SYLLABI AND SCHEME OF EXAMINATIONS
FOR
DISCIPLINE SPECIFIC COURSES
OF
B.Sc. ZOOLOGY AS SINGLE MAJOR
OFFERED BY DEPARTMENT OF ZOOLOGY

Program Code – USZOO4

(Based on Curriculum and Credit Framework for UG Programs under NEP 2020)

WITH EFFECT FROM THE SESSION 2024-25

Under multiple entry, exit, internship and Learning Outcomes Based Curriculum and Credit Framework for Bachelor of Science (Zoology as Single Major) Program

Discipline Specific Courses/ Major Course			Credits Distribution			Total Credits	Workload			Total Workload	Marks				
	Nomenclature of Course	Course Code	L	T	P		L	T	P		Theory		Practical		Total Marks
											Internal	External	Internal	External	
Semester I (Session 2024-25)															
DSC-A1@4credits	Biodiversity-I Non-Chordata	24ZOOS401 DS01	2	-	2	4	2	-	4	6	15	35	15	35	100
DSC-A2@4credits	Biodiversity-II Non-Chordata	24ZOOS401 DS02	2	-	2	4	2	-	4	6	15	35	15	35	100
Semester II (Session 2024-25)															
DSC-A3@4credits @4credits	Biodiversity-III Chordata	24ZOOS402 DS01	2	-	2	4	2	-	4	6	15	35	15	35	100
DSC-A4@4credits @4credits	Biodiversity-IV Chordata	24ZOOSD40 2DS02	2	-	2	4	2	-	4	6	15	35	15	35	100
Semester III (Session 2025-26)															
DSC-A5@4credits @4credits	Genetics	25ZOOS403 DS01	2	-	2	4	2	-	4	6	15	35	15	35	100
A6@4credits DSC-@4credits	Cellular functions	25ZOOS403 DS02	2	-	2	4	2	-	4	6	15	35	15	35	100

Semester IV (Session 2025-26)															
DSC -A7@ 4credits	**Evolution**	**25ZOOS404 DS01**	2	-	2	4	2	-	4	6	15	35	15	35	100
DSC - A8@4credits	**Biomolecules**	**25ZOOS404 DS02**	2	-	2	4	2	- -	4	6	15	35	15	35	100
DSC - A9@4credits	**Aquaculture**	**25ZOOS404 DS03**	2	-	2	4	2	-	4	6	15	35	15	35	100
DSC - A10@4credits	**Wildlife and conservation**	**25ZOOS404 DS04**	2	-	2	4	2	-	4	6	15	35	15	35	100
Semester V (Session 2026-27)															
DSC- A11@4 credits	**Animal behaviour**	**26ZOOS405 DS01**	2	-	2	4	2	-	4	6	15	35	15	35	100
DSC -A12@4 credits	**Ecology and Environment**	**26ZOOS405 DS02**	2	-	2	4	2	-	4	6	15	35	15	35	100
DSC -13@4 credits	**Applied Zoology-I**	**26ZOOS405 DS03**	2	-	2	4	2	-	4	6	15	35	15	35	100
DSC - A14@4credits	**Applied Zoology-II**	**26ZOOS405 DS04**	2	-	2	4	2	-	4	6	15	35	15	35	100
Semester VI (Session 2026-27)															
DSC - A15@4credits	**Animal Physiology**	**26ZOOS406 DS01**	2	-	2	4	2	-	4	6	15	35	15	35	100
DSC - A16@4credits	**Entomology**	**26ZOOS406 DS02**	2	-	2	4	2	-	4	6	15	35	15	35	100
DSC - A17@4credits	**Basis of Embryology**	**26ZOOS406 DS03**	2	-	2	4	2	-	4	6	15	35	15	35	100
			2	-	2	4	2	-	4	6	15	35	15	35	100

DSC - A18@4credits	**Fish and fisheries**	**26ZOOS406 DS04**													
Semester VII (Session 2027-28)															
DSC - H1@4credits	Animal Cell Biology	24ZOO201DS 01	2	-	2	4	2	-	4	6	15	35	15	35	100
DSC -H2@4 credits	Techniques in Animal Science	24ZOO201DS 02	2	-	2	4	2	-	4	6	15	35	15	35	100
DSC -H3@4 credits	Diversity of Life form-1	24ZOO201DS 03	2		2	4	2	-	4	6	15	35	15	35	100
DSC- H4@4 credits	Animal Biochemistry and metabolism	24ZOO201DS 04	2	-	2	4	2	-	4	6	15	35	15	35	100
DSC -H5@4 credits	Molecular Biology	24ZOO201DS 05	2	-	2	4	2	-	4	6	15	35	15	35	100
Semester VIII (**Option - 1**) 4 Year U.G. Hons. (BSc. Zoology Hons.) (Session 2027-2028)															
DSC–H6@4 credits	Inheritance Biology	24ZOO202DS 01	2	-	2	4	2	-	4	6	15	35	15	35	100
DSC–H7@4 credits	Diversity of Life form-II	24ZOO202DS 02	2	-	2	4	2	-	4	6	15	35	15	35	100
DSC–H8@4 credits	Animal Behaviour	24ZOO202DS 03	2	-	2	4	2	-	4	6	15	35	15	35	100
DSC–H9@4 credits	Evolutionary Biology	24ZOO202DS 04	2	-	2	4	2	-	4	6	15	35	15	35	100
DSC–H10@ 4 credits	Developmental Biology	24ZOO202DS 05	2	-	2	4	2	-	4	6	15	35	15	35	100

Semester VIII (**Option - 2**) 4 Year U.G. Hons. (BSc. Zoology Hons.) (Session 2027-2028)															
DSC–H6@4 credits	**Inheritance Biology**	24ZOO202DS 01	2	-	2	4	2	-	4	6	15	35	15	35	100
DSC–H7@4 credits	**Diversity of Life Form-II**	24ZOO202DS 02	2	-	2	4	2	-	4	6	15	35	15	35	100
Dissertation @ 12 credits	**Dissertation**	**27ZOO408P D01**								20	-	-	150	350	500

L: Lecture; T: Tutorial; P: Practical

Syllabi for B.Sc. (Zoology as Single Major)
Program Code – USZOO4

Semester ....I....
Session: 2024-25

Name of Program	**BSc. Zoology Single Major**	**Program Code**	**USZOO4**
Name of the Course	**Biodiversity-1 Non -Chordata**	**Course Code**	**24ZOOS401DS01**
Hours per Week	**6**	**Credits**	**4=(2+0+2)**
Maximum Marks	**100**	**Time of Examinations**	**3 Hrs**

Note:
Examiner will set nine questions and the candidates will be required to attempt five questions in all. Question number one will be compulsory containing short answer type questions from all units. Further, examiner will set two questions from each unit and the candidates will be required to attempt one question from each Unit. All questions will carry equal marks.

