SYLLABI AND SCHEME OF EXAMINATIONS FOR DISCIPLINE SPECIFIC COURSES OF B.Sc. LIFE SCIENCES OFFERED BY DEPARTMENT OF ZOOLOGY

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

MAHARSHI DAYANAND UNIVERSITY ROHTAK (HARYANA)

To be applicable on the students w.e.f. session 2024-25 (3rd Semester onwards) and on the students w.e.f. session 2025-26 (1st semester onwards)

CREDIT STRUCTURE FOR DISCIPLINE SPECIFIC COURSES OF B.Sc. LIFESCIENCES
OFFERED BY DEPARTMENT OF ZOOLOGY

Semester	Discipline-Specific Courses (DSC) / Major courses	Minor(MIC)/ Vocational (VOC)/ Skill Enhancement Courses (SEC)/ Internship	Multidisciplinary courses(MDC)	Ability Enhancement courses(AEC)	Research project/ Dissertation	Value-Added Courses (VAC)	Total Credits
I	DSC - A1 @ 4 credits Chemistry	MIC1 @ 4 credits **Common Pool**	MDC1 @ 3 credits **Common Pool**	AEC1 @ 2 credits **Common Pool**	----------	----------	24
	24ZOOM401DS01 **Animal diversity-I** DSC – B1 @ 4 credits	SEC1@ 3 credits** **Apiculture** **24ZOO401SE01**					
	DSC - C1 @ 4 credits Botany						
II	DSC - A2 @ 4 credits	SEC2 @ 3 credits** **Pest Management** **24ZOO402SE02**	MDC2 @ 3 credits **Common Pool**	AEC2 @ 2 credits **Common Pool**	----------	VAC1 @ 2 credits VAC2 @ 2 credits **Common Pool**	24
	24ZOOM402DS01 **Animal diversity-II** DSC – B2 @ 4 credits						
	DSC – C2 @ 4 credits Botany						
Students exiting the programme after second semester and securing 52 credits including 4 credits of summer internship will be awarded UG Certificate in the relevant Discipline/ Subject							
III	DSC – A3 @ 4 credits Chemistry	MIC2 @ 4 credits **Common Pool**	MDC3 @ 3 credits **Common Pool**	AEC3 @ 2 credits **Common Pool**		----------	24
	25ZOOM403DS01 **Cell Biologyand Genetics** DSC – B3 @ 4 credits	SEC3@ 3 credits** **Microtomy** **25ZOO403SE03**					
	DSC – C3 @ 4 credits Botany						
IV	DSC – A4 @ 4 credits Chemistry	MIC3@ 4 credits **Common Pool**	----------	AEC4 @ 2 credits **Common Pool**	----------	VAC3 @ 2 credits **Common Pool**	24
	25ZOOM404DS01 Biomolecules and Mammalian Physiology**DSC – B4 @ 4 credits**						

	DSC – C4 @ 4 credits **Botany**						
Students exiting the programme after fourth semester and securing 96 credits including 4 credits of summer internship will be awarded UG Diploma in the relevant Discipline/Subject							
V	**DSC – A5 @ 4 credits** **Chemistry**	**MIC4@ 4 credits** **Common Pool**	----------	----------	----------	----------	**24**
	26ZOOM405DS01 Basics of developmental biology **DSC – B5 @ 4 credits**	**Internship @ 4 credits#**					
	DSC – C5 @ 4 credits **Botany**						
VI	**DSC – A6 @ 4 credits** **Chemistry**	**MIC5 @ 4 credits** **Common Pool**	----------	----------	----------	----------	**24**
	26ZOOM406DS01 Ecology & Evolution **DSC – B6 @ 4 credits**	**MIC6@ 4 credits** **I Common Pool**					
	DSC – C6 @ 4 credits **Botany**						
Students will be awarded 3-year UG Degree in the relevant Discipline/Subject upon securing 132 credits.							
VII*	**27ZOO407DS01** **Animal Cell Biology** **DSC-H1@4credits**	**SEC4** **@ 4 credits (any one)** Management of Wildlife 24ZOO201SEC01A **Or** Limnology 24ZOO201SEC01B	----------	----------	----------	----------	**24**
	27ZOO407DS02 **Techniques in Animal Science** **DSC-H2@4 credits**						
	27ZOO407DS03 **Diversity of Life Form-1** **DSC-H3@4 credits**						
	27ZOO407DS04 **Animal Biochemistry**						

