DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY,
CHHATRAPATI SAMBHAJINAGAR.

CIRCULAR NO.SU/ B.Sc./NEP/52/2023

It is hereby inform to all concerned that, the syllabus prepared by the Board of Studies & Ad-hoc Boards and recommended by the Dean, Faculty of Science & Technology the **Academic Council at its meeting held on 30 November 2023 has accepted the Following Syllabi as per Norms of National Education Policy – 2020** under the Faculty of Science & Technology run to the Affiliated Colleges, Dr.Babasaheb Ambedkar Marathwada University as appended herewith:-

Sr.No.	Courses	Semester
1.	B.Sc. Home Science	Ist and IInd semester
2.	B.Sc. Biotechnology	Ist and IInd semester
3.	B.Sc.Agrochemical and Fertilizer	Ist and IInd semester
4.	B.Sc. Geology	Ist and IInd semester
5.	B.Sc. Computer Science	Ist and IInd semester
6.	B.Sc. Microbiology	Ist and IInd semester
7.	B.Sc.Analytical Chemistry	Ist and IInd semester
8.	B.Sc.Environmental Science	Ist and IInd semester
9.	B.Sc.Dairy Science and Technology	Ist and IInd semester
10.	B.Sc. Chemistry	Ist and IInd semester
11.	B.Sc. Polymer Chemistry	Ist and IInd semester
12.	B.Sc. Biochemistry	Ist and IInd semester
13.	B.Sc. Bioinformatics	Ist and IInd semester
14.	B.Sc. Physics	Ist and IInd semester
15.	B.Sc.Instrumentation Practice	Ist and IInd semester
16.	B.Sc. Non Conventional and Conventional Energy	Ist and IInd semester
17.	B.Sc. Horticulture	Ist and IInd semester
18.	B.Sc. Forensic Science & Cyber Security	Ist and IInd semester
19.	B.Sc.Industrial Chemistry	Ist and IInd semester
20.	B.Sc.Zoology	Ist and IInd semester

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This shall be effective from the Academic Year 2024-25 and onwards.

All concerned are requested to note the contents of this circular and bring notice to the students, teachers and staff for their information and necessary action.

University Campus,
Chhatrapati Sambhajinagar
431 004.
REF.No.SU/2023/19381-89
Date:- 15.12.2023.

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Deputy Registrar,
Academic Section

Copy forwarded with compliments to :-

1] **The Principal of all concerned Colleges,**
Dr. Babasaheb Ambedkar Marathwada University,
2] **The Director, University Network & Information Centre, UNIC, with a request to upload this Circular on University Website.**

Copy to :-

1] The Director, Board of Examinations & Evaluation,
Dr. Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.
2] The Section Officer,[B.Sc.Unit] Examination Branch, Dr. Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar
3] The Programmer [Computer Unit-1] Examinations, Dr. Babasaheb Ambedkar Marathwada University, Chhatrpati Sambhajinagar.
4] The Programmer [Computer Unit-2] Examinations, Dr. Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar
5] The In-charge,[E-Suvidha Kendra], Rajarshi Shahu Maharaj Pariksha Bhavan, Dr. Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar
6] The Public Relation Officer, Dr. Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar
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Dr. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, CHHATRPATI SAMBHAJINAGAR.

FACULTY OF SCIENCE & TECHNOLOGY

3 Years/4 Years B.Sc. (Hons) &

4 Years B.Sc. (Hons with Research) Programme

Course Structure & Curricculum

As per the NEP –2020 (out come based credit system)

Subject: Zoology

For affiliated colleges.

(Effective from 2024-25)

15/12/2023

Credit distribution structure for Two Years with Multiple Entry and Exit options –
Class: BSc. First Year Semester: I st Semester

Subject: Zoology Theory + Practical

Course type	Course Code	Teaching Scheme (Hrs./ week)		Credits Assigned		Total Credits
		Theory	Practical	Theory	Practical	
Major Mandatory	1 **DSC-1ZOO 100** : Animal Diversity-(Non- Chordate)	2		2	-	2+2+2 =06
	2 **DSC-2 ZOO 101**: Cell Biology	2		2	-	
	3 **DSC-3 ZOO 102** Lab course DSC 1 &2 Animal Diversity-(Non- Chordate) Cell Biology		4		2	
GE/OE (any one from pool)	**4. GE/OE 1 ZOO 103** Vector disease and control **GE/OE 1 ZOO 104** Human Parasitology	2	-	2	-	2+2= 04
	5 GE/OE (2) **ZOO 105** Health and hygiene. **GE/OE** (2) **ZOO 106** Environmental Pollution and Management.	2		2		
VSC(Choose any one from Pool/ Basket.)	**6. VSC-1 ZOO 107** T Vermicomposting **VSC-1 ZOO 108** P Vermicomposting **VSC-1 ZOO 109**T Medical Dignostics. **VSC-1 ZOO 110** P Medical Dignostics	1	2	1	1	2+2=4
SEC(Choose any one from Pool/ Basket.)	**7. SEC-1 ZOO 111** T Bee Keeping. **SEC-1 ZOO 112** P Bee Keeping. **SEC-1 ZOO 113 T** Animal Microtechnique. **SEC-1 ZOO 114 P** Animal Microtechnique.	1	2	1	1	

15/12/2023

Credit distribution structure for Two Years with Multiple Entry and Exit options –
Class: BSc. First Year **Semester: IInd Semester**
Subject: Zoology **Theory + Practical**

Course type	Course Code	Teaching Scheme (Hrs./ week)		Credits Assigned		Total Credis
		Theory	Practical	Theory	Practical	
Major Mandatory	**DSC-4 ZOO 150** : Animal Diversity-(Chordate)	2		2	-	2+2+2=06
	DSC-5ZOO 151: Principles of Genetics	2		2	-	
	2. DSC-6 ZOO 152: Lab Course DSC-4&5.		4		2	
Minor	3. **M-1 ZOO 153** Wild life conservation of animals.					
GE/OE (any one from pool)	**4. GE/OE-3 ZOO 154** Human Reproductive Physiology. **GE/OE-3 ZOO 155**Human Osteology	2	-	2	-	2+2=04
	GE/OE 4 ZOO 156 Animal behaviour **GE/OE 4 ZOO 157** Dairy Production technology.	2	-	2		
VSC(Choose any one from Pool/ Basket.)	**5.VSC-2ZOO 158T**Poultry Farming**VSC-2ZOO 159 P** Poultry Farming **VSC-2ZOO 160** TAquarium fish keeping. **VSC-2ZOO 161**P Aquarium fish keeping.	1	2	1	1	2+2=4
SEC(Choose any one from Pool/ Basket.)	**6.SEC-2ZOO 162T** Biological techniques**SEC-2ZOO 163 P** Biological techniques **SEC-2ZOO 164T** Haematology.	1	2	1	1	

B. Sc. First Semester
Course Code - DSC-1ZOO 100
Zoology Paper: ANIMAL DIVERSITY- I
(PROTOZOA TO ECHINODERMATA)

Credits- 02

Total No. of Period - 30

Evaluation - Internal 40% External 60 % **Marks-50**

Learning Objective- To know the general characters and classification of non-chordates and understand the diversity and complexity of life from Protista to Echinodermata.

Learning Outcome- On completion of the course the students will be able to understand the general organization, diversity and adaptation of Non Chordates. The Student will learn the importance of biodiversity conservation.

Unit 1 Phylum Protista and Porifera

Introduction to animal kingdom Definition of Zoology, Outline classification of Animals, General characters and classification of Protista, porifera up to classes, Locomotory organelles and locomotion in Euglena and Amoeba, Reproduction in protozoa Canal system in Porifera

Unit 2 Phylum- Coelenterata, Helminthes and Annelida

General characters and classification of Coelenterata, helminthes and annelida up to classes, Polymorphism in Coelenterates, External morphology of Taenia solium, Ascaris lubricoides, External Feature and Digestive System of Pheretima (Earthworm)

Unit 3 Phylum- Arthropoda, Mollusca and Echinodermata

General characters and classification of Arthropoda, mollusca and Echinodermata up to classes, External morphology of cockroach, pila and sea star.

Suggested Readings:

1. Kotpal, R.L. Modern Text Book of Zoology Invertebrates, Rastogi Publication, Meerut.
2. Parker & Hashwell, Textbook of Zoology Vol. I (Invertebrates) A.Z.T.B.S. Publishers & Distributors. New Delhi.
3. E.L. JORDEN & P.S. VERMA, Invertebrate Zoology, S. Chand & Co. Ltd. New Delhi.
4. Hickman C. P. Jr., Hickman & L.S. Roberts. Integrated principles of zoology, Mosby College publication. St. Louis.
5. Ayur, E.K., And T.N. Ananthakrishnan, Manual of zoology Vol. I, Invertebrate, Part I and II S.Viswanathan (Printers and Publishers) Pvt. Ltd. Madras.