Course Learning Outcomes (CLO):

CLO 1: Student will be able to describe unique characters and recognize life forms of phylum Protozoa
CLO2: Student will be able to describe unique characters and recognize life forms of phylum Porifera
CLO 3:Student will be able to describe unique characters and recognize life forms of phylum Coelenterata
CLO 4: Student will be able to describe unique characters and recognize life forms of phylum Helminthes
CLO 5: Students will be capable of identifying the characters and classification of Non-Chordates

Unit 1:
Phylum Protozoa:General characters and classification up to class level
Type study of *Plasmodium*

Unit 2:
Phylum Porifera:
General characters and classification up to class level, Type study of *Sycon*

Unit 3:
Phylum – Coelentrata: General characters and classification up to class level
Type Study of *Obelia*

Unit 4:
Phylum – Platyhelminthes and Aschelminthes: General characters and classification up to class level,
Type study of Liver Fluke, *Fasciola hepatica*

References:

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, NewDelhi
4. Mehrotra, K.N. Bisht, D.S. (1981). Twenty-five years of apiculture research at IARI. I. Apiculture in relation to
5. agriculture.The Social Behaviour of the Bees, 1974 : By Missioner C.D

PRACTICAL SYLLABUS

A. Classification up to orders with ecological note and economic importance of the following animals:

1. Protozoa
2. Parazoa (Porifera):
3. Coelentrata
4. Playhelminthes:

B. Study of the following permanent stained preparations:

1. L.S. and T.S. *Sycon;* gemmules, spicules and spongin fibres of *Sycon,* canal system of sponges
2. T.S. *Hydra* (testis and ovary region)
3. T.S. *Fasciola* (different regions)
4. T.S. *Ascaris* (male and female)

Semester ....I....
Session: 2024-25

Name of Program	**BSc. Zoology Single Major**	**Program Code**	**USZOO4**
Name of the Course	**Biodiversity-II Non -Chordata**	**Course Code**	**24ZOOS401DS02**
Hours per Week	**6**	**Credits**	**4=(2+0+2)**
Maximum Marks	**100**	**Time of Examinations**	**3Hrs**

Note:
Examiner will set nine questions and the candidates will be required to attempt five questions in all. Question number one will be compulsory containing short answer type questions from all units. Further, examiner will set two questions from each unit and the candidates will be required to attempt one question from each Unit. All questions will carry equal marks.

Course Learning Outcomes (CLO):

CLO 1 Student will be able to describe unique characters and recognize life forms of phylum Annelida
CLO2: Student will be able to describe unique characters and recognize life forms of phylum Arthropoda
CLO 3:Student will be able to describe unique characters and recognize life forms of phylum Mollusca
CLO 4: Student will be able to describe unique characters and recognize life forms of phylum Echinodermata
CLO 5: Students will be capable of identifying the characters and classification of Non-Chordates

Unit 1:

Phylum – Annelida:
General characters and classification up to class level,
Type study of Earthworm, *Pheretima posthuma* (Habitat, habits, metamerism, digestive System, circulatorysystem, nervous system, reproductive system)

Unit 2:

Phylum – Arthropoda:
General characters and classification up to class level,
Type study of Cockroach, *Periplaneta americana* (Habitat, habits, external morphology, digestive system,respiratory system, excretory system, reproductive system)

Unit 3:

Phylum - Mollusca:
General characters and classification up to class level,Type study of *Pila*

Unit 4:

Phylum – Echinodermata:
General characters and classification up to class level, Type study of *Asterias* (Sea Star)
(Habitat, habits, external morphology, water vascular system, Circulatory System)

References:

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

PRACTICAL SYLLABUS

A. Classification up to orders with ecological note and economic importance of the following animals:

1. Annelida:
2. Arthropoda:
3. Mollusca:
4. Echinodermata:

B. Study of the following permanent stained preparations:

1. T.S. *Ascaris* (male and female)
2. T.S. *Pheretima* (pharyngeal and typhlosolar regions), Setae, septal nephridia and spermathecae of *Pheretima.*

PROJECT:

1. Annelida diversity
2. Arthropoda diversity

Semester ....II....
Session: 2024-25

Name of Program	**B.Sc. Zoology Single Major**	**Program Code**	**USZOO4**
Name of the Course	**Biodiversity-III Chordata**	**Course Code**	**24ZOOS402DS01**
Hours per Week	**6**	**Credits**	**4=(2+0+2)**
Maximum Marks	**100**	**Time of Examinations**	**3Hrs**

Note:
Examiner will set nine questions and the candidates will be required to attempt five questions in all. Question number one will be compulsory containing short answer type questions from all units. Further, examiner will set two questions from each unit and the candidates will be required to attempt one question from each Unit. All questions will carry equal marks.

Course Learning Outcomes (CLO):

CLO 1 Student will be able to describe unique characters and recognize life forms of phylum **Hemichordates:**
CLO2: Student will be able to describe unique characters and recognize life forms of phylum Urochordata
CLO 3:Student will be able to describe unique characters and recognize life forms of phylum **Pisces**:
CLO 4: Student will be able to describe unique characters and recognize life forms of phylum **Amphibia**:
CLO 5: Students will be capable of identifying the characters and classification of lower Chordates

Unit 1:
Hemichordates: Systematic position, distribution, ecology, morphology and affinities
Balanoglossus: Type Study

Unit 2:
Urochordata: Systematic position, distribution, ecology, morphology and affinities
Urochordata: Type Study of Herdmania

Unit 3:
Pisces: General characters and classification up to classes with examples emphasizing their biodiversity, Scales & Fins,
Type study of *Labeo*

Unit 4:
Amphibia: General characters and Classification upto class level; Type study of frog, Parental Care and Neoteny in Amphibia

References:
1. Jordan, E. L., and Verma, P. S. (2013). *Chordate Zoology* (14th edition). S. Chand and Company Ltd.
2. Kent, G. C. (2018). *Comparative Anatomy of the Vertebrates* (9th edition). McGraw-Hill Education.
3. Kotpal, R. L. (2019). *Modern Textbook of Zoology: Vertebrates* (12th edition). Rastogi Publications.
4. Pough, F. H., and Janis, C. M. (2019). *Vertebrate Life* (10th Edition). Oxford University Press.
5. Winter, M. (2016). *Wildlife Biology*. Syrawood Publishing House.