	and metabolism DSC–H4@4 credits **27ZOO407DS05 Molecular Biology DSC-H5@4 credits**						
VIII* (4yr UG Hon.)	**27ZOO408DS01 Inheritance Biology DSC–H6@4 credits** **27ZOO408DS02 Diversity of Life Form-II DSC–H7@4 credits** **27ZOO408DS03 Animal Behavior DSC– H8@4 credits** **27ZOO408DS04 Evolutionary Biology DSC–H9@4 credits** **27ZOO408DS05 Developmental Biology DSC–H10@ 4 credits**	**SEC5@ 4 credits (any one)** Aqua farming 24ZOO202SEC02A Or Bee Keeping 24ZOO202SEC02B	----------	----------	----------	----------	**24**
VIII* (4yr UG Hon. with Research)	**27ZOO408DS01 Inheritance Biology DSC–H6@4 credits** **27ZOO408DS02 Diversity of Life Form-II**	**SEC5@ 4 credits (any one)** Aqua farming 24ZOO202SEC02A	----------	----------	**Research project/ Dissertation@ 12 credits**	----------	**24**

	DSC–H7@4 credits ---------- ----------	Or Bee Keeping 24ZOO202SEC02B				**TOTAL CREDITS**	**216**

* Student should select one major discipline (Out of A, B, or C studied during first three years of UG Programmes) in which he/she wishes to pursue Honors. This framework is subject to modification as per UGC guidelines at the University level. The universities may decide to offer the Honors degree Programmes subject to the fulfilment of credit point table

** SEC for imparting practical skills related to Major (A, B and C)/minor.

#Four credits of internship earned by a student during summer internship after 2nd semester or 4th semester will be counted in 5th semester of a student who pursue 3 year UG Programmes without taking exit option.

Semester I														
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**	**50**	
DSC @ 4 credits	**Animal diversity-I**	**24ZOOM401DS01**	**2**		**2**	**4**	**2**		**4**	**6**	**15**	**35**		**100**
Semester II														
DSC @ 4 credits	**Animal diversity-II**	**24ZOOM402DS01**	**2**		**2**	**4**	**2**		**4**	**6**	**15**	**35**	**50**	**100**
Semester III														
DSC @ 4 credits	**Cell Biology and Genetics**	**25ZOOM403DS01**	**2**		**2**	**4**	**2**		**4**	**6**	**15**	**35**	**50**	**100**
Semester IV														
DSC @ 4 credits	**Biomolecules and Mammalian Physiology**	**25ZOOM404DS01**	**2**		**2**	**4**	**2**		**4**	**6**	**15**	**35**	**50**	**100**
Semester V														
DSC @ 4 credits	**Basics of developmental biology**	**26ZOOM405DS01**	**2**		**2**	**4**	**2**		**4**	**6**	**15**	**35**	**50**	**100**
Semester VI														
DSC @ 4 credits	**Ecology & Evolution**	**26ZOOM406DS01**	**2**		**2**	**4**	**2**		**4**		**15**	**35**	**50**	**100**

L: Lecture; T: Tutorial; P: Practical

Note:

The Syllabi and Scheme of Examinations (SOE) for Discipline Specific Courses/Major Courses for UG Semester 7 and Semester 8 will be same as applicable for Syllabi and S.O.E. for Post Graduate semester 1 and semester 2 respectively.

SYLLABI FORFOR DISCIPLINE SPECIFIC COURSES OF B.Sc. LIFESCIENCES OFFERED BY DEPARTMENT OF ZOOLOGY

Semester ..I.....

