DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY,
CHHATRAPATI SAMBHAJINAGAR.

CIRCULAR NO.SU/B.Sc./CBC&GS/94/2024

It is hereby inform to all concerned that, the Revised syllabi prepared by the Board of Studies/ Ad hoc Boards & recommended by the Dean, Faculty of Science & Technology, **Academic Council at its meeting held on 08 April 2024 has accepted** the following Syllabi under the Faculty of Science & Technology **as per Norms of Choiced Based Credit Grading System** run at the Affiliated Colleges, Dr.Babasaheb Ambedkar Marathwada University as appended herewith.

Sr.No.	Courses	Semester
1.	B.Sc.Zoology (Optional)	Vth & VIth semester
2.	B.Sc. Statistics (Optional)	Vth & VIth semester
3.	B.Sc.Home Science (Degree)	Vth & VIth semester
4.	B.Sc.Biotechnology (Degree)	Vth & VIth semester

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

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

University Campus,
Aurangabad-431 004.
REF.NO.SU/2024/26489-89
Date:- 20.05.2024

*****

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, Chhatrapati 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.
7] The Record Keeper, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

Dr. Babasaheb Ambedkar Marathwada University Chhatrapati Sambhajinagar
Semester Pattern Curriculum under, Choice based Credit System(CBCS)
Under Graduate Bachelor Degree
Programme (B.Sc.)

FACULTY OF SCIENCE & TECHNOLOGY

B.Sc. Zoology
Vth & VIth Semester

Course Structure &Curriculum

According to CBCS from 2024 onward

Subject: Zoology

For UG departments of affiliated collages.
(Effective from 2024-25)

Page 1 to 45

Dr. Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar

Semester Pattern Curriculum under, Choice based Credit System (CBCS)

Under Graduate Bachelor Degree Programme (B.Sc.)

Faculty of Science and Technology

Subject- Zoology

Course Structure and Curriculum with Examination Scheme

(Effective from academic year 2024-25)

B. Sc. Third Year (Semester –V)

Semester V								
	Course code	course Title	Total Periods (Teaching period/weeks)	Credits	Scheme of theExamination			
					Max. Marks	CIA	UA	Min. Marks
Optional I DSE-1A – Discipline specific Elective	ZOL 511	DSE-1A -1 (Theory paper IX) Select any one from (A1 /B1 /C1 / D1) A1 - Animal Physiology I B1 - Animal Behavior I C1 -Forensic Biology I D1 -Molecular Biology I	45(3/week)	2	50	10	40	20
	ZOL 512	DSE-1A-2 (Theory paper X) Select any one from A2/B2/C2/D2) A2 - Parasitology I B2 --Entomology I C2 - Fishery Science I D2- Biotechnology I	45(3/week)	2	50	10	40	20
	ZOL 521 Lab course	Lab course 6 based on ZOL511 (A1/B1/C1/ D1) A1 - Animal Physiology I B1 - Animal Behavior I C1 -Forensic Biology I D1 Molecular Biology I	45(3/week)	1.5	50	10	40	20
	ZOL 522 Lab course	Lab course 7 based on ZOL512 (A2/B2/C2/D2 A2 -- Parasitology I B2 -- Entomology I C2 - Fishery Science I D2- Biotechnology I	45(3/week)	1.5	50	10	40	20
Skill Enhancement Course (SEC-3)	ZOL 513	SEC-3.Any one skill to be chosen outof two- SEC-3 (E) **Vermicompost and Vermiculture** SEC3-(F)**Apiculture**	45(3/week)	2	50	10	40	20
			225	9	250	50	200	100
Total credits for semester V ;: (Theory :6 ;Laboratory : 3)								

Dr. Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar
Semester Pattern Curriculum under, Choice based Credit System (CBCS)
Under Graduate Bachelor Degree Programme (B.Sc.)
Faculty of Science and Technology
Subject- Zoology
Course Structure and Curriculum with Examination Scheme
(Effective from academic year 2024-25)
B. Sc. Third Year (Semester –VI)