PRACTICAL SYLLABUS

1. Classification upto orders, habit, habitats, external characters and economic importance (if any):
   - Protochordata: *Molqula, Hetryllus, Pyrosoma, Doliolum, Olikopleura,* and *Amphioxus.*
   - Cyclostomata: *Myxine, Petromyzon* and *Ammocoetus larva*.
   - Chondrichthyes: *Zygaena, Pristis, Narcine* (electric ray), *Trygon, Rhinobatus, Raja* and *Chimaera.*
   - Osteichthyes: *Acipenser, Lepidosteus, Muraena, Mystus, Catla, Hippocampus, Syngnathus, Exocoetus, Anabas, Diodon, Ostracion, Tetradon, Echinus, Lophius, Solea* and *Polypterus.* Any of the Lung Fishes.
   - Amphibia: *Necturus, Proteus, Amphiuma, Salamandra, Amblystoma, Axolotl larva, Alytes, Bufo, Rana.*
2. Demonstration & Study of Internal Anatomy of locally available fish (*Labeo*
3. Study of the skeleton of *Scoliodon, Labeo, Rana* (Frog), *Varanus,*
4. Study of the following prepared slides: Tornaria larva, T.S. *Amphioxus* (through different regions). Oikopleura, different types of scales.
5. Make permanent stained preparations of the Cycloid scales
6. Field Visit to National Park or Zoo.

Semester ....II....
Session: 2024-25

Name of Program	B.Sc. Zoology Single Major	Program Code	USZOO4
Name of the Course	Biodiversity-IV Chordata	Course Code	24ZOOS402DS02
Hours per Week	6	Credits	4=(2+0+2)
Maximum Marks	100	Time of Examinations	3hrs

Note:
Examiner will set nine questions and the candidates will be required to attempt five questions in all. Question number one will be compulsory containing short answer type questions from all units. Further, examiner will set two questions from each unit and the candidates will be required to attempt one question from each Unit. All questions will carry equal marks.

Course Learning Outcomes (CLO):
CLO 1 Student will be able to describe unique characters and recognize life forms of phylum **Reptilia**
CLO2: Student will be able to describe unique characters and recognize life forms of phylum Urochordata
CLO 3:Student will be able to describe unique characters and recognize life forms of phylum **Aves**
CLO 4: Student will be able to describe unique characters and recognize life forms of phylum **Mammals**
CLO 5: Students will be capable of identifying the characters and classification of higher Chordates

Unit 1:
Reptilia: General characters and Classification upto classes,
Type study of lizards

Unit 2:
Aves: General characters and Classifications upto classes. Flight/Aerial adaptation in birds,
Archaeopteryx as missing link

Unit 3:
Mammals: General characters and classification up to classes;
Type study of Rat

Unit 4:
PROJECT: Tiger, Rino, Elephant and crocodiles

References:
1. Jordan, E. L., and Verma, P. S. (2013). *Chordate Zoology* (14th edition). S. Chand and Company Ltd.
2. Kent, G. C. (2018). *Comparative Anatomy of the Vertebrates* (9th edition). McGraw-Hill Education.
3. Kotpal, R. L. (2019). *Modern Textbook of Zoology: Vertebrates* (12th edition). Rastogi Publications.
4. Pough, F. H., and Janis, C. M. (2019). *Vertebrate Life* (10th Edition). Oxford University Press.
5. Winter, M. (2016). *Wildlife Biology*. Syrawood Publishing House.

PRACTICAL SYLLABUS

1. Classification upto orders, habit, habitats, external characters and economic importance (if any):
   - Reptilia: *Hemidactylus, Calotes, Draco, Varanus, Phrynosoma, Chamaeleon, Typhlops, Python, Eryx, Ptyas, Bungarus, Naja, Hydrus, Viper, Crocodilus, Gavialis, Chelone* (Turtle) and *Testudo* (Tortoise).
   - Aves: *Casuarius, Arden, Anas, Milvus, Pavo, Eudynamis, Tyto, Alcedo, Halcyon*
   - Mammalia: *Ornithorhynchus, Echidna, Didelphis, Macropus, Loris, Macaque, Hystrix, Funambulus, Felix, Panthera, Canis, Herpestes, Capra, Pteropus.*
2. Internal anatomy of the following animals:
   (i) Computer simulated model/study of *Rat*: Digestive, arterial, venous and urinogenital systems; reproductive systems, cranial nerves, Ear ossicle
3. Study of the skeleton of Pigeon or Gallus and *Orcyctolagus*/rat, Palates of birds, skulls of dog & rabbit.
4. Study of the following prepared slides: Histology of rat (compound tissues),
6. Field Visit to National Park or Zoo.

Semester ....III....
Session: 2025-26

Name of Program	**BSc. Zoology Single Major**	**Program Code**	**USZOO4**
Name of the Course	**Genetics**	**Course Code**	**25ZOOS403DS01**
Hours per Week	**6**	**Credits**	**4=(2+0+2)**
Maximum Marks	**100**	**Time of Examinations**	**3Hrs**

Note:
Examiner will set nine questions and the candidates will be required to attempt five questions in all. Question number one will be compulsory containing short answer type questions from all units. Further, examiner will set two questions from each unit and the candidates will be required to attempt one question from each Unit. All questions will carry equal marks.

Course Learning Outcomes (CLO):
CLO 1. Students will understand the nature and basic concept of genetics.
CLO 2. Students will be able to apply the knowledge of genes and their role in organism
CLO 3. 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

Unit 1:
Introduction and Mendel's Laws of Inheritance, Linkage and recombination: Cell Cycle, crossing-over and chiasma formation; gene mapping.
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.

Unit 2:
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 chromocomal and cytoplasmic inheritance: Kappa particles in Paramecium, Shell coiling in snails, Milk factor in mice

Unit 3:

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.

Unit 4:
Inborn errors of metabolism (Alcaptonuria, Phenylketonuria, Albinism, sickle-cell anaemia).
Applied genetics: Genetic counseling, pre-natal diagnosis, DNA-finger printing, transgenic animals.

References:

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

PRACTICAL SYLLABUS

I. Cell division: Prepared slides of stages of mitosis and meiosis.
2. Temporary squash preparations of onion root tip / grasshopper testis for the study of mitosis using acetocarmine stain.
3. Mendel's Laws of Inheritance
4. Human karyotype

PROJECT REPORT ON:

1. Transgenic animals.
2. Human genetics
3. Sex determination and its mechanism

Semester ....III....
Session: 2025-26

Name of Program	**BSc. Zoology Single Major**	**Program Code**	**USZOO4**
Name of the Course	**Cellular function**	**Course Code**	**25ZOOS403DS02**
Hours per Week	**6**	**Credits**	**4=(2+0+2)**
Maximum Marks	**100**	**Time of Examinations**	**3HRS**

Note:
Examiner will set nine questions and the candidates will be required to attempt five questions in all. Question number one will be compulsory containing short answer type questions from all units. Further, examiner will set two questions from each unit and the candidates will be required to attempt one question from each Unit. All questions will carry equal marks.