B. Sc. First Semester
Course Code - DSC-2 ZOO 101
Zoology Paper: II
Cell Biology
Credits- 02

Total No. of Period - 30

Evaluation - Internal 40% External 60 % **Marks-50**

Learning Objective- To understand the structure and function of animal cell.

To understand structure and function of cell organelles

Learning Outcome - The student will understand the architecture and functions of cell and cell organelles.

Unit 1. Introduction to Cell Biology and Cell Environment-

General structure of Prokaryotic cell

General structure Eukaryotic cells

Energy efficiency of small cell

Chemical bonds, Inorganic - water, salts and ions

Organic compounds- Proteins, Carbohydrates, Lipids, Nucleic acids, Vitamins.

Plasma Membrane: - Structure, function and Fluid mosiac model

Unit 2. Cell organelles-

Nucleus:- Structure and Function of Nucleus

Structure of DNA and Types of RNA

Mitochondria: - Structure, function and Electron Transport Chain

Structure and function of Endoplasmic reticulum, Ribosomes, Golgi Bodies and Lysosomes, Microtubules, microfilaments and centrioles

Cell Cycle, Mitosis and Meiosis.

Unit 3. Cancer biology and Ageing: -

Characteristics of cancer cell

Types of Cancer: -Carcinomas, Sarcomas, Lymphomas, Leukemia etc.

Introduction to cell ageing

Effect of radiations on cells (UV radiations, photodynamic sensitization)

Suggested Readings:

- Albert B. et.al - Molecular Biology of the cell (Sinauer)
- Lodish. H. et al – Molecular Cell Biology.
- Gupta P.K. Cell and Molecular Biology Rastogi Publication Meerut.
- Dr. S.P. Singh, Dr. B.S. Tomar, Cell Biology 9th revised edition Rastogi Publication Meerut.
- Gerald Karp Cell and Molecular biology- Concepts and Experiments. John Wiley, 2007

B. Sc. First Semester
Course code DSC-3 DSC -3 ZOO 102

Paper-III PRACTICALS

PROTOZOA TO ECHINODERMATA and Cell Biology

Marks-50

Section A (Animal Diversity-I)

1. Study of animals belonging to Protozoa, Porifera, Cnidaria, Ctenophora, Platyhelminthes, Aschelminthes and Annelida with special reference to systematic position up to class level, habit, habitat, characteristic features and economic importance (one example of each class and Local examples are to be given more emphasis) with the help of Museum specimens, models, charts, Microslides, Photographs and Digital sources.
2. Study of animals belonging to - Onychophora, Arthropoda, Mollusca, Echinodermata with special reference to systematic position up to class level, habit, habitat, characteristic features and economic importance. (One example of each class and Local examples are to be given more emphasis) with the help of Museum specimens, Models, Charts, Microslides, Photographs and Digital sources.
3. Method of protozoan culture (Any one)
4. Temporary mounting :- Gemules and Spicules of sycon, Obelia colony, Parapodium of Neries
5. Study of different types of mouth parts in insect:-
   Mosquito, Housefly, Honey bee, Cockroach, Butterfly
6. Digestive and Nervous system of Earthworm (Museum specimen/Charts/digital sources)
7. Digestive system of Cockroach (Museum specimen/digital sources)

Section B- (Cell Biology)

1. Study of Prokaryotic cells –Grams staining technique
2. Study of Eukaryotic cells using suitable staining technique (Buccal epithelial cells)
3. Study of cytoplasmic movements in paramecium
4. Study of osmosis using human RBCs
5. Localization of Mitochondria by Janus Green stain
6. Study of cancer cells through permanent slides
7. Study of cell organelles through electron micrographs/charts
8. Study of Mitosis using suitable material /Meiosis using permanent slides.

Note: Demonstration of animal dissections through Models, Charts and Computer Aided Techniques as per U.G.C Guidelines

Suggested Readings:

1. *Jordan E.L., Verma P. S. (1987) Invertebrate Zoology. S. Chand and Company Pvt. Ltd. New Delhi.*
2. *Kotpal R.L. (2000) Invertebrates. Rastogi Publi. Meerut*
3. *Ekambaranatha Ayyar, M. Ananthakrishnan, T N. Outlines of Zoology, S. Vishwanathan, Madras*
4. *Prasad S.N. (Reprint 1992) Life of Invertebrates. VikasPulishing House Pvt. Ltd.*
5. *Dhami P.S., Dhami J.K. Invertebrate Zoology. S. Chand and Company Pvt. Ltd. New Delhi.*
6. *Parker A.J., Haswell W. A. A. (2002) Textbook of Zoology Vol. I . Mc millan*
7. *Ganguly B. B., Sinha A.K. and Adhikari S. (2000) Introduction to biology of Animals. New Central Book*
8. *Agency, Calcutta*
9. *Barnes R.D. (2000) Invertebrate Zoology. Saunders College Publishing*
10. *Karp, G. (2010). Cell and Molecular Biology: Concepts and Experiments. VI Edition. John*
11. *Wiley and Sons. Inc.*
12. *De Robertis, E.D.P. and De Robertis, E.M.F. (2006). Cell and Molecular Biology. VIII*
13. *Edition. Lippincott Williams and Wilkins, Philadelphia.*
14. *Cooper, G.M. and Hausman, R.E. (2009). The Cell: A Molecular Approach. V Edition.*
15. *S.V.Nikam and T.T.Shaikh Protozoology 2011, Oxford Publication house ,Jaipur*
16. Kotpal, R.L. Modern Text Book of Zoology Invertebrates, Rastogi Publication, Meerut.
17. Parker & Hashwell, Textbook of Zoology Vol. I (Invertebrates) A.Z.T.B.S. Publishers & Distributors. New Delhi.
18. E.L. JORDEN & P.S. VERMA, Invertebrate Zoology, S. Chand & Co. Ltd. New Delhi
19. Cytology, Genetics and Evolution – P.K. Gupta (Rastogi Publications, Delhi)
20. Cytology and genetics – Dyansagar V. R. (Tata McGraw Hill Pub. 1992 Reprint)
21. Manual of Practical Zoology – P. K. G. Nair and K. P. Achar (Himalaya Publication)

Course Code - 4. GE/OE 1 ZOO 103

I) Vectors, Diseases and Management.

Credits- 02

Total No. of Period - 30

Evaluation - Internal 40% External 60 % **Marks-50**

Learning Objective-

The course provides an insight into the common vector-borne diseases, their etiology, role of vectors in their spread, host- parasite relationship and finally the strategies to manage the vectors.

Learning outcomes

- After successfully completing this course, the students will be able to: develop awareness about the causative agents and control measures of many commonly occurring diseases.
- Develop understanding about the favourable breeding conditions for the vectors.
- Devise strategies to manage the vectors population below threshold levels, public health importance.
- Undertakemeasuresorstartawarenessprogrammesformaintenanceofhygieni cconditions, avoidance of contact from vector, destruction of breeding spots in the vicinity of houses and cattle shed by public health education campaign.

Unit 1. Introduction to insects: General features of insects; Morphological features- Head, Eyes,

Antenna, MouthpartsConcept of Vectors: Brief introduction of Carrier and Vectors (mechanical and biological vector), Reservoirs, Host-vector relationship, Vectorial capacity, Adaptations as vectors, Host Specificity.

Unit 2. Insect as vectors: Classification of insects up to orders, detailed features of orders with insects as vectors – Diptera, Siphonaptera, Siphunculata, Hemiptera.

Study of important insect vectors and its borne diseases and control measures:Mosquito , House fly, Fleas, Head louse, Blood sucking bugs

Unit 3. Vector management strategies:Control of vector flies by screening, fly traps, electrocution, poison baits and outdoor residual sprays; biological control, Chemical control and Integrated pest management.

Recommended readings

1. Imms,A.D. (1977).A GeneralTextBookofEntomology.Chapman&Hall,UK.
2. Chapman, R.F. (1998). The Insects: Structure and Function.IV Edition, CambridgeUniversityPress, UK.

Mathews,G.(2011).IntegratedVectorManagement:ControllingVectorsofMalariaandother Insect Vector borneDiseass.Wiley-Blackwell Belding,D.L.(1942).TextbookofClinical

Course Code - GE/OE 1 ZOO 104

II) Human Parasitology

Credits- 02

Total No. of Period - 30

Evaluation - Internal 40% External 60 % **Marks-50**

Learning Objective:

To acquaint learners with the concepts of parasitism, the relationship between parasites and hosts,between parasites and environment and the factors affecting the transmission of parasites

Learning Outcome:

Learners would understand the general epidemiological aspects of parasites that affect humans andapply simple preventive measures for the same. Learners would comprehend the life cycle of specific parasites and identify the important parasitic agents affecting human health.

