Department of Zoology

School of Biological Sciences

Curriculum Framework

B.Sc. Zoology

Based on National Education Policy- 2020

Doctor HarisinghGourVishwavidyalaya
(A Central University)
Sagar-Madhya Pradesh-470003

Level: 5 Semester I			
Nature of Course	**Course Code**	**Course Title**	**Credits**
Discipline Specific Major-1	**ZOO-DSM-111**	**AnimalDiversity- Theory**	**4**
	ZOO-DSM-112	**AnimalDiversity- Practical**	**2**
Ability Enhancement Course	**ZOO-AEC-113**	**Environmental Science**	**2**
Skill Enhancement Course	**ZOO-SEC-114**	**Poultry Farming**	**2**

B.SC. I SEMESTER COURSE
COURSE CODE: ZOO-DSM-111
ANIMALDIVERSITY
THEORY

L	T	P	C
4	0	0	4

12hrs/Unit(Total:60hrs)

UNIT–I Lower Invertebrates

- **Protozoa:**
  General characters and classification up to classes.
  LocomotoryOrganellesandlocomotioninProtozoa.
- **Porifera:**
  Generalcharactersandclassificationuptoclasses.
  Canal System in *Sycon*
- **Cnidaria:**
  Generalcharactersandclassificationuptoclasses.
  Polymorphism in Hydrozoa.
- **Platyhelminthes:**
  Generalcharactersandclassificationuptoclasses. Life history of*Taenia solium*

UNIT–II Higher Invertebrates-I

- **Nemathelminthes:**

  Generalcharactersandclassificationuptoclasses.
  Lifehistoryof*Ascarislumbricoides*anditsparasiticadaptations.
- **Annelida:**
  Generalcharactersandclassificationuptoclasses.
  Metamerism in Annelida
- **Arthropoda:**
  Generalcharactersandclassificationuptoclasses.
  Vision in Arthropoda
  MetamorphosisinInsects

UNIT–III- Higher Invertebrates-II

- **Mollusca:**
  Generalcharactersandclassificationuptoclasses.
  Torsion in Gastropods
- **Echinodermata:**
  Generalcharactersandclassificationuptoclasses
  Water-vascular system in Asteroidea
- **Hemichordata:**

  Generalfeaturesandaffinities of *Balanoglossus*

UNIT–IV Lower Chordates

- **Protochordata:**
  Generalfeaturesandaffinities of Cephalochordates and Urochordates

  Metamorphosis in *Herdmania*
- **Agnatha:**

  GeneralfeaturesofAgnathaandclassificationofcyclostomesuptoclasses
- **Pisces:**

  GeneralfeaturesandClassificationuptoorders.

  Osmoregulation
- **Amphibia:**

  GeneralfeaturesandClassificationuptoorders Parental

  care

UNIT-V Higher Chordates

- **Reptiles:**

  GeneralfeaturesandClassificationuptoorders

  Poisonous and nonpoisonous snakes

  Bitingmechanisminsnakes
- **Aves:**

  GeneralfeaturesandClassificationuptoorders. Flight

  adaptations
- **Mammals:**

  Classificationuptoorders. Origin

  of mammals

Essential Readings:

1. Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). The Invertebrates: A New Synthesis, III Edition, Blackwell Science
2. Young, J. Z. (2004). The Life of Vertebrates. III Edition. Oxford university press.Pough H. Vertebrate life, VIII Edition, Pearson International.
3. Kotpal, R.L.2019 Modern text book of Zoology: Invertebrates. Rastogi Publication, New Delhi.

SuggestedReadings:

1. Barrington,E.J.W.(1979).*InvertebrateStructureandFunctions*.IIEdition,E.L.B.S.and Nelson
2. PoughH.*Vertebratelife,*VIIIEdition,PearsonInternational.
3. HallB.K.andHallgrimssonB.(2008).*Strickberger'sEvolution*.IVEdition.JonesandBartlett Publishers Inc.

LearningOutcome:

Aftersuccessfullycompletingthiscourse,thestudentswillbeableto:

1. Learn structural and functional diversity in different groups of animals.
2. Gain knowledge and skill in the fundamentals of animal sciences.
3. Understandthecomplexinteractionsamongvariouslivingorganism.