Course Learning Outcomes (CLO):
CLO1: An in-depth knowledge on the critical biological functions that are requisite of normal cellular functions, and maintenance of life processes.

Unit 1: Endocytosis; pinocytosis; phagocytosis; autophagy; exocytosis. P-type pumps, Ftype pumps, ABC transporters. Aquaporins and bacteriorhodopsin.
Unit 2: Protein import into mitochondrion and plastids. Vesicular transport. Protein sorting. Molecular chaperones.
Unit 3: Structure and function of motor proteins: myosins; kinesins; dyneins. Structure and function of cilia and flagella; centrosomes; basal bodies. Nonmuscle motility: actin polymerisation.
Unit 4: Mechanism of cytokinesis. Cell cycle checkpoints. Cyclins and CDKs. Cyclin-CDK regulation of cell cycle; transcriptional regulation of cell cycle – cell cycle inhibitors; structure and function of telomere; shelterin.
References: 1. Albert, B., Johnson, A., Lewis, J., Raff, M., Roberts, K., and Walter, P. (2022). *Molecular Biology of the Cell* (7th edition). Garland Publishing, London. 2. Gupta, P. K. (2017). *Cell and Molecular Biology* (5th edition). Rastogi Publications. 3. Klug, W. S., Cummings, M. R., Spencer, C. A., Palladino, M., and Killian, D. (2019). *Concepts of Genetics* (11th edition). Pearson Education 4. Krebs, J. E., Goldstein, E. S., and Kilpatrick, S. T. (2017). *Lewin's Genes XII*. Jones & Bartlett Publishers. 5. Lodish, H., Berck, A., Kaiser, C. A., Krieger, M., Scott, M. P., Bretscher, A., Ploegh, H., and Matsudaira, P. (2016). *Molecular Cell Biology* (8th edition). W. H. Freeman.

PRACTICAL SYLLABUS

1. Temporary squash preparations of onion root tip / grasshopper testis for the study of mitosis using acetocarmine stain.
2. DNA: types, structure and its model preparation
3. Microscopy: principles and its significance
4. Staining techniques and their significance
5. Protein purification essay
6. Microscopic observation of living cells (Photomicrographs of human cheek)
7. Cross section of a hair follicle in human skin

Semester ....IV...
Session: 2025-26

Name of Program	**BSc. Zoology Single Major**	**Program Code**	**USZOO4**
Name of the Course	**Evolution**	**Course Code**	**25ZOOS404DS01**
Hours per Week	**6**	**Credits**	**4=(2+0+2)**
Maximum Marks	**100**	**Time of Examinations**	**3Hrs**

Note:
Examiner will set nine questions and the candidates will be required to attempt five questions in all. Question number one will be compulsory containing short answer type questions from all units. Further, examiner will set two questions from each unit and the candidates will be required to attempt one question from each Unit. All questions will carry equal marks.

Course Learning Outcomes (CLO):
CLO 1:To explore the origin of life, evolutionary transitions of eukaryotes and multicellularity and diversity of forms of life on earth with new scientific evidences.
CLO 2: To develop a better understanding about the nature and origin of life

CLO 3: Leading to the diversity of various living forms with unifying characteristic relationships between themselves and environment.

Unit 1:
Origin of life.
Concept and evidences of organic evolution.
Theories of organic evolution.

Unit 2: Concept of microevolution and macroevolution, Concept of species

Unit 3:
Evolutionary history and Palaeontology: evolutionary time scale, eras, period and epoch.

Unit 4:
Concept of macro-and mega-evolution.
Phylogeny of horse.
Evolution of man

References:

1. Dobzhansky,Th.GeneticsandOriginofSpecies.ColumbiaUnvieristyPress.
2. Dobzhansky,Th.,F.J.Ayala,G.L.StebbinesandJ.M.Valentine.Evolution.SurjeetPublication,Delhi.
3. Futuyama, D.J. Evolutinary Biology, Suinuaer Associates, INC Publishers, Dunderland. 4.Haiti, D.L. A Primer of Population Genetics. Sinauer Associates, Inc, Massachusetts.
4. Jha, A.P. Genes and Evolution. John Publication, New Delhi.

PRACTICAL SYLLABUS

1. Evolutionary evidences and/or its demonstration through models/video/CD etc and preparation of working models of the different systems of the following animals: - Adaptive modifications in feet and beaks of birds-
2. Evolutionary evidences of man and Horse
3. Study of evolutionary time scale.
4. Serial homology supporting evolution.
5. Phenotypic Plasticity supporting evolution.
6. Paleontological evidences supporting evolution.
7. Study of natural Selection in action.
8. To study different examples of co-evolution between different organisms.

PROJECT

9. Phylogenetics Tree from lower to higher vertebrates

Semester ....IV...
Session: 2025-26

Name of Program	B.Sc. Zoology Single Major	Program Code	USZOO4
Name of the Course	Biomolecules	Course Code	25ZOOS404DS02
Hours per Week	6	Credits	4=(2+0+2)
Maximum Marks	100	Time of Examinations	3HRS

Note:
Examiner will set nine questions and the candidates will be required to attempt five questions in all. Question number one will be compulsory containing short answer type questions from all units. Further, examiner will set two questions from each unit and the candidates will be required to attempt one question from each Unit. All questions will carry equal marks.

Course Learning Outcomes (CLO):
CLO 1: Knowledge on the fundamental components of life forms.
CLO 2: Students would gain a general understanding of the major types of biochemical molecules, including small, Large, And Super Molecular Components Found in Cells;

Unit 1:
Carbohydrates – classification and general functions; structure of simple sugars; stereoisomerism; glycosidic bonds. Classification, structure and general functions of lipids; structure, biosynthesis and functions of cholesterol.

Unit 2: Covalent bond, ionic bond, Van der Waals, electrostatic, hydrogen bonding, hydrophobic interaction. Chemical and biological properties of water. Classification and functions of vitamins, neurotransmitters, hormones, melanin, chlorophyll, anthocyanin, carotene.

Unit 3:
Proteins Structure-primary, secondary, tertiary, and quaternary. Conjugated proteins-structure and functions.

Unit 4:
Biosynthesis of triglycerides; Biosynthesis of urea, proline, aspartic acid, Uridylic acid, adenylic acid, Classification, and nomenclature of enzymes; Regulation of enzymatic activity;

References:

1. D.Voet and J.G.Voet. Biochemistry, John Wiley & Sons.
2. D.Freifelder. Physical Biochemistry, W.H. Freeman & Company
3. I.H. Segal. Biochemical Calculations, John Wiley & Sons.
4. T.E. Creighton. Protein- structure and Molecular Properties, W.H. Freeman & Company.