Unit I: Introduction to Parasitology **10 hours**

1.1 Definition: host, parasite, vector, (biological, mechanical), commensalism, mutualism,and parasitism.
1.2 Types of parasites and parasitic adaptations: ectoparasites, endoparasites and theirsubtypes.
Types of hosts: intermediate and definitive, paratenic, reservoir.
Host – parasite relationship: Host specificity – definition, structural specificity,physiological specificity and ecological specificity

Unit II: Life cycle, pathogenicity, and control measures **10 hours**

2.1 Endoparasites-Plasmodium vivax, Entamoeba histolytica, Taenia solium, Paragonimus westermani (Lung fluke)
2.2 Ectoparasites- Pediculus humanus (Head louse), Cimex (bed bug), Sarcoptes scabiei(Mite).

Unit III: Zoonotic diseases in India-Prevention and Control **10 hours**

3.1 Viral zoonotic diseases - Rabies, Swine flu, Covid-19
3.2 Bacterial zoonotic diseases- Leptospirosis, Anthrax, Plague

Suggested Readings:

1. Parasitology: K. D. Chatterjee.

2. Parasites: ecology, diseases, and management (2013).

3. Parasitic Helminths: Targets, Screens, Drugs, and Vaccines, 201.

4. Parasitism: The Diversity and Ecology of Animal Parasites (2014) Tim Goater, Timothy M. Goater, Cameron P. and Esch, Gerald W. Cambridge University Press.

5. Principles of Veterinary Parasitology (2016), 1

st Edn, Dennis E. Jacobs, Mark Fox, Lynda M.

Gibbons, Carols Hermosilla, John Wiley & Sons.

6. Veterinary Parasitology (2013), Hany M. Elsheikha, Jon S. Patterson, CRC Press Taylor & Francis Group

7. Textbook of medical parasitology – C. K. Jayaram Panikar.

8. Textbook of medical parasitology – Arora & Arora.

9. Textbook of medical parasitology – S. C. Parija.

10. Veterinary Parasitology, 2013 - (Taylor, M. A.).

11. Encyclopedia of parasitology, 2008.

12. The Biogeography of Host-Parasite Interactions by Serge Morand, Boris R. Kransov, Oxford University Press.

13. Textbook of medical microbiology – Rajesh Bhatia & Itchpujani.

14. Textbook of medical microbiology – Arora & Arora.

15. Biological Control of Parasites, 2012.

16. Biology of Malaria Parasites, 2012.

17. Sherris medical microbiology: Ryan.

18. Medical microbiology: Jawetz Melnick & Adelbergs.

19. Current concepts in parasitology, 2012.

20. Textbook of Parasitology, Ashok Kumar, Discovery Publishing.

21. Introduction to parasitology: With special reference to the parasites of man, A.C. ChandlerJohn Wiley & Sons.

22. A text book of Parasitology – D. P. Karyakarte & A. S. Damle.

5 GE/OE (2) ZOO 105

I) Health and hygiene

Credits- 02

Total No. of Period - 30

Evaluation - Internal 40% External 60 % **Marks-50**

Learning objectives:

The course designed for public health and hygiene at graduation level will give understanding for health hygiene, dietary issues, diseases related to malnutrition, communicable and non-communicable diseases to the learner.

Learning outcomes

- The students will be able identify current national and global public health problems.
- It will create aware about the issues of food safety, water safety, vaccination, exercise andobesity, exposure to toxins.
- Learner will be able to frame a public health plan during any epidemic or spread of infectiousdisease etc.
- Learner will be able to assess the health inequalities with regard to gender, race, ethnicity, incomeetc

Unit-I: Maintenance of Personal Hygiene

Introduction to public health and hygiene-
Pollution and health hazards; water and air borne diseases.
Role of health education in environment improvement and prevention of diseases.
Personal hygiene, oral hygiene and sex hygiene.

Unit-II: Nutrient Deficiency Diseases

Classification of food into micro and macro nutrients. Balanced diet, dietary plan for an infant,normal adult, pregnant woman and old person.
Significance of breast feeding.
Malnutrition anomalies – Anaemia (Iron and B12deficiency), Kwashiorkar, Marasmus, Rickets,Goiter (cause, symptoms, precaution and cure).
Substitution of diet with required nutrients to prevent malnutrition disorders.

Unit-III: Communicable and Non-Communicable Diseases

Communicable viral diseases- Measles, Poliomyelitis, Swine flu, Corona, and Hepatitis.
Sexually transmitted diseases- AIDS, Syphilis and Gonorrhoea.
Health education and preventive measures for communicable diseases.
Non-communicable diseases: hypertension, Coronary heart disease, Diabetes- types andtheir effect on human health.
Gastrointestinal disorders- Acidity, Peptic Ulcer, Constipation, Piles (cause, symptoms, precautionand remedy).
Obesity (Definition and consequences).
Mental illness (depression and anxiety).

Suggested Readings

1) Park and Park, 1995: Text Book of Preventive and Social Medicine – Banarsidas Bhanot Publ. Jodhpur – India.
2) Epidemiology and Management for Health Care: Sathe, P.V. Sathe, A.P., PopularPrakashan, 6. Mumbai, 1991.
3) International Public Health: Diseases, Programs, Systems, and Policies by MichaelMerson, Robert E Black, Anne J Mills Jones and Bartlett Publishers.
4) Mary Jane Schneider (2011) Introduction to Public Health.
5) Muthu, V.K. (2014) A Short Book of Public Health.
6) Detels, R. (2017) Oxford Textbook of Public Health (6th edition).
7) Gibney, M.J. (2013) Public Health Nutrition.
8) Wong, K.V. (2017) Nutrition, Health and Disease.

GE/OE (2) ZOO 106

Environmental Pollution and Management.

Credits- 02

Total No. of Period - 30

Evaluation - Internal 40% External 60 % **Marks-50**

Learning objectives:

To bring awareness about major types of pollution and the control measures of each

To inculcate a sense of responsibility among students about various principles of environment

To make them understand about recent pollution related case studies

To find new sustainable ways to protect the mother Earth

To encourage students about applicability of knowledge in day todays life.

Learning Outcome

1. Students will understand the impact of human activities on various M. C. E. Society's Abeda Inamdar Senior College Of Arts, Science and Commerce, Camp, Pune-1 (Autonomous) Affiliated to Savitribai Phule Pune University NAAC accredited 'A' Grade resources of environment through case studies
2. Students will learn about various types of pollution, its impact and control measures.
3. Students will correlate about how the subject knowledge helps in solving various social, economic and environment related problems
4. Students will be empowered with recent technologies that are ecofriendly and can help them to be the entrepreneurs.

Unit 1. Air Pollution: Definition; Major air pollutants and their sources; Effects – On Biological systems– Animals, Humans & Plants; On Non-Biological systems – material; physical environment.

Green House Effect, Ozone layer depletion, Smog, Acid Rain, Global warming

Water pollution: Definition, introduction, sources & types of water pollution – physical, chemical & biological – effect of water pollution. Drinking water quality standards waste water treatment, Effects & control measures, Detergent – Eutrophication, Pesticide – Bioaccumulation, Biomagnification.

Unit 2. Soil pollution: Definition; Sources/ routes of contamination Effects –On soil quality/ productivity; On Biological system – on soil microorganisms, on Plants, Animals.

Noise Pollution: Definition, Introduction, Sources, Measurement, Instrument, Permissible limits, Categories/ Zones in context to noise level; Effects—Auditory and Non- Auditory—on Living and non –living things.

Unit 3. Prevention and control measures of Air, water, soil and noise pollution—at Individual level, Institute level, Commercial level, industrial level.

Suggested Readings

1. Air Pollution- M. N. Rao & H. V.N. Rao; Tata McGraw Hill, New Delhi, 1989.
2. "Environment Pollution Control and Environmental Engg." C. S. Rao, Tata McGraw Hill, New Delhi, 1994.
3. Soil pollution & Soil Organism - P.V. Mishra

4. Water Pollution—A.K. Tripathy& S.N. Pandey; A. P. H. Publishing Corporation
5. Environmental Air pollution & it's control—G.R. Chatwal; Anmol Publications, New Delhi, 1989
6. Environmental Chemistry; A. K. De; New Age International Publishers; 6thEdtn.
7. Understanding Environment; Edt by Kiran B. Chhokar, Mamata Pandya, Meena Raghunathan; Centre for Environment Education; Sage Publication.
8. Perspective in Environmental Studies; Kaushik &Kaushik; New Age International Pvt. Ltd Publishers 9) Environmental Science; S. C. Santra; New Central Book Agency (P) Ltd.; 2ndEdtn.
9. Water Pollution, P.K. Goel, New Age International, 2006 Revised Edtn

Course Code – VSC-1.VSC-1 ZOO 107 T
Zoology Paper
Vermicomposting (Theory)

Credits- 01 Total No. of Period - 30

Evaluation - Internal 40% External 60 % Marks-50

COURSE OBJECTIVES:

To introduce the concept of vermicomposting.
To study the different species of earthworms and their role.
To learn about vermicomposting tools.