B.SC. I SEMESTER COURSE
COURSE CODE: ZOO-DSM-112
ANIMALDIVERSITY
PRACTICAL

L	T	P	C
0	0	2	2

06hrs/Unit(Total: 30hrs)

1. **Protozoa:***Amoeba,Euglena,Plasmodium,Paramecium*
2. **Porifera:**T.Sand L.Sof*Sycon,Hyalonema,*and *Euplectella,Euspongia*
3. **Cnidaria:***Obelia,Physalia,Aurelia,Tubipora,Metridium,Corealliu,Pennatula,Madrepora, Zoanthus, Alcynoium, Porpita, Physaila, Gorgonia*
4. **Platyhelminthes:***Taeniasolium*andStudyofitslifehistorystages,*Dugesia*
5. **Nemathelminthes:**Maleandfemale*Ascarislumbricoides*
6. **Annelida:***Aphrodite,Nereis,Pheretima,Hirudinaria,Polygordius,Heteroneries,Chaetopterus*
7. **Arthropoda:** *Palaemon, Cancer, Limulus, Palamnaeus, Scolopendra, Julus, Periplaneta,Apis,Bombaxmori,Dragonfly,Lepus,Musca,Julus.Paripatus,Mentis*
8. **Mollusca:***Chiton,Dentalium,Pila,Unio,Loligo,Sepia,Octopus,Solen,Limax,Dantalium*
9. **Echinodermata:***Pentaceros,Ophiura,Echinus,Cucumaria*and*Antedon,Starfish,Ophiothorix, Echinus, Holothuria, Thyone*
10. **Protochordata:***Balanoglossus,Herdmania,Branchiostoma*
11. **Agnatha:***Petromyzon,Myxine*
12. **Pisces:***Sphyrna,Pristis,Torpedo,Labeo,Exocoetus,Anguilla*
13. **Amphibia:***Ichthyophis/Ureotyphlus,Salamandra,Bufo,Hyla*
14. **Reptilia:***Chelone,Hemidactylus,Chamaeleon,Draco,Vipera,Naja,Crocodylus,Gavialis*
15. KeyforIdentificationofpoisonousandnon-poisonoussnakes
16. **Aves:**Studyofsix commonbirdsfromdifferent orders
17. **Mammalia:***Sorex*,Bat,*Funambulus,Loris*
18. An "**animal album**" containing photographs, cut outs, with appropriate write up about the abovementionedtaxa.Differenttaxa/topicsmaybegiventodifferentsetsofstudentsforthis purpose.

    Theseneed notbe repeatedas drawingsbythealbum maker.

B.SC. I SEMESTER COURSE
ABILITYENHANCEMENTCOURSE
COURSE CODE:ZOO-AEC-113
ENVIRONMENTAL SCIENCES
THEORY

L	T	P	C
2	0	0	2

12hrs/Unit(Total: 60hrs)

Unit I: Introduction to Ecosystem

- Structure and function of ecosystem; energy flowing an ecosystem: food chains, food webs and ecological succession.
- Case studies of the following ecosystem:
  a) Forest ecosystem
  b) Grassland ecosystem
  c) Dessert ecosystem
  d) Aquatic ecosystems

Unit-II: Natural Resources: Renewable and Non-Renewable Resources

- Land resources and land use change; Land degradation, soil erosion and desertification.
- Deforestation: Causes and impacts due to mining, dam building on environment.
- Water: Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter-state)
- Energy resources: Renewable and non-renewable energy sources, use of alternate energy sources, growing energy needs, case studies.

Unit-III: Biodiversity and Conservation

- Levels of biological diversity: genetic, species and ecosystem diversity.
- India as mega-biodiversity nation: Endangered and endemic species of India, Threats of biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts, and biological invasions.
- Conservation of biodiversity
- Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value.

