
2. Charts: a) Phylogeny of horse with diagrams/ cut outs of limbs and teeth of horse ancestors
b) Darwin's finches with diagrams/cut out of beaks of different species
3. Frog- Study of developmental stages – whole mounts and section through permanent slide – cleavage stages, blastula, gastrula, neurula, tail bud stage, tadpole external and internal gill stages.
4. Study of different types of placenta- histological section through permanent slides or photomicrographs.
5. Study of placental development in humans by ultrasound scans.
6. Examination of gametes- frog/rat- sperm of ova through permanent slides or photomicrographs.



Note: Students/Candidates are required to obtain minimum passing marks separately in practical component and theory as per the University rules.

Suggested Readings:

1. Dobzhansky, Th. Genetics and Origin of Species. Columbia University Press. Dobzhansky, Th., F.J. Ayala, G.L. Stebbins and J.M. Valentine. Evolution. Surjeet Publication, Delhi.
2. Futuyama, D.J. Evolutionary Biology, Suinaer Associates, INC Publishers, Dunderland.
3. Strikberger, M.W. Evolution. Jones and Bartett Publishers, Boston London.
4. S.F. Gilbert. Developmental Biology. Sinauer Associates Inc., Massachusetts.
5. Ethan Bier. 'The Cold Spring'. Cold Spring Harbor Laboratory Press, New York.

Course Outcome (CO):

At the end of the course, the students would be able to:

CO1 Students will be able to describe origin of life and theories of evolution.

CO2 Students will be able to describe concept of speciation and evolution of horse and man.

CO3 Students will be able to describe different stages during fertilization.

CO4 Students will be able to describe the different stages in the development of chick and frog.

CO5 Students will be able to describe to understand how evolution and development leads to a sustainable life in species.

Mapping: C24ZOO501T and C24ZOO501P

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	W	M	M	M	W	W	M
CO2	W	W	S	W	M	W	M	W	W	W
CO3	W	W	W	S	M	S	W	W	W	S
CO4	W	W	W	S	W	S	W	M	W	S
CO5	M	M	S	W	M	W	M	M	W	W

S= strong M= medium W= weak

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Zoology
Minor course (Vocational) [MIC(V)]
Pest Management (Semester-V)

Paper Code: C24VOC543T

Credits: 2

Contact hours/week: 2

Exam time: 2 Hrs

External Marks: 35
Internal Marks: 15
Total Marks: 50

Note: The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four more questions (each question may be of 2 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt three questions in all selecting one question from each unit consisting of 10 marks each in addition to compulsory Question No. 1.

UNIT I

Study of important insect pests of crops:

Sugarcane: (With their systematic position, habits and nature of damage caused. (a) Sugarcane leafhopper (*Pyrilla perpusilla*) (b) Sugarcane Whitefly (*Aleurolobus barodensis*) (c) Sugarcane top borer (*Sciropophaga nivella*) (d) Sugarcane root borer (*Emmalocera depressella*) (e) Gurdaspur borer (*Bissetia steniellus*)

Life cycle and control of *Pyrilla perpusilla* only. Cotton: (With their systematic position, habits and nature of damage caused. (a) Pink bollworm (*Pectinophora gossypiella*) (b) Red cotton bug (*Dysdercus cingulatus*) (c) Cotton grey weevil (*Myloccerus undecimpustulatus*) (d) Cotton Jassid (*Amrasca devastans*) Life cycle and control of *Pectinophora gossypiella*

Wheat: Wheat stem borer (*Sesamia inferens*) with its systematics position, habits, nature of damage caused. Life cycle and control methods.

Paddy: (With their systematic position, habits and nature of damage caused) (a) Gundhi bug (*Leptocoris acuta*) (b) Rice grasshopper (*Hieroglyphus banian*) (c) Rice stem borer (*Scirpophaga incertulus*) (d) Rice Hispa (*Dicladispa armigera*) Life cycle and control of *Leptocoris acuta* only.

UNIT II

Study of important insect pests of vegetables and stored grain:

Vegetables: (Their systematics position, habits and nature of damage caused. (a) *Aulacophora faveicollis* – The Red pumpkin beetle. (b) *Dacus cucurbitas* – The pumpkin fruit fly. (c) *Tetranychus tecarius* – The vegetable mite. (d) *Epilachna* – The Hadda beetle Life cycle and control of *Aulacophora faveicollis*

Stored grains: (Their systematic position, habits and nature of damage caused. (a) Pulse beetle (*Callosobruchus maculatus*) (b) Rice weevil (*Sitophilus oryzae*) (c) Wheat weevil (*Trogoderma granarium*) (d) Rust Red Flour beetles (*Tribolium castaneum*) (e) Lesser grain borer (*Rhizopertha dominica*) (f) Grain & Flour moth (*Sitotroga cerealella*) Life cycle and control of *Trogoderma granarium*)

Important bird and rodent pests of agriculture & their management.