Semester VI								
	Coursecode	Course Title	Total Periods (Teaching period/weeks)	Credits	Scheme of theExamination			
					Max. Marks	CIA	UA	Min. Marks
Optional I DSE-1B – Discipline specific Elective	ZOL 611	DSE-1B -1 (Theory paper XI) Select any one from(A1 /B1 /C1 / D1) A1 - Animal Physiology II B1 -- Animal Behavior II C1 - Forensic Biology II D1 - Molecular Biology II	45(3/week)	2	50	10	40	20
	ZOL 612	DSE-1B-2 (Theory paper XII) Select any one fromA2/B2/C .2/D2) A2 -- Parasitology II B2 -- Entomology II C2 - Fishery Science II D2- Biotechnology II	45(3/week)	2	50	10	40	20
	ZOL 621 Lab course	Lab course 8 based on ZOL 611 (A1/B1/C1/ D1) A1 - Animal Physiology II B1 -- Animal Behavior II C1 -- Forensic Biology II D1 - Molecular Biology II	45(3/week)	1.5	50	10	40	20
	ZOL 622 Lab course	Lab course 9 based on ZOL 612 (A2/B2/C2/D2) A2 - Parasitology II B2 -- Entomology II C2 - Fishery Science II D2- Biotechnology II	45(3/week)	1.5	50	10	40	20
Skill Enhancement Course (SEC-4)	ZOL 613	SEC-4.Any one skill to be chosen outof two- SEC-4 (G)Aquarium Fish keeping. SEC4 -(H) Sericulture	45(3/week)	2	50	10	40	20
			225	9	250	50	200	100
Total credits for semester VI ;: (Theory :6 ;Laboratory : 3)								

B.Sc. Fifth Semester
Course Code-ZOL- 511 DSE-1A -1
Zoology (Theory paper IX)
A1 - Animal Physiology I
Course Credits: 2
Total No.of period-45 (3 per week)

Learning Objectives of the Course:

i. To understand the structure of the different organ systems in man/mammals.
ii. To understand the mechanisms involved in the functioning of the different systems.
iii. To learn the structure and physiology of digestion, respiration and circulation in animals.

Course Outcomes (COs): After completion of the course, students will be able to –

i. Understand the nutrition and physiology of digestion in man.
ii. describe the structure and respiratory mechanism and transport of gases.
iii. learn the structure and working of mammalian heart, blood composition and clotting mechanism.

Unit I: Nutrition and Digestion

1. Nutrition: Definition, types (Autotrophs & Heterotrophs)
2. Brief Introduction to digestive system (Human).
3. Enzymes: Definition, classification, inhibition, regulation.
4. Digestion of carbohydrates, proteins, lipids and cellulose
5. Absorption, assimilation of digested food
6. Role of gastrointestinal hormones in digestion.

Unit II: Respiration

1. Respiratory organs of animals,
2. Structure of lungs and respiratory mechanism.
3. Respiratory pigments: - Properties and function of respiratory pigments.
4. External respiration.
5. Transport of gases.
6. Internal respiration.

Unit III: Circulation

1. Types of circulation: open and closed
2. Types of hearts: neurogenic and myogenic
3. Structure and Working of mammalian heart.
4. Heart functions, conduction and regulation of heartbeat, regulation of heart rate
5. Blood and its composition.
6. Mechanism of blood clotting.

Learning Resources:

1. A.K. Berry. –animal physiology
2. Arthur C. Guyton MD, A Text Book of Medical Physiology, Eleventh ed., John E. Hall, Harcourt Asia Ltd.
3. Dantzler, W.H. Comparative Physiology (Handbook of Physiology): Vol. 1, 2, (ed.)
4. Gerard J. Tortora and Sandra Reynolds Garbowski Principles of Anatomy and Physiology, Tenth Ed., John Wiley & Sons.
5. Guyton– a book on medical physiology
6. Moeye K.-Animal Physiology, Cambridge low prize edition.
7. Mohan Arora – animal physiology , Himalaya publication
8. Nagbhushnum R.,Sarojini R., Kodarkar M.S. –Animal Physiology Oxford University Press, New York, USA
9. Parameswaran, Anantakrishnan and Ananta Subramanyam, 1975. Outlines of Animal Physiology,
10. Prosser,C.L. Brown, 1985, Comparative Animal Physiology, Satish Book Enterprise, Agra
11. R. Eckert. Animal Physiology: Mechanisms and Adaptation. W.H.
12. Roger Eckert and Randal, Animal PhysioJogy, 4th ed, Freeman Co, New York.
13. S. Viswanathan [printers & Publishers] Pvt. Ltd.
14. Sambasivaiah, Kamalakara rao and Augustine chellappa 1990. A Text book of Animal physiology and ecology, S. Chand & co., Ltd., New Delhi – 110 055.
15. Sherwood, Klandrof, Yanc, Human Physiology, Thompson Brooks/Coole, 2005.
16. Singh. H.R, Text Book of Animal Physiology and Biochemistry
17. Veer Bal Rastogi, Text Book of Animal Physiology
18. Verma ,Agarwal & Tyagi-animal physiology
19. William F. Ganong, A Review of Medical Physiology, 22 ed, McGraw Hill, 2005.
20. William S. Hoar, 1976. General and comparative physiology, prentice Hall of India Pvt. Ltd., New Delhi. 110 001.
21. Wood E.W. Principle of Animal physiology
22. Xnut Scmidt-Nieison, Animal Physiology, Sth ed, Cambridge Low Price Edition.