PRACTICAL SYLLABUS

1. EXPERIMENT INVOLVING TITRIMETRIC PROCEDURES
a. Estimation of amino acids by formal titration.
b.Estimation of ascorbic acid by titrimertic method using 2, 6-dichlorophenol indo phenol.
c.Determination of saponification value of edible oil.
d.Determination of Acid number of edible oil.
e. Estimation of reducing sugar from biological fluids by Benedict's titrimertic method. f.Iodine number of oil.
2. QUALITATIVE ANALYSIS.
a. Reactions of simple sugars including glucose, fructose, galactose, mannose, pentose, maltose, sucrose, lactose, starch, glycogen and dextrin.
b. Reactions of proteins - solubility, Biuret, Millon's, Xanthoproteic test, denaturation by heat, pH change and precipitation by acidic reagents. Color reactions of amino acids like tryptophan, tyrosine, cysteine, methionine, arginine, proline and histidine.

c. Reactions of lipids - solubility, saponification tests for unsaturations, Liebermann Burchard test for Cholesterol.

Semester ....IV...
Session: 2025-26

Name of Program	**BSc. Zoology Single Major**	**Program Code**	**USZOO4**
Name of the Course	**Aquaculture**	**Course Code**	**25ZOOS404DS03**
Hours per Week	**6**	**Credits**	**4=(2+0+2)**
Maximum Marks	**100**	**Time of Examinations**	**3HRS**

Note:
Examiner will set nine questions and the candidates will be required to attempt five questions in all. Question number one will be compulsory containing short answer type questions from all units. Further, examiner will set two questions from each unit and the candidates will be required to attempt one question from each Unit. All questions will carry equal marks.

Course Learning Outcomes (CLO):
CLO1: To acquaint the students about biology of fish which are important contributors to food as good source of protein.
CLO2: Students will gain knowledge about aquaculture practices that will be helpful in applied areas.
CLO3: The study of Aquaculture will also be helpful in acquainting with methods of conserving fish diversity

Unit 1:
Different systems for aquaculture: pond culture, cage culture, raceway culture. Culture of important fish species (Mayer carps, common carps, Chinese carps, cat fish culture and Tilapia culture).

Unit 2: Integrated Aquaculture and waste water aquaculture Pearl Culture Frog culture Prawn culture-Fresh and brackish water

Unit 3:
Impact of Aquaculture on Environment Methods of Fishing : Crafts and gear technology, Nutrition in Aquaculture: Nutrient and non-nutrient diet components, Preparation and processing of feed, feed formulae, Natural and supplementary feed and their utilization

Unit 4:
Role of genetics in aquaculture– gynogenesis, androgenesis, triploidy, tetraploidy, hybridization, sex reversal and breeding, production of transgenic fish, impact of GMOs on aquatic biodiversity.

References:
1. Fishponds in Farming Systems, Zijpp, V. D., Verreth, J. A. J., Tri, L. Q., van Mensvoort, M. E. F., Bosma, R. H., and Beveridge, M. C. M., Wageningen Academic Publishers, Netherlands
2. Aquaculture Principles and Practices, Pillay, T. V. R., Blackwell Publishing, USA
3. Aquaculture and Fisheries Biotechnology Genetic Approaches, Dunham, R. A., CABI Publishing, USA

PRACTICAL SYLLABUS

1. Identification of Catla catla, Labeo rohita, L. calbasu, Cirrhinus, mrigala, Puntius sarana, Channa punctatus, C. marulius, C. stariatus, Trichogaster fasciata, Mystus seenghala, M. cavasius, M. tengra, Callichrous pabola, C. bimaculatus, Wallago attu, Prawns, Crabs, Lobsters, Clams, Mussels & Oysters.
2. A study of the slides of fish parasites.
3. A study of the different types of nets, e.g., cast net, gill net, drift net and drag net.
4. Preparation and processing of feed, feed formulae
5. A visit to lake/reservoir/fish breeding centre

Semester ....IV...
Session: 2025-26

Name of Program	**BSc. Zoology Single Major**	**Program Code**	**USZOO4**
Name of the Course	**Wildlife and conservation**	**Course Code**	**25ZOOS404DS04**
Hours per Week	**6**	**Credits**	**4=(2+0+2)**
Maximum Marks	**100**	**Time of Examinations**	**3HRS.**

Note:
Examiner will set nine questions and the candidates will be required to attempt five questions in all. Question number one will be compulsory containing short answer type questions from all units. Further, examiner will set two questions from each unit and the candidates will be required to attempt one question from each Unit. All questions will carry equal marks.

Course Learning Outcomes (CLO):
1. Students will be able to understand about wildlife zones of India
2. Students will be able to explain the concept of Protected area system
3. It will make the students understand about IUCN categories
4. Students will be able to explain the mechanism of biodiversity threats
5. Students will be able to understand about understanding of wildlife management methods

Unit 1:
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)

Unit 2
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 3:
Red Data Book and its uses
IUCN Categories of wildlife species
Climate change and loss of biodiversity

Unit 4:
Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts
Wildlife Tourism
Biosphere Reserves concept and Indian Biosphere Reserves; Location & Significance

References:
1. Trends in wildlife biodiversity conservation and management. B.B. Hosetti and M. Venkatesh warlu.
2. Wildlife conservation and management. Reena Mathur.
3. Concepts of Wildlife management. B.B.Hosetti.
4. Techniques for wildlife Census in India by W.A. Rogers (A field manual); Wildlife Institute of India, Dehradun.
5. Wildlife Wealth of India by T.C. Majupuria; Tecpress Services, L.P., 487/42-SOL-Wattenslip, Pratunam Bangkok, 10400, Thailand.

PRACTICAL SYLLABUS

1. Study of biodiversity among various organisms (Listing of all the animals found in and around your house and also try to find out their Zoological names).
2. Identification and photography of various species.
3. Visits to a local animal park or zoo to identify and study the captive fauna and preparation of report.
4. Study of adaptive characteristics of various vertebrates in different climate.
5. Study of biodiversity in grassland and pond water by using Shannon -Weiner index.
6. Comparison of two species of birds belonging to same genus (Interspecific difference).