LEARNING OUTCOMES:

After the completion of this course, the learner will be able to:
Take up vermicomposting as entrepreneurship.

1. **Introduction and methods of Vermicomposting**
   An introduction to different species of earthworms used in vermiculuture (epigenic, endogenic, digenic, their habitat and ecology), Bed and Pit method
2. **Process of Vermicomposting and its advantages**
   Collection of waste and its segregation and processing bed preparation for Anerobic and Aerobic composting inoculation of earthworms, Vermicompost and vermiwash, Nutritive values of vermicompost, Application of vermicompost for different crops, Soil health improvement and crop productivity enhancement, Transportation process of vermicompost and vermiwash (organic matter)
3. **Earthworm Species:** Local species of

Earthworm, choosing the right earthworm,
Complementary activities of auto-evaluation,
Biology of Eisenia fetida and Eudrilus eugeniae:
Taxonomy, anatomy, physiology and reproduction.

Suggested readings

1. Vermitechnology by A. Mary Violet Christy
2. A textbook of Vermicompost by Keshav Singh
3. The worm farmer's handbook by Rhonda Sherman
4. Vermicomposting Principles, practice and benefits by Maximallian Schiller
5. Vermiculture and Organic farming by TV Sathe
6. Vermicompost production by Dr. S Rehan Ahmad
7. Commercial vermiculture by Peter Bogdanov

Course Code –VSC-1 ZOO 108 P
Zoology Paper (Practical)
Vermicomposting

Credits- 01

Total No. of Period – 30 **Marks-50**

Practicals

1) Study of vermicompost equipments, devices, vermiwash

2) Preparation of vermibeds and maintenance

3) Harvesting and packaging of vermicompost

4) Study of external features of Eisenia fetida/ Pheretima posthuma

5) Field visit for collection of earthworm and their identification

6) Key to identify different types of earthworm

7) Visit to vermicomposting farm

Course Code VSC-1 ZOO 109T

. Zoology Paper (Theory)

Medical Diagnostics

Credits- 01

Total No. of Period - 15

Evaluation - Internal 40% External 60 % **Marks-50**

COURSE OBJECTIVES:

To introduce the concept of medical diagnostics

To study the basic diagnostic tools and techniques..

LEARNING OUTCOMES:

After the completion of this course, the learner will be able to:

.Have a clear understanding of basic medical diagnostic tests and ability to Perform them

Unit 1. Introduction to Medical Diagnostics: Importance of medical diagnostics.Blood composition, Preparation of blood smear and Differential Leucocyte Count (D.L.C) using Leishman's stain, Platelet count using haemocytometer, Erythrocyte Sedimentary Rate (E.S.R), Packed Cell Volume (P.C.V.).

Unit 2. Urine Analysis: Physical characteristics; abnormal constituents Tumours: Types (Benign/Malignant), Detection and metastasis; Medical imaging: X-Ray of Bone fracture, MRI and CT scan (using photographs).

Unit 3. Non-infectious diseases: Causes, types, symptoms, complications, Diagnosis and prevention of Diabetes (Type I and Type II), Hypertension (Primary and secondary), Testing of blood glucose using Glucometer/Kit Infectious disease s: Causes, types, symptoms, diagnosis and Prevention of Tuberculosis and Hepatitis.

SUGGESTED READINGS

- Park, K. (2007), Preventive and Social Medicine, B.B.Publishers
- Godkar P.B. and Godkar D.P. Textbook of Medical Laboratory Technology, II Edition, Bhalani PublishingHouse
Cheesbrough M., A Laboratory Manual for Rural Tropical Hospitals, A Basis for TrainingCourses
- Guyton A.C. and Hall J.E. Textbook of Medical Physiology,Saunders
- Robbins and Cortan, Pathologic Basis of Disease, VIIIEdition,Saunders
- Prakash, G. (2012), Lab Manual on Blood Analysis and Medical Diagnostics, S. Chand and Co.Ltd.

Course Code VSC-1 ZOO 110 P

Zoology Paper (Practical)

Medical Diagnostics

Credits- 01

Total No. of Period - 30

Practicals:

1. Introduction to various tools involved in medical diagnosis
2. Determination of sugar in urine and blood
3. Determination of erythrocyte sedimentation rate
4. Study of ECG (PQRS)
5. Study of heart functioning
6. Whole blood count.
7. Urea estimation in urine.

Course Code –SEC-1 ZOO 111 T

Zoology Paper Beekeeping (Theory)
Credits- 1

Total No. of Period - 15

Evaluation - Internal 40% External 60 % **Marks-50**

Learning Objective:

- To inculcate importance of Bee keeping and honey processes in relation with entrepreneurship development.
- To give students knowledge about various techniques of Bee keeping and honey processing and its marketing to make them self-sustainable after graduation.
- To teach techniques of construction of Bee Hives and its maintenance.
- To teach students about Honey production and health related problems with Honey bees. Importance of honey
- Students will learn important steps in bee keeping and bee hive handling without fear.
- Students will learn the use of different equipments in bee keeping.

Learning Outcomes:

- The learner will able to differentiate in different types of honey bee castes.
- Learner will be able to use the artificial hive for beekeeping
- Learner will be able to use the technique of honey purification and processing.
- Learner will be able to construct the artificial honey hive and maintain it.
- Learner if is not employed can find own employment by doing Bee keeping
- Lerner can start own beekeeping equipment agency for farmers or beekeepers.

UNIT I Scope and history of Apiculture - systematic position of honeybee, Species of Honey bees, Biology and life history of Honey bee.

UNIT II Bee colony – social organization, bee communication,swarming,pheromone. Bee hive – structure and types of bee hives, Newtons beehives. Instruments used in Apiary.

Site selection of apiculture, flora of apiculture – nectar,non nector and pollen plants, modern method of apiculture, Care and management of apiary.

UNIT III Nector - honey composition and its formation. Medicinal and commercial values of honey. Bee wax and its uses, Diseases of honey bees and their control measures. Enemies of honey bee.

Economic Importance of Apiary products, Bee Keeping Industry status in India, Recent Efforts,

Apiculture as self – employment venture.

Course Code –SEC-1 ZOO 112 P
Zoology Paper Beekeeping (Practical)
Credits- 1

Total No. of Period – 30 **Marks-25**

Practical session:

1. Identification of different casts in honeybees-Queen, drones and workers
2. Structure of honey comb-different type sf cells for queen, drones and workers
3. Morphological peculiarities of worker bees-Honey and pollen storage structures
4. Familiarize bee keeping instruments and bee hives

Suggested Readings

1. Abrol,D.P.(1997)BeesandBeekeeping.KalyaniPublisher,NewDelhi.
2. Abrol, D. P. (2010) A Comprehensive guide to Bees and Beekeeping. ScientificPublisher,New Delhi.
3. Withhead, S. B. (2010) Honey bees and their management Axis books Publisher,Jodhpur.
4. Nagaraja, N. and Rajagopal , D. (2013) Honey bees: Diseases, Parasites, Pests,Predatorand theirmanagement. M.J.PPublisher, Chennai.
5. Dharamsing and Singh, D. P. A Handbook of Beekeeping, Agrobios India (Publisher), Jodhpur.
6. Cherian R, & K.R. Ramanathan, 1992 – Bee keeping in India,
7. Mishra, R.C., 1985 – Honey bees and their Management in India, ICAR.
8. Singh, S.1982-Bee keeping – ICAR 4. Sharma, P. and Singh L. 1987 – Hand book of bee keeping, Chandigarh
9. Rare, S. 1998-Introduction. to bee keeping, Vikas publishing house.

Course Code –SEC-1 ZOO 113 T

Animal Micro techniques (Theory)

Credits- 1

Total No. of Period - 15

Evaluation - Internal 40% External 60 % **Marks-50**

Learning objectives:

- To prepare the whole mounts microscopic slides and staining reactions.
- Study of microscopically sectioning
- To study the preservation and storage of histological slides.