Name of Program	**B.Sc. LIFESCIENCES**	**Program Code**	**UMLS4**
Name of the Course	**ANIMAL DIVERSITY-I**	**Course Code**	**24ZOOM401DS01**
Hours per Week	**4**	**Credits**	**4**
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 Protozoa

CLO 2. 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

Unit 1:

Phylum-Protozoa

i) Generalcharacters

ii) Typestudyof*Plasmodium;*

iii) Parasitic protozoans: Life history, mode of infection and pathogenicity of *Entamoeba,Trypanosoma*

Phylum-Porifera:

i) Generalcharacters

ii) Canalsystem and Spiculesinsponges

Unit 2:Phylum-Coelenterata:

i) Generalcharacters

ii) Coralsandcoralreefs

Phylum-Helminths:

i) Generalcharacters

ii) Typestudy-*Fasciolahepatica*

Unit 3:

Phylum-Annelida:

i) Generalcharacters

ii) MetamerismInAnnelids

Phylum–Arthropoda:

Generalcharacters

Typestudy–*Periplaneta*

Unit 4:

Phylum-Mollusca:

i) Generalcharacters

Phylum-Echinodermata:

i) Generalcharacters
ii) TypeStudy-*Asterias*(SeaStar)

Phylum – Hemichordata:General characters

References:

1. Jordan, E.L and P.S. Verma. 2009. Invertebrate Zoology, S.Chand and Co. Ltd. New Delhi.
2. Ayyar, E.K and T. Ananthakrishnan. 1992. Manual of Zoology Vol.1 Invertebrates Part I and II, S.Viswanathan Printers and Publishers Pvt. Ltd. Madras.
3. Kotpal, R.L. 2021. Zoology Invertebrates. Rastogi Publications, Meerut.
4. Nair, N.C., N. Arumugam, N. Soundarapandian, T. Murugan and S. Leelavathy. 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. Barnes (1994)· Invertebrate Zoology ; Saunders College Pub

Zoology Practical : 1st Semester

(A) Classification up to orders with ecological note and economic importance of the following animal:

1. Protozoa Specimens

Permanent prepared slides: Amoeba, Euglena, Trypanosoma, Noctiluca, Paramecium (binary fission and conjugation), Opalina, Vorticella, Balantidium.

2. Porifera Specimens:

Sycon. Grantia, Euplectella, Hyalonema, Spongilla, Euspongia

3. Coelenterata Specimens:

Porpita, Physalia, Aurelia, Rhyzostoma, Metridium, Millipora, Tubipora, Madrepora, Favia, Fungia.

Permanent prepared slides: Hydra (W.M.), Hydra with buds, Obelia (colony and medusa), Sertularia, and Bougainvillea, Aurelia.

4. Platyhelminthes Specimens:

Dugesia, Fasciola, Taenia, Echinococcus,

Permanent prepared slides: Miracidium, sporocyst, redia, cercaria, scolex and proglotttids; Taenia (mature and gravid).

5. Aschelminthes :

Ascaris (male & female), Trichinella, Ancylostoma.

6. Annelida Specimens:

Pheretima, Heteronereis, Aphrodite, Chaetopterus, Tubifex and Pontobdella.

7. Arthropoda Specimens:

Peripatus, Palaemon (Prawn), Lobster, Cancer (crab), Sacculina, Eupagurus (hermit crab), Daphnia, Lepisma, Periplaneta (cockroach), Schistocerca (locust), Mantis (praying mantis), Cicada, Termite queen, Apis (honey bee), Bombyx (silk moth). Millipedes, Scolopendra (centipedes), Palamnaeus (scorpion), Aranea (spider), Limulus (king crab).

8. Mollusca Specimens:

Mytilus, Ostrea, Pecten, Patella, Aplysia, Doris, Limax, Loligo, Sepia, Octopus, Nautilus (complete and T.S.), Chiton and Dentalium.

9. Echinodermata Specimens:

Asterias, Echinus, Cucumara, Ophiothrix, Antedon.

10. HemichordataSpecimen : Balanoglossus

(B) Study of the following permanent stained preparations:

1. L.S. and TS. Sycon; gemmules, spicules and sponging fibres of Sycon, canal system of sponges.
2. TS. Hydra (testis and ovary region).
3. T.S. Fasciola (different regions).
4. T.S. Ascaris (male and female).
5. T.S. Pheretima (pharyngeal and typhlosolar regions), Setae, septal nephridia and spermathecae of Pheretima.