Unit-IV: Environmental Pollution

- Environmental pollution: types, causes, effects and controls; Air, water, soil and noise pollution
- Nuclear hazards and human health risks
- Solid waste management: Control measures of urban and industrial waste.
- Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture
- Pollution case studies

Unit-V: Human Communities, Policies & Practices

- Human population growth: Impacts on environment, human health and welfare.
- Resettlement and rehabilitation of project affected persons; case studies.
- Disaster management: floods, earthquake, cyclones and landslides.
- Environmental movements: Chipko, Silent valley, Bishnoi of Rajasthan.
- Environmental Laws: Environmental Protection Act; Air (Prevention & Control of Pollution) Act; water (Prevention and control of pollution), Act: Wildlife Protection Act; Forest Conservation Act. International agreements: Montreal and Kyoto protocols and convention on Biological Diversity (CBD).

Environmental ethics: Role of Indian and other religions and cultures in environmental conservation. Nature reserves, tribal populations and rights and human wildlife conflicts in Indian context.

Essential readings:

1. Erach Bharucha. 2005. Text book of Environmental Studies for undergraduate courses, University Grants Commission, New Delhi.

Suggested readings:

1. Odum, E.P. 1983. Basic Ecology, Sanders, Philadelphia.
2. Cunningham, W.P., Cooper, T.H., Gorhani, E and Hepworth, M.T. 2001. Environmental Encyclopedia, Jaico Publ. House, Mumbai, 1196p.

Learning outcomes:

Aftersuccessfullycompletingthiscourse,thestudentswillbeableto:

- Understand how interactions between organisms and their environments drive the dynamics of individuals, populations, communities, and ecosystems
- Recognize the ecological basis for regional and global environmental issues
- Develop an in-depth understanding of the interdisciplinary relationship of cultural, ethical, and social aspects of local/global environmental issues

B.SC. I SEMESTER COURSE

SKILLENHANCEMENTCOURSE

COURSE CODE: ZOO-SEC-114

POULTRYFARMING

THEORY

L	T	P	C
2	0	0	2

06hrs/Unit(Total: 30hrs)

Unit1:External morphology of Fowls

Plymouth Rock,Light Sussex,Minorca, Rhode Island, Red and White Leghorn.

Unit2:**ClassificationofFowls**

Basedontheiruse:MeattypesuchasBroilers,Eggtypesuchas White Leghorn and Commercial layers, Dual purpose varieties, Game and Ornamental purpose varieties.

Unit3: **PoultryFeeding**

ManagementofEggLayers – Managementof Broilersinlargescalefarms.

Unit4:**Poultry diseases**

Viral, Bacterial, Fungal, Protozoan and Parasitic Lice etc.,

Prevention and precautions during vaccination.

Unit5:**Management of a modern Poultry Farms**

Progressive plans to promote Poultry as a Self- Employment venture.

Essential Readings

1. Sainsbury D. 1999. Poultry Health and Management: Chickens, Ducks, Turkeys, Geese, Quail, 4th Edition, Blackwell Science, ISBN 0632051728.
2. McMullin, 2004. Pocket Guide to Poultry Health and Disease, Nottingham University Press,ISBN095301505X.

SuggestedReadings

1. ApplebyMC,HughesBO,MenchJA. , 2 0 0 4 . PoultryBehaviorandWelfareNottingham University Press,ISBN 0851996671
2. GillespieJ., 2000.ModernLivestockPoultryProduction,6thEdition)ISBN 0766816079.
3. Leeson S and Summers J D,2009. Broiler Breeding Production (Digital reprint). Nottingham UniversityPress,ISBN 1904761798
4. RoseS,1996.PrinciplesofPoultryScience, CABIPublishing, ISBN 085199122X.

LearningOutcome:

Aftersuccessfullycompletingthiscourse,thestudentswillbeableto:

- Identifypoultryspecies, their various developmentalstages,poultrydiseasesandtheirpreventioninordertogenerateemployment opportunities.