Learning outcomes:

- Study cell tissue structure, histology of tissues and details of morphology of animals.
- Understand applications and scope of
- Understand Cell tissue structure, histology of tissues and details of morphology of animals.
- the learner will get Job opportunities in Health institutes, Hospitals and Pathological labs.

Unit 1. Introduction:

Definition, Scope and Applications of Micro technique. Collection and selection of specimen or tissue of animal for whole mount, smearing or teasing.

Fixation: Definition and Importance and examples of fixatives.

Significance and the process of Washing, Dehydration, Clearing agents

Merits and demerits of clearing agents- Xylene, Toluene

Significance and use of Cold and hot infiltration

Unit 2. Significance and procedure:

Embedding: Embedding containers: a) Paper trays b) L o Embedding procedure

Block making: Block making, labeling of block and storage of block.

Trimming and Mounting of trimmed block on microtome peg.

Course Code –SEC-1 ZOO 114 P
Animal Micro techniques (Practicals)

Credits- 1

Total No. of Period - 30

Section cutting and affixing: (Lab Course)

1. Rotary and Rocking microtome- its uses, precautions and handling, Microtome knives
2. Section cutting- Defects, Possible causes and remedies during section cutting,
3. Affixing and processing of sections
4. **Staining, Mounting, Clearing and camera lucida:** Preparation of Haematoxylin, Eosin stain and Giemsa stain, Mordants, Double staining, use of mounting media-DPX and Canada balsam.
5. Preparation of permanent slides.
6. Use of camera Lucida and Micrometer scale.

Suggested Readings:

• Weesner., F.M. (1968), General zoological microtechniques. Maryland, U.S.A.: The Williams & Wilkins Company

• Mr. Jeremy Sanderson (1994) Biological Microtechnique by Garland Science publishers: First edition

• Baker F.I and R.E Silverton,

• R.Marimuthu(2011) Microscopy and Microtechnique published by Mjp

• Vonnie D.C.Sheild and Thomas Heinbokel Microtechnique.

• Peter Gray(1952) Basic Microtechnique published by The blakiston company,toronto.

• Dr.M.K.Prasad (2000) Outlines of Microtechnique published by Emkay.

• Brian Bracegirdle(1978) A History of Mirotechnique published by Heinemann Educational books Ltd.

• Richard W.Horobin(1982) Histochemistry published by Butterworth Educational books Ltd.

Course type	Course Code	Teaching Scheme (Hrs./ week)		Credits Assigned		Total Credits
		Theory	Practical	Theory	Practical	
Major Mandatory	**DSC-4 ZOO 150** : Animal Diversity-(Chordate)	2		2	-	2+2+2 =06
	DSC-5 ZOO 151: Principles of Genetics	2		2	-	
	2. DSC-6 ZOO 152: Lab Course DSC-4&5.		4		2	
Minor	3. **M-1 ZOO 153** Wild life conservation of animals.					
GE/OE (any one from pool)	**4. GE/OE-3 ZOO 154** Human Reproductive Physiology. **GE/OE-3 ZOO 155** Human Osteology	2	-	2	-	2+2= 04
	GE/OE 4 ZOO 156 Animal behaviour **GE/OE 4** ZOO **157** Dairy Production technology.	-	2	-	2	
VSC(Choose any one from Pool/ Basket.)	**5.VSC-2 ZOO 158 T** Poultry Farming **VSC-2 ZOO 159 P** Poultry Farming **VSC-2 ZOO 160** T Aquarium fish keeping. **VSC-2** ZOO **161** P Aquarium fish keeping.	1	2	1	1	2+2=4
SEC(Choose any one from Pool/ Basket.)	**6.SEC-2ZOO 162 T** Biological techniques **SEC-2ZOO 163 P** Biological techniques **SEC-2 ZOO 164 T** Haematology. **SEC-2 ZOO 165 P** Haematology.	1	2	1	1	

B. Sc. Second Semester
Course Code - DSC-4 ZOO 150

Zoology Paper: ANIMAL DIVERSITY-II (Chordata)

Credits- 02

Total No. of Period - 30

Evaluation - Internal 40% External 60 %

Marks-50

Learning objectives:

To know the general characters and classification of chordates and understand the increasing complexity of organization of life from lower to higher chordates

Learning Outcomes:

On completion of the course the student should able to know the general organization of chordates as group and know taxonomy and characteristics feature of various chordate phyla.

Unit I Protochordata

General features and classification of protochordates; General features of Agnatha .

Classification and affinities of cyclostomata .

Unit II: Pisces, Amphibia & Reptilia

General features and classification of phylum chordates up to classes;

General feature of classification of pisces, amphibia and reptilia up to orders, Migration and Parental care in fishes, parental care in Amphibia; identification of poisonous and non-poisonous snakes, snake venom, symptoms and first aid treatment of snake bite.

Unit III: Aves & Mammals: Aves: General features and classification up to orders, volant adaptation in birds, migration in birds and adaptation in feet of birds.

Mammals: General features and classification up to orders, (Prototheria, metatheria and Eutheria) Adaptive radiation in mammals.

Suggested readings:

- Young J. Z. (2004) the life of Vertebrates. III Edition. Oxford University press.
- Modern Text Book of Zoology Vertebrate – R.L.Kotpal, Rastogi Publication Meerut.
- A Text Book of Chordate Zoology – R.C.Dalela –Jaiprakashnath Publication Meerut.
- Chordate Zoology – E.L.Jordan and P.S.Verma, S.Chand and Company New Delhi
- Zoology- S. A. Miller and J. B. Harley, Tata McGraw Hill.
- Biological Science, 3rd Ed. D. J. Taylor, N. P. O. Green and G. W. Stout, Cambridge Univ. Press. Low priced Ed.
- Verma &Agarwal- chordate Embryology – S.Chand publication.
- Lal S. S. (1996) Text book of Practical Zoology, Vertebrates, Rastogi Publication.

Course Code - DSC-5 ZOO 151

Zoology Paper: Principles of Genetics

Credits- 02

Total No. of Period - 30

Evaluation - Internal 40% External 60% **Marks-50**

Learning objectives:

To Introduce basic terms of genetics

To study Mendelian principles of inheritance and other forms pattern of inheritance

To introduce the concept of sex determination and its types, sex influenced and sex limited genes.

Learning outcomes:

Understand and apply the principles of inheritance.

Understand the concept of multiple alleles,.

Learners would understand mechanisms of sex determination.

Unit 1:

Elements of heredity & variation: Definition of genetics and variation, Mendel's laws of heredity in short; Gene interaction: Definition- modifications in Mendelian phenotypic ratio like, Supplementary gene, Complementary gene, Epitasis

Unit 2:

Multiple Alleles: Coat Colour in rabbit, ABO Blood group in man, Rh factor
Cytoplasmic inheritance: Definition of maternal effect. Coiling shell in snail *(Limnea peregra)* Male sterility. CO_2 sensitivity in *Drosophila.* Kappa particles in *Paramecia.*

Unit 3:

Sex Determination: Chromosome theory in sex determination, genic balance theory of sex determination, X/A ratio in *Drosophila,* Triploid intersexes and Gynandromorphs in *Drosophila.* Mutation: Gene mutation: - Definition and classification, Chromosomal aberration (structural & numerical), Spontaneous & induced mutation

Suggested Readings:

- P.K. Gupta Genetics- Rastogi Publications Meerut.
- P.K. Gupta, Genetics Classical to Modern- Rastogi Publications Merrut.
- Verma P.S. and V.K. Agarwal, Genetics, S.Chand and Publication.
- Levin O.D. and Lewin R. Biology of Gene McGraw Hill Troppan Co.Ltd.
- Gunther S. Stent. Molecular Genetics McMillan Publication Co.Inc.
- Goodenough V. Genetics New York, Holt Rinchart and Winston.
- Winchester, Genetics Oxford HBH Publication.
- Strikberger, Genetics McMillan Publication
- Sinnott Dunn and Dobzansky- Principles of Genetics

Course Code - DSC-6 ZOO 152:
Lab Course DSC-4&5.
Animal Diversity-II (Chordata) and Principles of Genetics
Credits- 02

Total No. of Period – 60 **Marks-50**

Animal Diversity-II (Chordata)

1. Museum study of vertebrates (At least 20). (Identification, classification, sketches, General characters and biological importance.
2. Mounting of Placoid, Cycloid and Ctenoid scales of fish Key for the identification of Poisonous and non-poisonous snakes.
3. Types of beaks and feet of birds.