B.Sc. Fifth Semester
Course Code ZOL 511 DSE-1A -1
Zoology(Theory paper IX)
B1 -- Animal Behavior I
Course Credits: 2
Total No. of period-45 (3 per week)

Learning Objective
To study the complex and diverse approaches of animal behavior.
To study different types of animal behavior and Communications in animals.

Learning Outcome
At the end of the course the students will be able to:
1. Examine and critically to evaluate the emergence of ideas that have shaped how we observe and collect data on animal behaviour.
2. Understand the main historical ideas that underpin animal behavior theory
3. Critically review hypotheses to explain animal behaviour
4. Understand different methods for collecting data on animal behaviour.
5. Have advanced their written and oral presentation skills.

Unit – 1
Introduction to Animal Behavior
1. Brief contributions of Karl Von Frish, Ivan Pavlov, Konrad Lorenz, Niko Tinbergen.
2. Proximate and ultimate causes of behavior.
3. Patterns of Behavior Stereotyped Behaviors - Orientation and Reflex.
4. Individual Behavioral patterns: Instinct and Learned Behavior
5. Associative learning, classical and operant conditioning, Habituation, Imprinting.

Unit – 2
Social Behavior
1.Social organization in Termites and Honey bees Social behavior : Altruism.
Conflict behavior.
2.Sexual Behavior Sexual dimorphism, Mate choice in peacock.
3.Intra-sexual selection (male rivalry in red deer).
4. Kinship theory: Relatedness & inclusive fitness.
5. Parental care in fishes (Nest Building & cost benefit)

Unit – 3 Chronobiology
1. Brief historical developments in chronobiology.
2. Adaptive significance of biological clocks. Biological rhythms.
3. Communications in animals.
4. Role of pheromones in animal communication- Insects and Vertebrates
5. Communication in Honey bees (Waggle dance).
6. Territoriality in Monkeys and Dogs
7. Bioluminescence in deep sea fishes and insects

Suggested Readings:

1. Animal Behaviour by Drickamar.
2. John Alcock, Animal Behaviour, Sinauer Associate Inc., USA.
3. Paul W. Sherman and John Alcock, Exploring Animal Behaviour, Sinauer Associate Inc., Massachusetts, USA.
4. Chronobiology Biological Timekeeping: Jay. C. Dunlap, Jennifer. J. Loros, Patricia J. DeCoursey(ed). 2004, Sinauer Associates, Inc. Publishers, Sunderland, MA, USA
5. Insect Clocks D.S. Saunders, C.G.H. Steel, X., Afopoulou (ed.) R.D. Lewis. (3rdEd) 2002 Barens and Noble Inc. New York, USA

B.Sc. Fifth Semester
Course Code ZOL 511 DSE-1A -1
C1 -- Forensic Biology I(Theory paper IX)
Course Credits: 2
Total No.of period-45 (3 per week)

Learning Objectives:

To demonstrate theoretical and practical training in different branches of Forensic Biology and their role in crime scene investigation.

Course Outcomes:

i. To understand about introduction and forensic significance of biological evidences and crime scene investigation.
ii. To understand about the basic introduction and forensic examination of hair and fiber and forensic diatomology.
iii. To understand about introduction, significance and tests of different types of body fluids in crime scene investigation and bloodstain pattern analysis

Unit I: Forensic Science and Forensic Biology:

Forensic Science: Introduction, Definition, Scope and branches of Forensic Science.