Pest control: Biological control, its history, requirement and precautions and feasibility of biological agents for control.

Chemical control: History, Categories of pesticides, important pesticides from each category to pests against which they can be used, insect repellents and attractants. Integrated pest management.

Chairperson

In-charge of Zoology

(Signature)

Pest Management Lab

Paper Code: C24VOC543P

Credits: 2

Contact hours/week: 4

Exam time: 3 Hrs

External Marks: 35

Internal Marks: 15

Total Marks: 50

- Students are required to obtain minimum passing marks separately in practical component and theory as per the University rules.
- External morphology, identification marks, nature of damage and host of the following pests:
 - Sugarcane: Sugarcane leaf-hopper, Sugarcane whitefly, Sugarcane top borer, Sugarcane root borer, Gurdaspur borer (any two).
 - Cotton: Red Cotton bug
 - Wheat: Wheat stem borer
 - Paddy: Gundhi bug, Rice grasshopper, Rice stem borer, Rice hispa (any one).
 - Vegetables: *Aulocophora faveicollis*, *Dacus cucurbitas*, *Tetranychus tetricus*, *Epilachna* (any three).
 - Pests of stored grains: Pulse beetle, Rice weevil, Grain & Flour moth, Rust-red flour beetle, lesser grain borer (any three).
 - Stages of life history of silk moth and honey bee.
 - Preparation of permanent/temporary slides for identification of mosquitoes.

Suggested Readings:

- David Dent, Richard Binks (2020). Insect Pest Management CABI Publishing; 3rd edition
- Larry P Pedigo, Marlin E. Rice (2014) Entomology and Pest Management. Waveland Pr Inc; 6th edition
- John R. Ruberson (2019) Handbook of Pest Management, CRC Press; 1st edition
- Kalatia M.K. (2021) Introduction to principles of pest and disease management; Walnut Publication
- Smith K M (2013) A Textbook of Agricultural Entomology by Hill, Cambridge University Press

Course Outcome (CO):

At the end of the course, the students would be able to:

CO1 Students will be able to understand ecologically important and harmful insects.

CO2 Students will be able to recognize life cycle of crop insects.

CO3 It will make the students understand about the vegetable pest.

CO4 Students will be able to explain about various pest control approaches.

CO5 Students will be able to identify various insect and pest species.

Mapping: C24VOC543T and C24VOC543P

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	M	W	M	S	M	M	W	M
CO2	M	S	M	W	W	S	M	S	W	M
CO3	M	S	M	W	M	S	M	M	M	W
CO4	W	W	M	W	M	M	W	S	W	S
CO5	M	S	M	W	W	S	S	M	M	M

S= strong M= medium W= weak

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Zoology
Discipline Specific Course
Applied Zoology (Semester-VI)

Paper Code: C24ZOO601T

Credits: 3

Contact hours/week: 3

Exam time: 2.5 Hrs

External Marks: 50

Internal Marks: 20

Total Marks: 70

Note: The examiner is required to set nine questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 2 marks each. In addition to this, eight more questions (each question of at least 2 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt five questions in all selecting one question from each unit in addition to compulsory Question No. 1. All questions will carry equal marks.

UNIT I

Apiculture: History and introduction; Honey bee and kinds; Social organization and colony nests; Lifecycle: Bee keeping, selection, methods, products; Honey composition, quality and importance
Sericulture: Silkworm moth species and their life cycle; Rearing of silkworm, silk reeling, twisting and weaving; Silk composition, kind and uses; Diseases and pests of silkworm.

UNIT II

Prawn Culture: Introduction to Prawns, species; Prawn farming methods, processing and preservation of prawns. Pearl Culture: Historical background, species; Pearl formation, composition, quality and commercial value, Artificial culturing, synthetic pearl types and their manufacturing, methods of harvesting.

UNIT III

Pisciculture: Economically important fresh water and marine fishes; Fish culture, Fish farming technologies, Problems of seed collection from natural resources, Induced breeding methods, Products and by products from pisciculture
Poultry: Nomenclature and breeds of poultry birds; Egg structure and quality, nutritive values, factors affecting size and egg processing, Poultry products and by products.

UNIT IV

Fur and leather industry: Fur producing animals; Fur farming, dressing, processing and dyeing, Fur industry in India; Animals of leather industry, processing of skin, flaying, curing salting and tanning.
Piggery and other utilities of animals: Characteristics of swine and important breeds, Products and by products; Pharmaceuticals from animals; Uses of animals in vaccine production.