4. Dissection of Scoliodon / Labeo **(Demonstration thorough software)**
   Afferent and efferent,
   Cranial Nerves.
   Brain
5. Dissection of Rat/ Frog ; **(Demonstration thorough software)**
   Urinogenital system,
   Arterial system,
   Venous System,
   Brain of Rat
6. Arrange study tour / Visit to Zoological survey of Inida/ Museum/ National Park and Submit the project report.

Lab Course: Principles of Genetics

7. Culture of Drosophila- experimental organism in genetics
8. Observation of common mutant of drosophila.
9. Determination of human blood groups A, B, AB, and O, Rh factor.
10. Minor problems based on monohybrid ratio & human blood group and its interpretation.
11. Major problems based on dihybrid ratio & interaction of genes.
12. Study of chromosomal aberration

Course Code –. M-1 ZOO 153
Wild life conservation of animals.
Credits- 02 (Theory) **Marks-50**

Learning Objectives:

1 Student should understand the principles of evolution, wildlife and conservation biology.

2. To understand and gain knowledge on modern concepts in wildlife management.

3. To provide an insight into relevant conservation policies and legislations and their enforcement mechanism.

4. To develop scientific skills for resolving human wildlife conflicts.

Learning Outcomes:

1 students are able to understand conservation will help protection of wildlife.

2. Understand wildlife legislation will systematically organize the understanding of wildlife conservation, trade and management.

3. Knowledge of the ecology and behaviour of wild animals.

4. Know the critical evaluation of existing wildlife management practice and options for the future.

Unit-I Concept and Conservation of Biodiversity **Concept** of Wildlife; Pattern and distribution.

Factors causing biodiversity degradation, Concept of species extinction.

In situ conservation (Biosphere Reserves, National Parks, Wildlife Sanctuaries, Conservation Reserves, Community reserves, Sacred Habitats), Ex-situ conservation (Botanical & Zoological Gardens, Gene Banks, Seed And Seedling Banks, Pollen Culture, Tissue Culture and DNA banks, Butterfly Gardening); Concept of Biodiversity Hotspots and Mega-diversity Country; Role of captivity In wildlife management.

Habitat Conservation Techniques: Concept of Habitat, Habitat Management, Habitat Edge improvement, Role of Corridor in Wildlife Management,

Unit-II Biodiversity of Indian subcontinent, Bio-geographical region in India, India as a mega diversity nation; India's National Biodiversity Action Plan, Biodiversity hotspot in India;

Unit-III Observation and survey techniques: Species Census methods; Species sampling method (Quadrat, Line Transect, Belt Transect, Pit fall, Mark-Recapture technique, Radio-telemetry etc.); Ethics in Field Studies. Methods of recording field observations; Essential Field kit and its usage; Data analysis

SUGGESTED READINGS: 1. Usher, M. B. (1986). Wildlife conservation evaluation: attributes, criteria and values. London, New York: Chapman and Hall.

2. Harris, J. D.; Brown, P. L. (2009). Wildlife: Destruction, Conservation and Biodiversity. Nova Science Publishers

3. Wildlife Habitat Management: Concept and application in forestry; Brenda C. McCom); taylor & Franscis group (2015)

4. Text Book of Wildlife Management; by S K Singh; Publisher: IBDC (1 January 2009

Course Code - GE/OE-3 ZOO 154

I) HUMAN REPRODUCTIVE PHYSIOLOGY

Credits- 02

Total No. of Period – 30

Evaluation - Internal 40% External 60% **Marks-50**

Learning objectives:

To acquaint the learners with different aspects of human reproduction.

To make them aware of hormonal regulation of reproduction and the concept of birth control.

Learning outcomes:

Learners will able to understand human reproductive physiology.

Unit 1. Male Reproductive Physiology:

Male reproductive system; Spermatogenesis: spermatozoa – ultrastructure, hormone control of spermatogenesis, maturation of sperm; Semen and its constituents,

Unit 2. Female Reproductive Physiology:

Female reproductive system, Oogenesis: process and hormonal control,; Ovulation sand fertilization: process of ovulation,

Reproductive cycles: types and duration of reproductive cycles, estrous cycle and menstrual cycle

Unit 3, Reproductive hormones and contraception:

Male hormones; Endocrine regulation of ovulation, fertilization, Placentation.

Sex hormones in Reproduction, hormones in sexual behabiour,

Hormonal control of parturition, process of lactation and hormonal control,

Difference between contraception and birth control

Suggested readings

William S.Hoar- General and Comparative Physiology, prentice hall of India ltd.

Wood E.W. Principle of Animal physiology

Nagbhushnum R.,Sarojini R., Kodarkar M.S. –Animal Physiology

Verma, Agarwal & Tyagi-animal physiology

Moeye K.-Animal Physiology, Cambridge low prize edition.

Dantzler, W.H. Comparative Physiology (Handbook of Physiology): Vol. 1, 2, (ed.) Oxford University Press, New York, USA

R. Eckert. Animal Physiology: Mechanisms and Adaptation. W.H.

Mohan Arora – animal physiology, Himalaya publication

A.K. Berry. –animal physiology

Gerard J. Tortora and Sandra Reynolds Garbowski Principles of Anatomy and Physiology, Tenth Ed., John Wiley & Sons

Arthur C. Guyton MD, A Text Book of Medical Physiology, Eleventh ed., John E. Hall, Harcourt Asia Ltd.

William F. Ganong, A Review of Medical Physiology, 22 ed, McGraw Hill, 2005

Sherwood, Klandrof, Yanc, Human Physiology, Thompson Brooks/Coole, 2005.

Knut Scmidt-Nielson, Animal Physiology, 5th ed, Cambridge Low Price Edition.

Roger Eckert and Randal, Animal Physiology, 4th ed, Freeman Co, New York.

Singh. H.R, Text Book of Animal Physiology and Biochemistry

Veer Bal Rastogi, Text Book of Animal Physiology

Course Code - GE/OE-3 ZOO 155

II) Human Osteology

Credits- 02

Total No. of Period - 30

Evaluation - Internal 40% External 60% **marks 50**

Learning objectives:

To introduce the different bones of human skeleton and their functional importance.
To study long limb muscles involved in body movements

Learning Outcomes:

Learner will be able to understand the structure, types and functions of human skeleton.
Learner will be able to understand the types of long limb muscles, its arrangement and their role in body movements.

Unit 1. Introduction: Bone structure (Histology), physical properties, chemical composition and general functions of bones.
Cartilage: General structure, functions

Unit 2. Axial skeleton:

Skull: General characteristics of skull bones - Cranial and facial bones
Vertebral column: General characteristics of a vertebra, structure of different types of vertebrae (cervical, thoracic, lumbar, sacrum and coccyx)
Ribs and sternum: General skeleton of ribs and sternum
Hyoid bone: Structure and function.

Unit 3. Appendicular skeleton:

Pectoral girdle and bones of forelimbs
Pelvic girdle and bones of hind limbs
Limb muscles-Flexors, Extensor, Rotator, Abductors, and Adductors.

Suggested Readings:

Comparative Anatomy of the Vertebrates; Ninth Edition; Kent, G.C. and Carr R.K.; The McGraw-Hill Companies; 2000.
Text book of Chordates; Saras publication.
Modern text book of Zoology; Prof. R.L. Kotpal.
Integumentary system and its derivatives; Samuel D. Hodge.
Atlas of Human Anatomy - Vol I; R.D. Sinelnikov; Mr. Publishers Moscow.
A Guide of Osteology (for medical students); Prakash Kendra, Lucknow.
Text Book of Comparative Anatomy and Physiology; Tortora.
Human Osteology - Tim D White.
Text Book of Human Osteology - Singh Inderbir.
Mechanisms of Body Functions; Second Edition; Dexter M. Easton; Prentice-Hall of India Pvt. Ltd., New Delhi; 1978.
Human Anatomy - John W. Hole, Jr., Karen A. Koos, Publisher: W. C. Brown Publisher, USA.
Principles of Anatomy and Physiology - Gerard T. Tortora and Sandra Reynolds Grabowski. Publisher: Harpers Collins College Publishers (7th Edition).
Comparative Anatomy of Vertebrates by Sumitra Saxena and R. K. Saxena.
Comparative Anatomy of Vertebrates by S. K. Kulshrestha.
Vertebrates: Comparative Anatomy, Function, Evolution by Kenneth Kardong.
Comparative Anatomy of the Vertebrates by George C Kent and Robert K. Carr.
Comparative Anatomy of Vertebrates by Robert Wiedersheim.
Illustrations of Comparative Anatomy, Vertebrate and Invertebrate - For the Use of

Students In The Museum Of Zoology And Comparative Anatomy.
Human Osteology, 3rd Edition by Tim D. White, Michael T. Black and Pieter A. Folkens.
Hand Book of Osteology, 13th Edition by S. Poddar and Ajay Bhagat.
The Anatomy and Biology of the Human Skeleton by D. Gentry Steele.