(C) Preparation of the following slides:
1. Temporary preparation of Volvox, Gemmules
2. Preparation of permanent stained whole mounts of Hydra, Obelia.

(D) Project:
1. Parasitic adaptations (Protozoa to Helminthes)
2. Vermicomposting: Earthworm rearing and economics of the project

Semester ..II.....

Name of Program	B.Sc. LIFESCIENCES	Program Code	UMLS4
Name of the Course	ANIMAL DIVERSITY-II	Course Code	24ZOOM402DS01
Hours per Week	4	Credits	4
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:**
CLO 2. 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:**

Unit 1 :
Chordates : Salient features of chordates, principles of classification
Protochordates : Type study of Herdmania

Unit 2:
Pisces : General characters. Types of scales and fins in fishes.
Type study :Labeorohita

Unit 3:
Amphibia : General characters
Type study : Frog, Parental care in Amphibians
Reptilia : General characters, evolution and evolutionary tree of Reptiles,poisonous and non-poisonous snakes and poison Apparatus in Snakes

Unit 4:
Aves : General characters, flight Adaptations in Birds and bird migration.
Mammals : General characters, dentition in mammals, Adaptive Radiations in Mammals

References:
1. Jordan, E.L and P.S. Verma. 2009. Invertebrate Zoology, S.Chand and Co. Ltd. New Delhi.
2. Ayyar, E.K and T. Ananthakrishnan. 1992. Manual of Zoology Vol.1 Invertebrates Part I and II, S.Viswanathan Printers and Publishers Pvt. Ltd. Madras.
3. Kotpal, R.L. 2021. Zoology Invertebrates. Rastogi Publications, Meerut.
4. Nair, N.C., N. Arumugam, N. Soundarapandian, T. Murugan and S. Leelavathy. 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

Zoology Practical : 2nd Semester

1. Classification upto orders, habit, habitats, external characters and economic importance (if any):
Protochordata: Molqula, Botryllus, Doliolum, Olikopleura, and Amphioxus.
Cyclostomata: Myxine, Petromyzon and Ammocoetus larva.
Chondrichthyes: Zygaena, Pristis, Narcine (electric ray), Rhinobatus, and Chimaera.
Osteichthyes: Acipenser, Lepidosteus, Muraena, Catla, Hippocampus, Syngnathus, Exocoetus, Anabas, Diodon, Solea and Polypterus
Amphibia: Necturus, Salamandra, Amblystoma, Axolotl larva, Bufo, Rana.
Reptilia: Hemidactylus, Calotes, Varanus, Chamaeleon, Python, Bungarus, Naja, Viper, Crocodilus, Gavialis, Chelone (Turtle) and Testudo (Tortoise).
Aves: Anas, Milvus, Pavo, Eudynamis, Tyto, Alcedo
Mammalia: Ornithorhynchus, Echidna, Didelphis, Macropus, Loris, Macaque, Hystrix, Funambulus, Felix, Panthera, Canis, Herpestes, Pteropus.
2. Internal anatomy of the following animals:
(i) Computer simulated model/study of General anatomy; (b) Rat: Digestive, arterial, venous
(c) Hemidactylus: Digestive, arterial, venous
3. Study of the skeleton of Rana (Frog), Gallus
4. Study of the following prepared slides: different types of scales.
5. Make permanent stained preparations of the following: Cycloid scales
6. Field Visit to National Park or Zoo.

Semester ..III.....

Name of Program	**B.Sc. LIFE SCIENCES**	**Program Code**	**UMLS4**
Name of the Course	Cell Biologyand Genetics	**Course Code**	**25ZOOM403DS01**
Hours per Week	**4**	**Credits**	**4**
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 would gain expertise in the ultrastructural information of animal cell besides the detailed views of the cell interior revealing the various events and actions of cell at the molecular level.

CLO 2: The study will help the students to understand the new discoveries about the structure and internal functioning of the cell due to technological improvements.

CLO 3: The study will help the students to increase powerful means of visualization in the field of cell biology.