Applied Zoology Lab

Paper Code: C24ZOO601P

Credits: 1

Contact hours/week: 2

Exam time: 3 Hrs

External Marks: 20

Internal Marks: 10

Total Marks: 30

1. Life history of Chicken in poultry farm
2. Life history of honeybee.
3. Morphology of Carp, Cat fish and Perch.
4. Fishing Crafts and Gears
5. Preparation of permanent slides of phytoplankton and zooplanktons which constitute the food of commercial fishes, their identification and study of important characters.
6. Field visit to aviary/fish pond and fish market/sericulture unit/Prawn farm and preparation of field report.

Note: Students/Candidates are required to obtain minimum passing marks separately in practical component and theory as per the University rules.



Suggested Readings:

1. Concepts of Insect Control by Ghosh M. R. Wiley Eastern Ltd. New Delhi.
2. Economic Zoology. Shukla Upadhyay, Rastogi Publication, Meerut, India, 1998.
3. Insect Pest Management by Dent, D.
4. Agricultural Entomology by Hill, D.S., Timber Press.
5. General and Applied Entomology by Nayar K. K. and T. N. Ananthkrishnan and B. V. Davis, Tata McGraw Hill Publications. New Delhi.
6. Agricultural Pests: Biology and Control Measures by B. M. Deoray and T. B. Nikam, Nirali Publication, Pune.

Course Outcome (CO):

At the end of the course, the students would be able to:

CO1 Students will be able to identify different species and casts of honeybees and species of silkworm.

CO2 Students will be able to use the tools and techniques used in apiculture, sericulture, aquaculture, piggery, poultry and leather Industry and capabilities to initiate startups will develop.

CO3 Students will be able to explain the basic concept of Poultry and Pisciculture.

CO4 Student will understand the basic concepts of industry based applied methods.

CO5 Students will develop skills in basic laboratory techniques and understand the principles in biology.

Mapping: C24ZOO601T and C24ZOO601P

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	M	M	S	S	S	M	S	M
CO2	M	W	W	M	W	S	W	W	S	S
CO3	W	M	M	W	W	M	M	M	S	S
CO4	W	W	M	M	W	M	W	W	S	S
CO5	W	W	W	M	W	W	W	W	S	S

S= strong M= medium W= weak

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**Zoology
Minor Course**

Basics of Endocrinology and Immunology (Semester-VI)

Paper Code: C24MIC643T

Credits: 4

Contact hours/week: 4

Exam time: 3 Hrs

External Marks: 70

Internal Marks: 30

Total Marks: 100

Note: The examiner is required to set nine questions in all. The first question will be compulsory consisting of seven short questions covering the entire syllabus consisting of 2 marks each. In addition to this, eight more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt five questions in all selecting one question from each unit in addition to compulsory Question No.1. All questions will carry equal marks.

UNIT I

Introduction to hormone: History of endocrinology, Classification and Characteristic, pituitary gland and its general physiological action: Adenohypophysis hormone (somatotropin and prolactin), Glycoprotein hormones (FSH, LH and TSH), Neurohypophysis hormone (oxytocin and vasopressin, urotensin), physiological role of adrenal hormone, Thyroid hormone action in poikilotherms and homeotherms.

UNIT II

Hormone Action and applications: Membrane and nuclear receptor hormones (regulation and signal transduction) Permissive actions of hormones and termination of hormone action. Endocrine feedback to stimuli. Hormone and human health: Production of hormones as pharmaceuticals, Genetic analysis of hormonal disorders. Hormones on IVF, Pregnancy testing and Amniocentesis.

UNIT III

Overview of Immune System: Introduction to basic concepts in immunology, Components of immune system of Innate and Adaptive Immunity, Cells and organs of immune system (primary and secondary organs), Basic properties of antigen B and T cell epitopes, Adjuvants and haptens, structure, classes and functions of antibodies and interaction as tools for research and diagnosis.

UNIT IV

Working of immune system: Structure and functions of MHC molecules. Basic properties and functions of cytokines, Complement system (component and pathways), Introduction to concept of autoimmunity (Rheumatoid Arthritis and tolerance, AIDS). General introduction to Vaccines with its function in biological sciences.

Suggested Readings:

1. General Endocrinology C. Donnell Turner Pub- SaundersToppan Endocrinology: An Integrated Approach; Stephen Nussey and Saffron Whitehead. Oxford: BIOS Scientific Publishers; 2001.
2. Hadley, M.E. and Levine J.E. 2007. Endocrinology, 6th Edition. Pearson Prentice- Hall, Pearson Education Inc., New Jersey.
3. Kindt, T. J., Goldsby, R.A., Osborne, B. A. and Kuby, J (2006). Immunology, VI Edition. W.H. Freeman and Company.
4. David, M., Jonathan, B., David, R. B. and Ivan R. (2006). Immunology, VII Edition, Mosby, Elsevier Publication.
5. Abbas, K. Abul and Lichtman H. Andrew (2003.) Cellular and Molecular Immunology. V Edition. Saunders Publication

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Course Outcome (CO):

At the end of the course, the students would be able to:

CO1 Students will be able to develop an in-depth comprehensive knowledge of endocrinology from a physiological cellular and molecular perspective.