Course Code - GE/OE 4 ZOO 156

I Animal behaviour

Credits- 02

Total No. of Period - 30

Evaluation - Internal 40% External 60% **marks 50**

Learning Objectives: Student should understand

1. To acquire the knowledge of key concepts and principles in animal behavior.
2. To understand animal behavior and response of animals to different instincts.
3. The course shall make the students aware of various animal behavior patterns.
4. To acquire students with an importance of the animal behavioral study.
5. Natural and vital factors affecting the behavior of animals.

Learning Outcomes:

1 After completion, students are able to demonstrate the knowledge of key concepts in animal behavior.

2. Understand the importance of studying animal behavior.

3. Understand the complex evolutionary processes and behavior of animals.

4. Know the communication between animals from different communities.

Unit I Behaviour: Definition - Innate behaviour, learning, reasoning, motivation, conflict and sexual behavior; Migration and homing with special reference to birds;

Communication in animals: Visual, olfactory, auditory and tactile. Camouflage and Mimicry - types of mimicry

Unit II Ecological Aspects of Behaviour: Habitat selection, food selection and optimal foraging theory, anti-predator defense mechanisms, aggression, territoriality and dispersal.

Social Behaviour: Aggregations - Schooling in fishes, flocking in birds, herding in mammals; group selection, kin selection, altruism, inclusive fitness, and social organization in insects and primates.

Unit III Reproductive Behaviour: Evolution of sex, reproductive strategies, mating systems, courtship, sperm competition, sexual selection and parental care.

Hormones and behaviour, pheromones and behaviour.

Unit IV Biological rhythms: Circadian, circannual, tidal/lunar, ultradian, infradian rhythms, synchronization of biological rhythms, phase shift. Photoperiodism with reference to birds and mammals - human circadian rhythms.

SUGGESTED READINGS: 1. David McFarland, Animal Behaviour, Pitman Publishing Limited, London, UK.

2. Manning, A. and Dawkins, M. S, An Introduction to Animal Behaviour,CambridgeUniversity Press, UK.

3. John Alcock, Animal Behaviour, Sinauer Associate Inc., USA.

4. Paul W. Sherman and John Alcock, Exploring Animal Behaviour, Sinauer Associate Inc., Massachusetts, USA

Course Code - GE/OE 4 ZOO 157

II Dairy Production technology.

Credits- 02

Total No. of Period - 30

Evaluation - Internal 40% External 60% **marks 50**

Learning Objectives:

The course is designed to give an account of different breeds of dairy cattle, their characteristics and performance, the factors affecting their health and the technologies that help artificial insemination and genomic testing.

Learning Outcomes: After successful completion of the course, students will be able to;

1. Understand the pre-requisites for starting a Dairy farm
2. Recognize different breeds of Cows & buffaloes following safety precautions.
3. Prepare and give recommended feed and water for livestock
4. Maintain health of livestock along with productivity
5. Vaccination of cattle, nutrients requirements
6. Entrepreneurship i.e., Effectively market dairy products
7. Ensure safe and clean dairy farm and Standard safety measures to be taken in establishing am industry
8. Efficiently start and manage to establish or develop a Dairy Industry

Unit 1. (Introduction and Establishment of a Dairy Farm):

Dairy development in India - Dairy Cooperatives (NDRI, NDDB, TCMPF)
Constraints of Present Dairy Farming and Future Scope of Dairy Parmer.
Selechon of site for dairy farm; Systems of housing - Loose housing system, Conventional Dairy Farm; Records to be maintained in a dairy farm.

Unit 2. (Livestock Identification and Management):

Breeds of Dairy Cattle and Buffaloes — Identification of Indian cattle and buffalo breeds and Exotic breeds; Methods of selection of Dairy animals.
Systems of inbreeding and crossbreeding.
Weaning of calf, Castration, Dehoming, Deworming and Vaccination programme
Care and management of calf, heifer, milk animal, dry and pregnant animal, bulls and Bullocks.

Unit 3. (Feed Management, Dairy Management, Cleaning and Sanitation):

Basic Principles of Feed, Important Feed Ingredients, Feed formulation and Feed Mixing
Operation Flood —Definition of Milk and Nutritive value of milk and ICMR recommendation of nutrients —Per Capita Milk production and availability in India and Andhra Pradesh -Methods of Collection and Storage of Milk—Labelling and Storage of milk products
Cleaning and sanitation of dairy farm — Safety precautions to prevent accidents in an industry.

Activities Suggested:

1. Group discussion& SWOT analysis
2. Visit to a Dairy Farm

3. Visit to Milk Cooperative Societies
4. Visit to Feed Milling Plants
S. Market Study and Identification of Government Schemes, Insurance and Bank Loans in relation to dairy farming

Suggested Readings:

1. Dairy Science: Peterson (W.E.) Publisher — Lippincott & Company
2. Principles and practices of Dairy Farm —Jagdish Prasad
3. Text book of Animal Husbandry - G C Benarjee
4. Hand book of Animal Husbandry - ICAR Edition
S. Outlines of Dairy TeGhrtology — Sukumar (De) - Oxford University press
6. Indian Dairy Pfoducts — Rangappa (K.S.) & Acharya (KT) — Asia Publishing House.
7. The technology of milk Proceesing — Ananthakrishnan, C.P., Khan, A.Q. and Padmanablian, P.N. — Shri Lakshmi Publications.
8. Dairy India 2007, 5ixth edititon
9. Economics of Milk Production — Bharati Pratima Acharya Publishers.
10. http://www.asyi-infra.com/BooksPDF/Dairr@»20Farmer%J0or%20Entrepreneur.pdf
11. https://labour.gov.in/indi:strial-safetv-health

Course Code Zoology Paper – VSC-2 ZOO 158 T

Poultry Farming (Theory)

Credits- 01

Total No. of Period - 15

Evaluation - Internal 40% External 60% marks 50

Learning Objective:

To impart training on Modern Poultry Farming Technology

To create knowledge on self-employment opportunity.

Learning Outcomes:

Students at the successful completion of the course will be able to

1. Evaluate the status of Indian Poultry Industry
2. Explain the Scientific Poultry keeping
3. Compare the diversified Poultry practices
4. Inspect the different breeds of chicken

UNIT 1

External morphology of variety of fowls such as Plymouth Rock, light Sussex, Minorca, Rhode Island, Red and White Leghorn.

Classification of fowls based on their use: meat type such as Broilers, Egg type such as white leghorn and commercial layers, Dual purpose varieties, game and ornamental purpose varieties.

UNIT 2

Feeding poultry – Management of Egg Layers – Management of Broilers in large scale farms.

UNIT 3

Poultry diseases viral, Bacterial, fungal, Protozoan and parasitic Lice etc. Prevention and precautions during vaccination.

Management of a modern poultry farms – Progressive plans to promote poultry as a self Employment venture.

Reference Books:

Jull Morley, A. 1971: Poultry Husbanry, Tata –McGraw Hill Publ. Co New Delhi – India.

Sastry, Thomas and Singh, 1982: Farm Animals Management and Poultry production – Vikas Publ. co. New Delhi – India.

Harbans Singh and Earl.N. Moore, 1982: Livestock and poultry production – prentice hall India Publ. Co., New Delhi – India.

Banarjee, G.C. 1986: poultry, Oxford – IBH publ. co., New Delhi – India. B.Sc. Z

Course Code–VSC-2 ZOO 159 P

Zoology Paper - Poultry Farming (practical)

Credits- 01

Total No. of Period – 30 **Marks 50**

Co-curricular Activities Suggested:

1. Group discussion & SWOT analysis
2. Visit to a poultry farm
3. Invited Lectures by Concerned officers of government or private farms.
4. Cheap and Healthy Feed preparation by students based on government standards,
5. Market study and Survey (Monitoring of daily price hike in poultry market and analysis)
6. Online Swayam Moocs course on poultry farming.
7. Identify different Poultry & fowl breeds; Demonstrate different System of Poultry rearing as-Free-range, semi intensive, intensive rearing prepare various model Structure of poultry breeder farm, hatcheries and commercial Poultry farms.
8. Identify major Feed ingredients of Poultry; demonstrate various feeding requirements in various species of poultry, elaborate different forms of poultry feed,
9. Prepare schematic diagramme of site and location of poultry farm, identify various types of Poultry houses & Ventilation system in poultry housing.
10. Elaborate the principles and important factors in breeding, Incubation and Hatchery Management, Practices in Poultry farming; Identify various System of Raring in Broiler & Layer Poultry
11. Identification of various infectious diseases of Poultry i.e. Viral, Bacteria, Fungi, protozoa and Parasites. Describe various nutritional deficiency diseases of poultry,

Course Code Zoology Paper –VSC-2 ZOO 160 T

Aquarium Fish Keeping (Theory)

Credits- 01

Total No. of Period - 15

Evaluation - Internal 40% External 60% **marks 50**

Learning Objective:

To impart training on Aquarium fish keeping technology
To create knowledge on self-employment opportunity
Learning Outcome: The studies learn details of aquarium, fish keeping and maintenance

UNIT 1

The potential scope of Aquarium Fish industry as a Cottage Industry. Exotic and Endemic species of Aquarium Fishes. Aquarium plants, Water quality management in Aquarium, Accessories used in Aquarium

UNIT 2

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.
Food and feeding of Aquarium fishes – use of live fish feed organisms. Preparation and composition of formulated fish feeds, Diseases in Aquarium Fishes

UNIT 3

Live fish transport – Fish handling, packing and forwarding techniques.
General Aquarium maintenance – budget for setting up an aquarium fish farm as a cottage Industry.