Unit 1:

Plasma Membrane: Fluid mosaic model, transport across the membrane, mechanism of active and passive transport, endocytosis and exocytosis.
Endoplasmic reticulum (ER): Types and its functions.
Goigi complex: Structureand role of golgi-complex in animal cell.
Ultrastructure and functions of Nucleus: nucleolus, nucleosome concept and role of histones, fine structure of chromosomes, Euchromatin and heterochromatin, lampbrush chromosomes and polytene chromosomes.

Unit 2:

Ribosomes: Types, and role in protein synthesis.
Lysosomes: Structure, enzyme and their role; polymorphism
Mitochondria: Structure and role of mitochondria.
Cytoskeleton: Microtubules, microfilaments, centriole and basal body, cilia and flagella
Mitosis and Meiosis, an elementary idea of cellular basis of Immunity.

Unit 3:

Mendelian inheritance**,** Linkage and recombination, Sex determination and its mechanism,
Sex linked inheritance: Haemophilia and colour blindness in man,
Multiple allelism: A, B, O blood group in man.
Inborn errors of metabolism (Alkaptonuria, Phenylketonuria, Albinism) sickle-cell-anaemia

Unit 4:

Nature and function of genetic material : Structure and type of nucleic acids
Gene mutations: spontaneous and induced (chemical and radiations) mutations;
chemical basis of mutations; transition, transversion,
Chromosomal abnormalities involving autosomes and sex chromosomes :
Structural chromosomal aberrations (deletion, duplication, inversion and

translocation).DNA replication,transcription,translation.

References:

1. Molecular Cell Biology, J. Darnell, H. Lodish and D. Baltimore Scientific American Book, Inc., USA.
2. MolecularBiologyoftheCell,B.Alberts,D.Bray,J.Lewis,M.Raff,K. Roberts,andJ.D. Watson. Garland Publishing Inc., New York.
3. Cell and molecular biology Phillip Sheeler,Donald E. Bianchi Wiley,1987

Zoology Practical : 3rd Semester

(A) Cell biology :

1. 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. Temporary staining preparation of given specimen e.g. Volvox, Paramecium

(B) Genetics :

1. Numerical based on three point test cross

2. Numerical based on Human blood groups, autosomal and sex linked diseases

(C) Demonstration of the following by the C. D. –

1. Human Karyotype

2. Replication, Transcription, Translation

(D) Preparation of models of the following –

1. Cell organelles e.g. Mitochondria, Nucleus, Plasma membrane

2. Various stages of mitosis and meiosis

3. DNA: types and structure

(E) Project:

1. Various inborn errors of metabolism in human

2. Preparation of DNA model

3. Chromosomal aberrations

Semester ..IV.....

Name of Program	B.Sc. LIFESCIENCES	Program Code	UMLS4
Name of the Course	Biomolecules and Mammalian Physiology	Course Code	25ZOOM404DS01
Hours per Week	4	Credits	4
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 principles of physiology of both cells and organisms.
CLO2: Students would gain expertise in physiology of different Phyla and Classes of animals
CLO3: An appropriate understanding of functioning of each system of different groups of animals with their comparison will be acquainted.

Unit 1:
Introduction, classification, function and generalstructure and properties of Proteins, carbohydrates and lipids.
Nomenclature, classification and mechanism of enzyme action. Inhibition of enzyme action, cofactors.

Unit 2:
Nutrition : Digestion and absorption of Carbohydrates, Proteins, Fats. Vitamins.
Circulation: Origin, conduction and regulation of heart beat, cardiac cycle, electrocardiogram, cardiac output, Composition and functions of blood & lymph; Mechanism of coagulation of blood, haemopoiesis

Unit 3:
Respiration: Exchange of respiratory gases, transport of gases, lung air volumes, oxygen dissociation curve of haemoglobin, Bohr's effect, Hamburger's phenomenon (Chloride shift), control / regulation of respiration.
Excretion: Patterns of excretory products viz. Ammoniotelic, ureotelic uricotelic, ornithine cycle (Kreb's– Henseleit cycle) for urea formation in liver. Urine formation, counter-current mechanism of urine concentration.