Forensic Biology: Introduction, Evidence of Biological Importance, Nature, the scope of crime scene presence and characterization of blood, semen, saliva, urine, sweat, vomit, botanical materials, diatoms, wildlife samples, and other biological evidence.

Crime Scene Investigation of Biological Evidence: Modus Operandi and its role in crime investigation crime scene, Protection, Recognition, Search & Collection, Documentation Packaging & Transportation of Biological Evidence encountered in various cases.

Unit II: Biological Evidences:

Hair & Fiber: Hair: Hair trichology – Nature, Importance, location, structure, Collection and tests for determination of origin, biochemistry, and forensic aspects of hair. Fiber: Introduction, source, importance and types of fiber, natural (plant, animal, and mineral), synthetic (nylon, polyester, terylene, carbon nanotube fiber), and blended (terrycloth, rayon).

Diatomology: Diatoms: Nature, classification, location, structure, life cycle, extraction from various body tissues including bone marrow, preparation of slides, methods of identification and comparison, forensic significance.

Unit III: **Body Fluid Analysis:**

Definition, Properties, Significance, collection, preservation, preliminary and confirmatory test of Blood, Semen, Saliva, Sweat, and Urine.

Bloodstain Pattern Analysis:

Bloodstain characteristics. Formation, types and forensic importance of bloodstain patterns. Cast-off bloodstain patterns. Projected bloodstain patterns. Contact bloodstain

patterns. Blood spatters, Blood trails. Bloodstain drying times. Documentation of bloodstain pattern evidence

Learning Resources:

1. Forensic Biology by Richard Li CRC Press; 2nd edition (27 April2015).
2. Practical Skills in Forensic Science–Alan Langford, John Deane Tal Addison-Wesley Longman Ltd (February 1, 2005).
3. Scientific & Legal Applications of Bloodstain Pattern Interpretation – Stuart H. James CRC Press; Ist edition (June 29, 1998).
4. Saferstein, Richard, Criminalistics - An Introduction to Forensic Science, 6th Ed. Prentice-Hall, New Jersey, 1998.
5. Sharma, B. R., Forensic Science in Criminal Investigation and Trials (3rd Ed) Universal Law Publishing Co. Ltd. New Delhi, 2001.
6. B. R. Sharma, Forensic Science in Criminal Investigation and Trials (6th Edition).
7. R. Krushnamurthy, T. Khedkar and S. Lade Forensic Biology, S. S. B. Publication.

ZOL 511 DSE-1A -1
D1 - Molecular Biology I (Theory paper IX)
Course Credits: 2
Total No. of period-45 (3 per week)

Learning objectives:
Introduce the learners to chemical and molecular processes that affect genetic material. It also intends to make them understand the concept Nucleic acid, chromosome , DNA etc

Learning outcome:
The course will prepare learners to recognize the significance of molecular biology as a basis for the study of other areas of biology and biochemistry. Moreover, it will also assist them in understanding related areas in relatively new fields of genetic engineering and biotechnology.

Unit – 1 Nucleic Acids :
Structure of DNA(Watson and Crick Model)
Types of DNA – A,B,Z, & H forms
Denaturation and Renaturation of DNA
DNA as a genetic material –Evidences
RNA as a genetic material in viruses(TMV)

Unit – II Chromatin Structure
Prokaryotic chromosome structure
Ultrastructure of nucleosome
Higher order packaging of DNA – Solenoid, Super solenoid structure
Eukaryotic chromatin structure
Chromatin types (Euchromatin, Heterochromatin)

Unit – III DNA Replication
Experimental proof that DNA replication is semi conservative
DNA replication in prokaryotes:
DNA polymerase;
Initiation;
Unwinding;
Primer Synthesis;
Elongation.
Termination
Difference between DNA replication of Prokaryotes and Eukaryotes