Semester ....V...
Session: 2026-27

Name of Program	**BSc. Zoology Single Major**	**Program Code**	**USZOO4**
Name of the Course	**Animal behaviour**	**Course Code**	**26ZOOS405DS01**
Hours per Week	**6**	**Credits**	**4=(2+0+2)**
Maximum Marks	**100**	**Time of Examinations**	**3HRS.**

Note:
Examiner will set nine questions and the candidates will be required to attempt five questions in all. Question number one will be compulsory containing short answer type questions from all units. Further, examiner will set two questions from each unit and the candidates will be required to attempt one question from each Unit. All questions will carry equal marks.

Course Learning Outcomes (CLO):
1. Students will be able to understand about different types of animal behaviour.
2. Students will be able to explain the concept of Protected area system
3. It will make the students understand about IUCN categories
4. Students will be able to explain the mechanism of biodiversity threats
5. Students will be able to understand about understanding of wildlife management methods

Unit 1:
Types of behaviour – innate, imprinting, and learned behaviour, Altruism and reciprocal altruism.

Unit 2
Mimicry: aggressive, Batesian and Mullerian. Colouration: aposematism and camouflage

Unit 3:
Hormonal control of behaviour – roles of melatonin, oxytocin, adrenaline and noradrenaline, and steroids. Hormonal basis of sex change.

Unit 4:
Infrasound; echolocation; dancing in bees, domestication and behaviour change

References:

1. Mathur, R., and Singh, S. P. (2008). Evolution and Behaviour. Rastogi Publications, Meerut, India.
2. Mandal, F. K. (2012). Textbook of Animal Behaviour. PHI Learning Private Limited, New Delhi, India.
3. Rubenstein, D. R., Alcock, J. (2018). Animal Behavior: An Evolutionary Approach (11th edition). Sinauer Associates Inc.

PRACTICAL SYLLABUS

1. To identify types of behavior in local animals
2. To study the geotaxis behaviour of earthworm.
3. To study the Hydrotaxis, behaviour of earthworm
4. To study the Chemotaxis behaviour of earthworm and
5. To study the Phototaxis behaviour of earthworm
6. To study phonotaxic behaviour of earthworm
7. To study the camouflage in garden reptiles

Semester ..V....
Session: ... 2026-27

Name of Program	**BSc. Zoology Single Major**	**Program Code**	**USZOO4**
Name of the Course	**Ecology &Environment**	**Course Code**	**26ZOOS405DS02**
Hours per Week	**6**	**Credits**	**4=(2+0+2)**
Maximum Marks	**100**	**Time of Examinations**	**3hrs**

Note:
Examiner will set nine questions and the candidates will be required to attempt five questions in all. Question number one will be compulsory containing short answer type questions from all units. Further, examiner will set two questions from each unit and the candidates will be required to attempt one question from each Unit. All questions will carry equal marks. \

Course Learning Outcomes (CLO):
CLO1: The aim of this paper is to impart advanced knowledge about the global change in the environment
CLO2: Students would gain knowledge about the Interactions between environment and biota.

Unit 1:
Basic concepts of ecology: Definition, significance. Concepts of habitat and ecological niche.
Factors affecting environment: Abiotic factors (light-intensity, quality and duration), temperature, humidity, topography; edaphic factors; biotic factors.

Unit 2:
Ecosystem: Concept, components, properties and functions; Ecological energetics and energy flow-food chain, food web, trophic structure; ecological pyramids concept of productivity.
Biogeochemical cycles: Concept, reservoir pool, gaseous cycles and sedimentary cycles.
Population: Growth and regulation.

Unit 3:
Interactions between environment and biota; Concept and types of ecosystem, Stability and complexity of ecosystems; Productivity and biodegradation in different ecosystems; Limiting factor; food chain and energy flow, productivity and biogeochemical cycles (N2, P, C and S); Ecological pyramids and recycling; Community structure and organisation;

Unit 4:
Global environmental change; biodiversity, status, monitoring and documentation; Major drivers of biodiversity change, biodiversity management approach. Microbiology of water, air, soil and sewage

References:
1. Jorgensen, S.E. Fundamentals of ecological modeling. Elsevier, New York.
2. Lendren, D. Modelling in behavioral ecology. Chapman & Hal, London, UK.
3. Sokal, R.R. and F.J. Rohlf. Biometry. Freeman, San Francisco.

4. Odum : Ecology (Amerind)
5. Odum : Fundamentals of Ecology (W.B. Saunders)
6. Ricklefy : Ecology, (WH Freeman)
7. Turk and Turk : Environmental Science (W.B. Saunders)

PRACTICAL SYLLABUS

1. Chemical analysis of pond water and soil for pH,
2. Chemical analysis of pond water and soil for dissolved oxygen,
3. Chemical analysis of pond water and soil for free CO2 nitrates,
4. Chemical analysis of pond water and soil for phosphates and chlorides

PROJECT:

1. Population: Growth and regulation.
2. Biogeochemical cycles (N2, P, C and S)
3. Global environmental change

Semester ..V....
Session: ... 2026-27

Name of Program	**BSc. Zoology Single Major**	**Program Code**	**USZOO4**
Name of the Course	**Applied Zoology-I**	**Course Code**	**26ZOOS405DS03**
Hours per Week	**6**	**Credits**	**4=(2+0+2)**
Maximum Marks	**100**	**Time of Examinations**	**3hrs**

Note:
Examiner will set nine questions and the candidates will be required to attempt five questions in all. Question number one will be compulsory containing short answer type questions from all units. Further, examiner will set two questions from each unit and the candidates will be required to attempt one question from each Unit. All questions will carry equal marks. \

Course Learning Outcomes (CLO):
CLO1: Students will able to explain the basic concept of Poultry and Pisciculture
CLO2: Student will understand the basic concepts of industry based applied methods.
CLO3: Students will develop skills in basic laboratory techniques and understand the principles in biology.

Unit 1:
Pisciculture: Economically important fresh water and marine fishes; Fish culture, Problems of seed collection from natural resources, Induced breeding methods, Products and by products from pisciculture

Unit 2:
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 3:
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 4:
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

References:
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 McGrew Hill Publications. New Delhi.
7. Agricultural Pests: Biology and Control Measures by B. M. Deoray and T. B. Nikam, Nirali Publication

PRACTICAL SYLLABUS

1. Life cycle of Chicken, Poultry farming
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.

Semester ..V....
Session: 2026-27

Name of Program	**BSc. Zoology Single Major**	**Program Code**	**USZOO4**
Name of the Course	**Applied Zoology-II**	**Course Code**	**26ZOOS405DS04**
Hours per Week	**6**	**Credits**	**4=(2+0+2)**
Maximum Marks	**100**	**Time of Examinations**	**3hrs**

Note:
Examiner will set nine questions and the candidates will be required to attempt five questions in all. Question number one will be compulsory containing short answer type questions from all units. Further, examiner will set two questions from each unit and the candidates will be required to attempt one question from each Unit. All questions will carry equal marks. \

Course Learning Outcomes (CLO):
1. Students will be able to identify different species and casts of honeybees and species of silkworm.
2. 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
3 Information on the basics of zoology for the welfare of human lives, the uses and roles of animals for the sustenance of other organisms.