Unit 4:
Neural Integration: Origin and propagation of nerve impulse along withmedullated & non-medullated nerve fibre, conduction of nerve impulse across synapse.
Chemical integration of Endocrinology: Mechanism of hormone actionand physiology of hypothalamus, pituitary, thyroid, parathyroid, adrenal, pancreas andgonads.

References:
1. Chatterjee C C , Human Physiology. 1992.
2. Guyton, Text book of Medical Physiology, 10th Ed. W B Saunders 23
3. Wood, D.W. Principles and Animal physiology,1968.
4. Hoar, W.S. General and Comparative Physiology, Prentice Hall of India.
5. Strand, F.L. Physiology: A regulatory Systems Approach. Macmillan Publishing Co., New York.
6. Pummer, L. Practical Biochemistry, Tata McGraw-Hill.

7. Prosser, C.L. Environmental and Metabolic Animal Physiology. Wiley-Liss Inc., New York.
8. Satyanarayan (2021) : Biochemistry, Elsevier, 6th Edition

Zoology Practical : 4thSemester

1. Study of human salivary amylase activity: Effect of temperature, pH, Concentration.
2. Qualitative tests for identification of simple sugars, disaccharides and polysaccharides.
3. Estimation of abnormal constituents of urine (Albumin, sugar, ketone bodies).
4. Haematein crystal preparation.
5. Estimation of Hemoglobin.
6. DLC of Man/RBC count/WBC count.
7. Study of permanent slides of rat (compound tissues)
8. Project report –

a. Diseases related to hormones
b. Blood composition
c. ECG

Semester ..V.....

Name of Program	B.Sc. LIFESCIENCES	Program Code	UMLS4
Name of the Course	Basics of developmental biology	Course Code	26ZOOM405DS01
Hours per Week	4	Credits	4
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 andoogenesis; Structure of spermatozoon and ovum. Hormonal regulation of gametogenesis,ovulation, formation of corpus luteum.

Unit 2:
Fertilization: events and types,prevention ofpolyspermy,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.
Fate maps in chick.

Unit 4:
Concept of organizer and induction.
Regeneration in invertebrates and vertebrates.
Extra-embryonic membranes

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.

Zoology Practical : 5th Semester

1. Study of permanent slides of WM of chick embryo (13-18h, 24-36h, 36-48h, 48-72h).
2. Window preparation and identification of stages of development in chick egg
3. Demonstration by C. D –
    a. Developmental stages of frog
    b. Implantation and gestation in mammals
4. Model/Chart preparation – Extraembryonic membranes in mammals, Fate Maps of Frog and Chick
5. Project work : Gametogenesis, Hormonal regulation of pregnancy

Semester ..VI.....

Name of Program	B.Sc. LIFESCIENCES	Program Code	UMLS4
Name of the Course	Ecology & Evolution	Course Code	26ZOOM406DS01
Hours per Week	4	Credits	4
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:
Basic concepts of ecology: Definition, significance. Concepts of habitat andecologicalniche. 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:
Origin of life.
Concept and evidences of organic evolution.
Theories of organic evolution.
Conceptofspecies and speciation.

Unit 4:
Conceptof micro-,macro-andmega-evolution.
Phylogenyofhorse.
Evolutionofman.

References:
1. Futuyma, D. J. (2017). Evolution (4th edition). Sinauer Associates Inc.
2. Hall, B. K., and Hallgrimsson, B. (2013). Strickberger's Evolution (5th edition). Jones and Bartlett Publishers.
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4. Mandal, F. K. (2012). Textbook of Animal Behaviour. PHI Learning Private Limited, New Delhi, India.
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Zoology Practical : 6th Semester

1. Demonstration through models/video/CD etc of
    a. Adaptive modifications in feet and beaks of bird
    b. Biogeochemical cycles
    c. Ecosystem functioning
    d. Evolution of man and Horse
2. Chemical analysis of pond water and soil for pH,
3. Chemical analysis of pond water and soil for dissolved oxygen,
4. Chemical analysis of pond water and soil for free CO2 nitrates,
5. Chemical analysis of pond water and soil for phosphates and chlorides
6. Project work on the topics –
    a. Evidences in the favour of Organic evolution
    b. Biotic factors/Animal interactions