CO2 Students will be able to understand the basic structure and chemical organization of hormones and various signalling molecules.

CO3 Students will be able to explain how the immune system can fight infection and other diseases.

CO4 Student will be able to understand the concept of vaccines and its cons and pros.

CO5 Students will get practical knowledge of basic structure and function of hormones and Immune system.

Mapping: C24MIC643T

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	S	W	M	M	M	W	M
CO2	M	W	M	S	M	S	W	W	M	M
CO3	M	M	M	M	W	M	M	M	W	W
CO4	S	M	M	M	W	M	W	W	W	W
CO5	W	W	W	M	W	W	W	W	M	M

S= strong M= medium W= weak

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Zoology
Minor course (Vocational) [MIC(V)]
Economic Zoology (Semester-VI)

Paper Code: C24VOC643T

Credits: 2

Contact hours/week: 2

Exam time: 2 Hrs

External Marks: 35
Internal Marks: 15
Total Marks: 50

Note: The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four more questions (each question may be of 2 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt three questions in all selecting one question from each unit consisting of 10 marks each in addition to compulsory Question No. 1.

Unit I

Varieties of honey bees, Setting up an apiary: Lang troth's/Newton's hive, brood and storage chambers, iron frames and comb sheets, drone excluder, rearing equipment, handling of bees, artificial diet, Diseases of honey bee, honey extraction techniques, -chemical analysis of honey, Other beneficial products from bee.

Different types of silk and silkworms in India, Rearing of Bombyx mori, Rearing racks and trays, disinfectants, rearing appliances, black boxing, Chawki rearing, bed cleaning, moutage, harvesting of cocoons, Silkworm diseases: Pebrine, Flacherie, Grasserie, Muscardine and Aspergillosis, and their management; Silkworm pests and parasites: Uzi fly, Dermestid beetles, and their management; Silk reeling techniques and Quality assessment of silk fibre.

Unit II

Aquaculture Brood stock management; Induced breeding of fish, Management of hatchery offish, Management of nursery, rearing and stocking ponds, Preparation and maintenance of fish aquarium, Preparation of compound diets for fish, Role of water quality in aquaculture, Fish diseases: Bacterial, viral and parasitic, Preservation and processing of harvested fish, Fish by-products. Prawn farming, Culture of crab, Pearl culture and Culture of air breathing fishes.
Dairy and Poultry Farming Introduction, Indigenous and exotic breeds, Rearing, housing, feed and rationing, Commercial importance of dairy and poultry farming, Varietal improvement techniques, Diseases and their management, Dairy or poultry farm management and business plan.

Economic Zoology Lab

Paper Code: C24VOC643P

Credits: 2

Contact hours/week: 4

Exam time: 3 Hrs

External Marks: 35
Internal Marks: 15
Total Marks: 50

1. Study of different types of bees (Queens, Drones and Worker bees).
2. Study of different types of silk moths.
3. Study of different types of pearls.
4. Study of different types of fish diseases.
5. Identification of different types of scales in fishes.
6. Study of different types of fins.
7. Study of different modified structures of fishes (Saw of sawfish, Hammer of hammer head fish, tail of sharks etc.).



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Note: Students/Candidates are required to obtain minimum passing marks separately in practical component and theory as per the University rules.

Suggested Readings:

1. Sarkar, Kundu and Chaki. (2014) Introduction to Economic Zoology. NCBA Publisher.
2. T.V.R. Pillay, M.N. Kutty (2011) Aquaculture: Principles and Practices, Wiley India Pvt Ltd; Second edition
3. Shukla and Upadhyaya (2002). Economic Zoology, Rastogi Publishers
4. Yadav Manju (2003). Economic Zoology, Discovery Publishing House.
5. Jabde Pradip V (2005). Textbook of applied Zoology, Discovery Publishing House, New Delhi

Course Outcome (CO):

At the end of the course, the students would be able to:

CO1 Students will be able to identify different species and casts of honeybees and species of silkworm.

CO2 Students will be able to use the tools and techniques used in apiculture, sericulture, aquaculture, poultry, aquaculture and capabilities to initiate startups will develop.

CO3 Students will be able to explain the basic concept of Poultry and Pisciculture.

CO4 Student will understand the basic concepts of industry based applied methods.

CO5 Students will develop skills in basic laboratory techniques and understand the principles in biology.

Mapping: C24VOC643T and C24VOC643P

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	M	M	S	S	S	M	S	M
CO2	M	W	W	M	W	S	W	W	S	S
CO3	W	M	M	W	W	M	M	M	S	S
CO4	W	W	M	M	W	M	W	W	S	S
CO5	W	W	W	M	W	W	W	W	S	S

S= strong M= medium W= weak

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