Unit 1:
Apiculture: Types of bees, structure and composition of hive, rearing method and economic importance. Sericulture: culturable silkworms, rearing method and economic importance.

Unit 2:
Types of pesticides; pest control (natural, chemical and biological controls); integrated pest management. Vermicomposting: vermicomposting species; methods.

Unit 3:
Fish farm: structure; maintenance of ponds. Integrated fish farming. Breeding in fishes – natural and induced breeding; ecological and hormonal influence on maturation and spawning. Important cultivable fishes.

Unit 4:
Population: characteristics, dynamics; species richness and diversity; Sorensen's and Shannon-Weaver model. Wildlife: management and conservations; remote sensing; human-animal conflicts.

References:
1. Jhingran, V. G. (2002). *Fish and Fisheries of India*. Hindustan Publishing Corporation,

Delhi, India.
2. Kumar, A., Desmukh, N. Z., Kumar, D., and Goswami, R. (2020). *Applied and Economic Zoology*. Daya Publishing House.
3. Mathur, R. (2019). *Wildlife Conservation and Management.* Rastogi Publications, Meerut, India.
4. Upadhyay, V. B., Shukla, G. S. (2014). *Applied and Economic Zoology*. Rastogi Publications, Meerut, India.
5. Winter, M. (2016). *Wildlife Biology*. Syrawood Publishing House.

PRACTICAL SYLLABUS

1. Life history of silk worm.
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. Life history of earthworm.
7. Field visit to aviary/fish pond and fish market/sericulture unit/Prawn farm and preparation of field report.

Semester ..VI....
Session: 2026-27

Name of Program	**BSc. Zoology Single Major**	**Program Code**	**USZOO4**
Name of the Course	**Animal Physiology**	**Course Code**	**26ZOOS406DS01**
Hours per Week	**6**	**Credits**	**4=(2+0+2)**
Maximum Marks	**100**	**Time of Examinations**	**3hrs**

Note:
Examiner will set nine questions and the candidates will be required to attempt five questions in all. Question number one will be compulsory containing short answer type questions from all units. Further, examiner will set two questions from each unit and the candidates will be required to attempt one question from each Unit. All questions will carry equal marks. \

Course Learning Outcomes (CLO):
1. Students will be able to identify different species and casts of honeybees and species of silkworm.
2. Students will be able to use the tools and techniques used in apiculture, sericulture, aquaculture, piggery poultry and leather Industry and capabilities to initiate start ups will develop
3 Information on the basics of zoology for the welfare of human lives, the uses and roles of animals for the sustenance of other organisms.

Unit 1:
Extracellular and intracellular digestions. Digestion of carbohydrates, proteins and fats. Respiration: mechanism in gills and lungs. Types of respiration – external, internal, and cutaneous..

Unit 2:
Open and closed circulation. Mammalian heart: myogenic and neurogenic; pacemaker; cardiac cycle. Kidney: structure and function. Micturition. Types of

excretion: ammonotelic, uricotelic and ureotelic.
Unit 3: Osmoregulation in marine and terrestrial vertebrates. Muscle proteins. Mechanism of muscle contraction – sliding filament theory; cross-bridge model.
Unit 4: Types and structures of neurones. Resting and action potentials; propagation of nerve impulse. Major neurotransmitters. Structure of synapse. Synaptic transmission.
References: 1. Goyal, K. A., and Sastry, K. V. (2017). Animal Physiology (7th edition). Rastogi Publications, Meerut. 2. Hill, R. W., Wyse, G. A., and Anderson, M. (2019). Animal Physiology (5th edition). Sinauer Associates, Inc. 3. Kardong, K. (2018). Vertebrates: Comparative Anatomy, Function, Evolution (8th edition). McGraw-Hill. 4. Moyes, C. D., and Schulte, P. M. (2015). Principles of Animal Physiology (3rd edition). Benjamin Cummings. 5. Yancy, P. H., Sherwood L., and Klandorf, H. (2014). Animal Physiology: From Genes to Organisms (2nd edition). Cengage Learning, Inc.

PRACTICAL SYLLABUS

1. Study of human salivary amylase activity: Effect of temperature, pH, Concentration.
2. Estimation of abnormal constituents of urine (Albumin, sugar, ketone bodies).
3. Use of Kymograph unit & respirometer.
4. Haematin crystal preparation.
5. Estimation of Hb.
6. DLC of Man/RBC count/WBC count.
7. Study of permanent slides of endocrine glands
8. Blood antigens and antibodies: Blood group testing

Semester ..VI....
Session: ... 2026-27

Name of Program	**BSc. Zoology Single Major**	**Program Code**	**USZOO4**
Name of the Course	**Entomology**	**Course Code**	**26ZOOS406DS02**
Hours per Week	**6**	**Credits**	**4=(2+0+2)**
Maximum Marks	**100**	**Time of Examinations**	**3hrs**

Note:
Examiner will set nine questions and the candidates will be required to attempt five questions in all. Question number one will be compulsory containing short answer type questions from all units. Further, examiner will set two questions from each unit and the candidates will be required to attempt one question from each Unit. All questions will carry equal marks. \

Course Learning Outcomes (CLO):
CLO1: Students will gain Knowledge on the biology and diversity of insects,
CLO2: They will also learn uniqueness among their life forms, and their influences on other animals.

Unit 1:
Insecta: classification with general characters; methods of collection and preservation; Insect physiology: digestive, respiratory and reproductive organs;

body wall and mouthparts; respiration.
Unit 2: Social behaviour and caste system in insects; Insect hormones: types, biological effects and their applications. Hormonal regulation of metamorphosis..
Unit 3: Economically important insects: honeybee, lac, silkworm. Medically important insect: Diptera (mosquitoes), Hemiptera (bed bugs), Phthiraptera (sucking lice), Siphonaptera (fleas), Acarina (mites, and ticks).
Unit 4: Parasitic and predatory insects and their roles; control of insect pests (natural, chemical, biological and integrated methods). Biotechnology and insect pest management.
References: 1. Chapman, R. F. (2013). *The Insects: Structure and Function* (5th edition). Cambridge University Press. 2. Service., M (2012). *Medical Entomology for Students* (5th edition). Cambridge University Press. 3. Gillott, C. (2018). *Entomology* (3rd edition). Springer. 4. Gullan, P. J., Cranston, P. S., and Mcinnes, K. H. (2010). *Insects: An Outline of Entomology* (4th edition). Wiley-Blackwell. 5. Kotpal, R. L. (2019). *Modern Textbook of Zoology: Invertebrates* (12th edition). Rastogi Publications.