Suggested Reading
1. Molecular biology of cell, 3rd and 4th edition, Alberts B. D. Lewis J. Raff M. Roberts K. and Watson.
2. Gene, Vol. V, VI, VII, VIII and IX, Lewin B., Oxford University Press, Oxford.
3. Molecular biology of the Gene, 1993, Watson J. Hopkins, Roberts Steitz & Weiner, Benjamin Cummings.
4. Text Book of Molecular Biology, 19994, K. Sivrama Sastry G. Padmanabhan and C. Subramanyam: MacMillan, India.
5. Cell and Molecular biology, 1996, G. Karp, John Willey & Sons, U.S.A.
6. Principles of Genetics, 1997, P.D. Snustad, M.L.Smmons, J.B. & Jenkins, John Willey & Sons, U.S.A.
7. Cell and Molecular biology, De Robertis and De Robertis, 8th & 9th Edition, Saunders Publication

Lab course ZOL 521

Lab course 6 based on ZOL511 **A1 Animal Physiology I**

Physiology Experiments:

1. Qualitative tests for carbohydrates, protein and lipids.
2. Qualitative detection of salivary amylase activity under optimum conditions and in relation to pH and Temperature.
3. To study the digestive enzymes from cockroach.
4. Differential and total count of RBC/WBC from blood sample by using haemocytometer.
5. Detection of Heamatin crystals from blood sample.
6. Detection of Hb% from given blood sample.
7. Effect of isotonic, hypotonic, and hypertonic solutions on blood cell (RBCs).
8. Estimation of oxygen consumed by fish in relation to temperature or body weight by Wrinkle's method.
9. Determination of the ABO and Rh blood groups.
10. Study of histological sections of Rat (photomicrographs/permanent slides)
    a. T. S. of Oesophagus,
    b. T. S. of Stomach
    c. T.S. of Pancreas
    d. T.S. of small Intestine
    e. T. S. of Large intenstine
    f. T. S. of Lungs
    g. T. S. of Artery
    h. T. S. of Vein
11. Study of respiratory structures: Gills and lungs (charts/model)
12. Study of neurogenic and myogenic heart (Cockroach, shark, frog, calotes, mammal)

ZOL521 Lab course 6 based on ZOL511 **B1 Animal behavior I**

1. Courtship behavior in drossphila
2 Wing beat and Song produced
3. Duration intervals of courtship songs (wing buzzing etc)
4. Reading behavior of praying mantis.
5. Schooling behavior of Fishes.
6. To study the nest and nesting habits of the birds and social insects.
7. Field visit to an Animal Husbandry centre.

ZOL521 Lab course 6 based on ZOL511 **C1 -- Forensic Biology I**

1. Microscopic Comparison of Human Hair and Animal Hair
2. Techniques of species identification from various biological fluids
   a. Electrophoresis b . Precipitin tests
3. Acid Phosphatase test for semen
4. Microscopic examination of spermatozoa
5. Detection of Amylase activity- Starch-Iodine Assay.
6. To carry out the microscopic examination of diatoms.
7. Microscopic Comparison of Fibres

8. Presumptive and Confirmatory Tests for Blood
   a. Phenolphthalein Assay b Benzidine
   c Leucomalachite Green (LMG) d Luminol Test
9. Detection of Blood groups and Rh factor.

ZOL521 Lab course 6 based on ZOL511 **D1 Molecular Biology I**

1: Preparation of DNA paper model and study its characteristics.
2: Staining of DNA and RNA by methyl green – pyronin.
3: Estimation of DNA by Diphenylamine method.
4: Estimation of RNA by Bial's Orcinol method.
5: Isolation of DNA from Bacteria / liver.
6: Protein estimation by Lowry et al. Method
7: Isolation of nuclei. and their counting.
8: To study restriction digestion of DNA.
9: To study cell fractionation, use of sucrose density gradient.

ZOL 512 DSE-1A-2 (Theory paper X)
Select any one fromA2/B2/C2/D2)
A2-- General Parasitology I
Course Credits: 2
Total No. of period-45 (3 per week)

Course Objectives:

1. To study the major types of parasites of medical & veterinary importance.
2. To understand the basics of identification of common parasites of humans and animals.
3. To design and evaluate an intervention to control food and waterborne diseases.
4. To understand and evaluate epidemiological studies in different disease.

Course outcome:

The students after completing this course based on the expertise he may join the parasitological research institute, may be a scientist in the WHO, UN Parasitological researcher, scientist. May join as Parasitologist in the state and central government public health programs as officer. get job opportunities in the pathological labs as parasitologist.

UNIT- I. General topics in Parasite study.