Semester II			
Nature of Course	**Course Code**	**Course Title**	**Credits**
Discipline Specific Major-1	**ZOO-DSM-211**	**ComparativeAnatomyandDevelopmental Biologyof Vertebrates-Theory**	**4**
	ZOO-DSM-212	**ComparativeAnatomyandDevelopmental Biologyof Vertebrates-Practical**	**2**
Ability Enhancement Course	**ZOO-AEC-213**	**Aquarium Fish Keeping**	**2**
Skill Enhancement Course	**ZOO-SEC-214**	**Sericulture**	**2**

B.SC. II SEMESTER COURSE

COMPARATIVEANATOMYANDDEVELOPMENTALBIOLOGYOF VERTEBRATES

COURSE CODE: ZOO-DSM-211

THEORY

L	T	P	C
4	0	0	4

12hrs/Unit(Total:60hrs)

A. COMPARATIVEANATOMY

UNIT–I

- **IntegumentarySystem:**Derivativesofintegumentw.r.t.glandsanddigitaltips
- **SkeletalSystem:**Girdles, vertebrae and evolutionofvisceral arches
- **DigestiveSystem:**Briefaccountofalimentarycanalanddigestiveglands

UNIT-II

- **RespiratorySystem:**Gills,lungs,airsacsandswimbladder
- **CirculatorySystem:**Evolutionofheartandaorticarches

UNIT-III

- **UrinogenitalSystem:**Successionofkidney,Evolutionofurinogenitalducts
- **NervousSystem:**Comparativeaccountof brain

  SenseOrgans: Typesofreceptors

UNIT- IV

B. DEVELOPMENTALBIOLOGY

- **Earlyembryonicdevelopment**

Gametogenesis, Spermatogenesis, Oogenesis

Types of eggs, Egg membranes

Fertilization (External and Internal): Changes in gametes, Blocks to polyspermy;

Planes and patterns of cleavage;

Types of Blastula; Fate maps.

Early development of frog and chick up to gastrulation

Embryonic induction and organizers

UNIT–V

- **Lateembryonicdevelopment**
  Fate of Germ Layers

  Extra-embryonic membranes in birds

  Implantation of embryo in humans

  Placenta (Structure, types and functions of placenta).

- **Post Embryonic Development**

  Metamorphosis: Changes, hormonal regulations in amphibians and insects;

  Regeneration: Modes of regeneration, epimorphosis, morphallaxis and compensatory regeneration (with one example each).

  Ageing: Concepts and Theories

Essential Readings:

- Kardong, K. V. (2002). Vertebrates Comparative Anatomy. Function and Evolution. Tata McGraw Hill Publishing Company. New Delhi.
- Raven, P. H. and Johnson, G. B. (2004). Biology, 6th edition, Tata McGraw Hill Publications. New Delhi.
- Carlson,BruceM(1996).Patten'sFoundationsofEmbryology,McGrawHill, Inc.
- Gilbert,S.F.(2006).DevelopmentalBiology,VIIIEdition,SinauerAssociates,Inc.,Publishers, Sunderland, Massachusetts, USA.

SuggestedReadings:

- Kent, G.C. and Carr R.K. (2000). Comparative Anatomy of the Vertebrates. IX Edition. The McGraw-Hill Companies.
- Hilderbrand, M and Gaslow G.E. Analysis of Vertebrate Structure, John Wiley and Sons
- Balinsky B. I. and Fabian B. C. (1981). An Introduction to Embryology, V Edition, International Thompson Computer Press
- Kalthoff (2008). Analysis of Biological Development, II Edition, McGraw-Hill Publishers Lewis
- Wolpert (2002). Principles of Development. II Edition, Oxford University Press
- Walter, H.E. and Sayles, L.P; Biology of Vertebrates, Khosla Publishing House

LearningOutcome:

Aftersuccessfullycompletingthiscourse,thestudentswillbeableto:

1. Understand comparative anatomy of different systems in vertebrates
2. Understandtheevolutionaryhistoryofvertebratesandevolutionaryrelationships among different groups of vertebrates.
3. Learn the mechanism of embryonic development and implantation of fetus.