PRACTICAL SYLLABUS

External morphology, identification marks, nature of damage and host of the following pests:-

(i) Sugarcane: Sugarcane leaf-hopper, Sugarcance whitefly, Sugarcance top borer, Sugarcane root borer, 30 34(797) Gurdaspur borer (any two).

(ii) Cotton: Red Cotton bug

(iii) Wheat: Wheat stem borer

(iv) Paddy: Gundhi bug, Rice grasshopper, Rice stem borer, Rice hispa (any one).

(v) Vegetables: Aulocophora faveicollis, Dacus cucurbitas, Tetranychus tecarious, Epilachna (any three).

(vi) Pests of stored grains: Pulse beetle, Rice weevil, Grain & Flour moth, Rust-red flour beetle, lesser grain borer (any three). 2. Stages of life history of silk moth and honey bee. 3. Preparation of permanent/temporary slides for identification of mosquitoes

Semester ..VI.....

Session: ...2026-27.....

Name of Program	**BSc. Zoology Single Major**	**Program Code**	**USZOO4**
Name of the Course	**Basics of embryology**	**Course Code**	**26ZOOS406DS03**
Hours per Week	**6**	**Credits**	**4=(2+0+2)**
Maximum Marks	**100**	**Time of Examinations**	**3hrs**
Note: Examiner will set nine questions and the candidates will be required to attempt five questions in all. Question number one will be compulsory containing short answer type questions from all units. Further, examiner will set two questions from each unit and the candidates will be required to attempt one question from each Unit. All questions will carry equal marks. \			
Course Learning Outcomes (CLO):			

CLO1: The aim of this paper is to impart advanced knowledge about the Knowledge on the fundamental processes and roles of reproduction in animals, CLO2: Students would gain knowledge how the developmental stages are maintained and regulated.
Unit 1: Gametogenesis: spermatogenesis and oogenesis; Structure of spermatozoon and ovum. Hormonal regulation of gametogenesis, ovulation, formation of corpus luteum.
Unit 2: Fertilization: events and types, prevention of polyspermy, monozygotic and dizygotic twins. Parthenogenesis. Types of eggs and patterns of cleavage, Implantation and gestation, types and functions of placenta in mammals.
Unit 3: Blastulation, gastrulation and Fate maps in frog. Amphibian metamorphosis and hormonal regulation. Extra-embryonic membranes and fate maps in chick.
Unit 4: Concept of organizer and induction. Regeneration in invertebrates and vertebrates. Concepts and models of ageing.
References: 1. Barresi, M. J. F., and Gilbert, S. (2020). Developmental Biology (12th edition). Sinauer Associates, Inc. 2. Sadler, S. L. (2019). Langman's Medical Embryology (13th edition). Wolters Kluwer India Pvt. Ltd. 3. Sastry, K. V., and Shukla, V. (2018). Developmental Biology (2nd edition). Rastogi Publications. 4. Verma. P. S., and Agarwal, V. K. (2010). Chordate Embryology: Developmental Biology. S. Chand and Company Ltd., New Delhi. 5. Wolpert, L., Smith, J., Jessell, T., Lawrence, P., Roberson, E., and Meyerowitz, E. (2018). Principles of Development (5th edition). Oxford University Press.

PRACTICAL SYLLABUS

1. To study the various developmental stages of embryogenesis and life cycle of Drosophila.
2. To study the various developmental stages of life cycle of Frog.
3. To study various developmental stages of chick embryo with the help of the permanent slides.
4. To dissect out Drosophila larvae and to take out the imaginal discs
5. To study Influence of temperature on insect development
6. To study Influence of mutagens on insect development
7. To study Development and Preservation of chick Embryo

Semester ..VI....
Session: 2026-27

Name of Program	**BSc. Zoology Single Major**	**Program Code**	**USZOO4**
Name of the Course	**Fish and fisheries**	**Course Code**	**26ZOOS406DS04**

Hours per Week	**6**	**Credits**	**4=(2+0+2)**
Maximum Marks	**100**	**Time of Examinations**	**3hrs**

Note:
Examiner will set nine questions and the candidates will be required to attempt five questions in all. Question number one will be compulsory containing short answer type questions from all units. Further, examiner will set two questions from each unit and the candidates will be required to attempt one question from each Unit. All questions will carry equal marks. \

Course Learning Outcomes (CLO):

CLO1: Students will understand about fresh water fishes of India
CLO 2. Students will capable to undertake about fishing crafts and gears
CLO 3. It will make the students understand about the seed production in fishes
CLO 4. Students will be able to explain the culture technology in fishery
CLO 5. Students will be able to identify fish specimens

Unit 1:

Introduction to world fisheries: Production, utilization and demand.
Fresh Water fishes of India: River system, reservoir, pond, tank fisheries; captive and culture fisheries, cold water fisheries.

Unit 2:

Fishing crafts and gears.
Fin fishes, Crustaceans, Molluscs and their culture.
.

Unit 3:

Seed production: Natural seed resources – its assessment, collection, Hatchery production.
Nutrition: Sources of food (Natural, Artificial) and feed composition (Calorie and Chemical ingredients).

Unit 4:

Field Culture: Ponds-running water, recycled water, cage, culture; poly culture.
Culture technology: Biotechnology, gene manipulation and cryopreservation ofgametes.

References:

1. Arumugam N. (2014). Aquaculture and Fisheries, Saras Publication
2. Bardach, JE, Ryther & McLarney, Wo (1972) Aquaculture, New York: Wiley-Interscience. 896pp.
3. Lagler, KF, Bardach, JE, Miller, RR & Passino, DRM (1977) Ichthyology, 21nd Edition, New York, Wiley, 506 pp.
4. Khanna S S, & Singh H R (2014). Textbook of Fish Biology and Fisheries 3rd edn. Narendra Publishing House

PRACTICAL SYLLABUS

1. Identification of Catla catla, Labeo rohita, L. calbasu, Cirrhinus, mrigala, Puntius sarana, Channa punctatus, C. marulius, C. stariatus, Trichogaster fasciata, Mystus seenghala, M. cavasius, M. tengra, Callichrous pabola, C. bimaculatus, Wallago attu, Prawns, Crabs, Lobsters, Clams, Mussels & Oysters.
2. A study of the slides of fish parasites.
3. A study of the different types of nets, e.g., cast net, gill net, drift net and drag net.
4. Preparation and processing of feed, feed formulae
5. A visit to lake/reservoir/fish breeding centre