Suggested Readings:

1. Jingran V.G., 1991: Fish and fisheries in India – Hindustan Publ. co New Delhi – India.
2. Shanmugam K. 1992, Fishery Biology and Aqua Culture – Leo Pathipagam – Chennai- India.
3. Mill Dick, 1993: Aquarium fish, DK Publ.Co,Inc. New York –USA
4. Yadav. 1995: Fish and fisheries, Daya publ. co., New Delhi – India
5. Hall, C.B. 2005: Ponds and Fish culture – Agrobios – Jodhpur – India.
6. Day,F. 1978: Fishes of India Vol. I & II, William Danisan & Sons, India.
7. Mathur,S., Sharma,L.L. and Mathure,A.K.2006.Hand Book of Freshwater Ornamental Fishes,Yash Publishing House, Bikaner.
8. Hem Raj.2022.A Text Book of Aquarium Fish Keeping, S.Vinesh & Co.
9. Sanjib Saha.2022.Concept of Aquarium fish keeping, Techno World Publishers.
10. Jayashree, K.V., Thara Devi, C.S. and Arumugam, N.2020.Home Aquarium and Ornamental Fish Culture, Aras Publication, Nagercoil,Tamil Nadu.
11. Sakhare, V.B.2018.Inland Fisheries, Daya Publishing House, Delhi.

Course Code– VSC-2 ZOO 161 P

Zoology Paper -Aquarium Fish Keeping (practical)

Credits- 01

Total No. of Period – 30 **marks 50**

Practicals:

1. Introduction to Aquarium accessories and equipment's.
2. Identification of ornamental fishes.
3. Acclimatization of fish.
4. Preparation of formulated fish feed.
5. Identification of ornamental fish diseases and prophylactic measures.
6. Identification of aquarium plants

Course Code– SEC-2ZOO 162 T

Zoology Paper- Biological Techniques (Theory)
Credits- 1

Total No. of Period - 15

Evaluation - Internal 40% External 60% **Marks 50**

Learning objectives:

1. Student should understand the various techniques used in biological sciences.
2. To develop students competencies in bio techniques and its applications in a technology-rich, interactive environment.
3. Understand the mechanics of common laboratory assays and how they can be applies to research.
4. Aims to make students learn about modern instruments for various analytical work

Learning Outcome:

1. The students will be able to understand the purpose of the technique, its proper use and possible modifications/improvement.
2. Understand the principles and applications of different assays.
3. Understand the principles and applications of Microscopy, spectroscopic techniques in biology.
4. Understand the principles and applications of electrophoresis and blotting.
5. Understand the nature and types of radiations and their applications in structural and functional analysis of biological samples.

Unit -1. Principles and uses of analytical instruments – Balances, pH meter, calorimeter, spectrophotometer, centrifuge, ultracentrifuge.

Microscopy – Principle of light transmission, electron, and phase- contrast, fluorescence, electron, confocal, scanning electron microscopes. Microphotography. Image analysers.

Microbiological techniques –Media preparation and sterilization; Inoculation and growth monitoring; Use of fermenters; Microbial assays.

Unit -2 Cell culture techniques –Design and functioning of tissue culture laboratory; Cell viability testing; Culture media preparation and cell harvesting methods.

Separation techniques in biology –Molecular separations by chromatography, electrophoresis, precipitation etc. Computer aided techniques for data presentation, data analyses, statistical techniques, special software for specific tasks.

Radioisotope and mass isotope techniques in biology; Immunological techniques based on antigen - antibody interactions. Surgical techniques –Organ ablutions (eg; ovariectomy, adrenaletomy etc.)

Course Code– SEC-2 ZOO 163 P

Zoology Paper - Biological Techniques (practical)
Credits- 1

Total No. of Period - 30 **marks 50**

(Lab Course)

1. Checking the efficiency of pipette using a weighing balance and known measurements of volume.
2. Use and application of micropipettes to measure and dispense solutions.
3. Use and application of analytical weighing balance to weigh chemicals.
4. Preparation of stock solutions and standard solutions and use of serial dilution technique in preparation of dilute solutions.
5. Calculating molecular weight of a substance and preparation of molar solutions of differentchemicals.
6. Preparation of percent solutions and calculations to determine final concentrations.
7. Adsorption chromatography to separate coloured mixtures.
8. Handling and use of centrifuge, microscope, colorimeter and electrophoresis.

SUGGESTED READINGS:

1. Handbook of Analytical Instruments, Second Edition; Dr R S Khandpur, 2006 McGraw-Hill Education Private Limited.
2. Basic Methods in Microscopy: Protocols and Concepts from "Cells: a Laboratory Manual"; David Spector, Robert Goldman; Cold Spring Harbor Laboratory Press,U.S.; 1st edition (15 October 2005)
3. Lodish, Harvey; Berk, Arnold; Zipursky, S. Lawrence; Matsudaira, Paul; Baltimore, David; Darnell, James (2000). *"Microscopy and Cell Architecture"*. Molecular Cell Biology. 4th Edition.
4. Alberts B et al (2008), Molecular Biology of the Cell, 5th ed. Garland Science Publishing.
5. Becker WM, Kleinsmith LJ and Hardin J (2006), the world of the cell, 6th ed. Pearson Education Inc.
6. Bozzola JJ and Russell LD (1998), Electron Microscopy: Principles and Techniques for Biologists, 2nd ed. Jones and Bartlett Publishers, Inc.
7. Hoppert M (2003), Microscopic Techniques in Biotechnology, Wiley-VCH Verlag.
8. Lodish H, Berk A, Kaiser CA et al (2008), Molecular Cell Biology, 6th ed. W.H. Freeman and Company.
9. Pawley J (2006), Handbook of Biological Confocal Microscopy, 3rd ed. Springer.

Course Code– SEC-2 ZOO 164 T
Zoology Paper- Haematology. (Theory)
Credits- 1

Total No. of Period - 15

Evaluation - Internal 40% External 60% **marks 50**

Learning Objectives

1. To understand the composition and functions of human blood.
2. To appreciate different types of compounds used in processing and storage of blood.
3. To learn different techniques used in study of blood cells.
4. To develop skill of collecting, preserving and analysing blood samples.
5. To learn about changes in blood composition in disease.

Learning Outcomes

1. Ability to explain composition and functions of blood.
2. Knowledge about compounds used in processing and storage of blood.

Unit –1

Introduction - Definition, Components, Blood– Structure and Functions of blood cells, Lymph.
Collection of Blood- Collection of blood by skin puncture, Collection of blood by Venipuncture, Collection of arterial blood.

Unit –2

Anticoagulants - Definition, Action of E. D. T. A., Oxalates, double oxalates, fluorides, acid Citrate, dextrose-trisodium citrate, heparin.
Effect of anticoagulants on blood cell morphology.
Hemoglobin - Normal structure and various hemoglobin, Determination of hemoglobin By various methods.

Unit-3

Study of Blood Cell Count - Total WBC Count, Total RBC Count, Platelets Count, Absolute Eosinophil Count, Reticulocyte Count.
Study of Blood Smear for differential WBC Count - Preparation and Staining of smears, Counting Methods, Morphology of White cells, Types of White Cells, Abnormalities in Morphology of blood cells and related diseases.

Suggested Readings:

1. Medical Laboratory Technology - Ramnik Sood
2. Medical Lab Technology Vol. I, II & III – Kanai Mukherjee
3. Hand Book of Medical Technology - Mrs. Chitra
4. Medical Laboratory Technology – A. Ananthanarayan
5. Manual for Laboratory Technician of Primary Health by Minister of Health
6. Human Physiology Vol. I & II – C. C. Chatterji