B.SC. II SEMESTER COURSE

COMPARATIVEANATOMYANDDEVELOPMENTALBIOLOGYOF VERTEBRATES

COURSE CODE:ZOO-DSM-212

PRACTICAL

L	T	P	C
0	0	2	2

06hrs/Unit(Total: 30hrs)

A. OSTEOLOGY:

DisarticulatedskeletonofFowl

- Vertebrae(atlas,fusedthoracic,synsacrum,pygostyle)
- Limbbones(humerus,radio-ulna,femur,tarso-metatarsus)
- Girdles(pectoral,Ferculaand pelvic)

DisarticulatedskeletonofRabbit

- Vertebrae(atlas,axis,lumbar,sacrum,caudal)
- Limbbones(humerus,radio-ulna,femur, tibiofibula)
- Girdles(pectoraland pelvic)

Skull

- Oneherbivorous(Rabbit)
- Onecarnivorous (Dog)

DEVELOPMENTALBIOLOGY

Frog-Studyofdevelopmentalstages -wholemountsandsectionsthrough permanentslides.

- Cellstage (2,4,8,16)
- Latecleavage
- Embryo–(4mm,7mm)
- Egg(WM)
- Morula,Blastula,Gastrula,Neurala
- Tadpolegill (T.S.)
- ExternalGill(WM)
- Tadpole(WM)
- Tailregion(C.S)
- Examinationofgametes –frog/rat-spermandovathroughpermanentslidesor photomicrographs.

B.SC. II SEMESTER COURSE

SKILLENHANCEMENTCOURSES

COURSE CODE:ZOO-SEC-213

AQUARIUM FISKEEPING

THEORY

L	T	P	C
1	1	0	2

06hrs/Unit(Total:30 hrs)

UnitI: Introduction to Aquarium Fish Keeping

The potential scope of Aquarium Fish Industry as a Cottage Industry, Exotic andEndemic species of Aquarium Fishes

Unit II: Biology of Aquarium Fishes

Common characters and sexual dimorphism of Fresh water and Marine Aquarium fishes such as Guppy, Molly, Sword tail, Gold fish, Angel fish, Blue morph, Anemone fish and Butterfly fish

Unit III: Food and feeding of Aquarium fishes

Use of live fish feed organisms. Preparation and composition of formulated fish feeds

Unit IV: Fish Transportation

Live fish transport Fish handling, packing and forwarding techniques.

Unit V: Maintenance of Aquarium

General Aquarium maintenance – budget for setting up an Aquarium Fish Farm as a Cottage Industry.

Essential readings:

- Arumugam N.2010.Home Aquarium and Ornamental Fish Culture. Saras Publication, New Delhi
- Vincent Hargreaves.2010. Complete book on Fresh water Aquarium. Thunder Bay, Oxford.

Suggested readings:

- e-contents Aquarium Fish and their maintenance.

LearningOutcomes:

Aftersuccessfullycompletingthiscourse,thestudentswillbeableto:

1. Establishment of fresh water aquarium.
2. Lean maintenance of an aquarium.
3. Selection of Aquarium fishes.

B.SC. II SEMESTER COURSE

SKILLENHANCEMENTCOURSES

COURSE CODE:ZOO-SEC-214

SERICULTURE

THEORY

L	T	P	C
2	0	0	2

06hrs/Unit(Total:30hrs)

Unit I: **Classificationofcommercialvarietiesofmulberrysilkworms**

Mulberryplantation establishment and cultivation practices.

Unit II: **Diseases of mulberry silk worms**

fungal, bacterial, viral and Nematode diseases, Deficiency diseases and their remedial measures.

UnitIII: Silkwormrearingoperations

Chawkirearingand Lateagerearingtechniques.

Unit IV: **PhysicalandcommercialcharactersofCocoons**.

Reelingoperations,Importanceofby- products ofSericulture.

Unit V: **Economics of Sericulture**

Future and progress of Sericulture Industry in India. Prospects ofSericulture as Self-Employment venture.

Essential Readings:

1. M.MadanMohanRao.2010.AnIntroductiontoSericulture. Paras Publication.Delhi

SuggestedReadings:

1. e-content on Silkworm Rearing Technology, Mulberry Cultivation &Physiology, Mulberry Crop Protection, Sericulture Extn. Management & Economics, Silkworm Crop Protection.

LearningOutcome

Aftersuccessfullycompletingthiscourse,thestudentswillbeableto:

1. Developanunderstandingofvariousprerequisitetogetstartedwithsericulture.
2. Learnaboutthecommercialvarietiesofsilkworms andtheirproducts.