Introduction to Parasitology, Parasitism- Definition & concept. Types of Parasites. Factors influencing Parasitism; Influence of season, host age and other phonological factors on parasitic population (prevalence, intensity etc.).

Inter-specific biological relationships phoresis, symbiosis, Commensalisms, and parasitism. Types of hosts- Definitive and intermediate, primary and secondary specific host, Paratenic, Carrier, Susceptible, Resistant, Accidental, Vectors, Host specificity.

Introduction to Immunology of Parasitic infections. Natural & acquired immunity. Immunodiagnosis.

UNIT-II. Parasites as global problem.

Parasite and global public health. Global burden of infectious diseases. Parasitic zoonosis.

General principles of immunization and Hypersensitivity reactions.

Strategies in designing parasitic vaccines and Limitations.

UNIT-III. Protozoan Parasites.

Life cycle and pathogenicity of malarial parasites and control on malaria.

Study of coccidian parasites in vertebrates.

General organization of the parasitic Protozoa occurring in oral cavity, urinogenital tract, muscles and blood.

i) Trichomonas vaginalis ii) Trichomonas foetus iii) Trypanosoma gambiense iv) Trypanosoma cruzi v) Leshmania donovani vi) Leshmania tropica vii) Giardia lambiia. Viii) Entamoeba gingivalis ix) Toxoplasma gondii x) Balantidium coli.

UNIT-IV. Morphology life history, diseases/ harm caused and the control of following-

Introduction to Parasitic Acanthocephala and Annelida (Any one example each)

Parasitic Siphonoptera, Anupleura, Mallophaga. Parasitic Diptera . d) Parasitic Hemiptera and Pentastomidea Parasitic Crustacean and Acarids (any one example).

Suggested Readings:

1. 'Infectious Disease Epidemiology: theory and practice' 2nd edition. Nelson & Williams (Eds.).2007.
2. Medical Parasitology by Markell, Voge and John, 8th ed. W.B. Saunders Co.

3. Reingold, A.L. Outbreak Investigations – A Perspective. Emerging Infectious Diseases 1998; 4(1): 21-27.
4. Jones, K.E., Patel, N.G., Levy, M.A., Storeygard, A., Balk, D., Gittleman, J.L. and P. Daszak. Global trends in emerging infectious diseases. Nature 2008; 451(21): 990-993.
5. Taxonomy of Cestode Parasites of vertebrates: Khalil and Bray (CABI Publication, London)
6. An introduction to Nematodology -Chitwood
7. Helminth, Arthropod and Protozoa of domesticated animal -Solbsy E.J.W
8. Laboratory methods of work with plant and soil nematodes -Southey
9. Human helmintology Munual for Clinicals, Sanitarians Medical Zoologists –Faust, Emerest Caroll
10. Practical exercise in Parasitology -Halton, Behave, Marshall.
11 Chatterjee K. D. (1969) -Parasitology (Protozoology and Helminthology)
12 Cheng T.C. (1964)-The Biology of animal parasites, Saunders International Student Edition.
13 The Invertebrates Vol II, McGraw Hill, New York.- Dawes B. (1946).
14. Text book Medical Parasitology of Jaypee Brothers, - Panikar C.K.J (1988)
15. Medical Publishers, New York. - Panikar C.K.J (1988)
16. The Parasitology of Trematodes Oliver and Boyd Ltd. Edinburgh - Smyth J.D (1977)
17.The Zoology of Tapeworm. - Wardle and Mcleod (1952)
18. The advances in the Zoology of tapeworm from - 1970- Wardle and Mcleod
19. Systema Helmenthum Vol. II Cestoda. - Satyu Yamaguti (1959)
20. The Physiology of Cestodes. - J.D Smyth

ZOL 512 DSE-1A-2 (Theory paper X)
B2-- Entomology I
Course Credits: 2
Total No. of period-45 (3 per week)

Course Objectives:

To study the importance of insect in and their classification which is helpful for identification of insect.

Course Outcome By the end of the course

Student will be able to learn methods to collect and identified different insect

Student will able to use economically important insect and will be aware about pests.

Unit I

1. Introduction to Economic entomology.
2. Methods of collection and preservation of insect.
3. Type study of grasshopper- systematic position, external morphology,
4. digestive, nervous, reproductive system including development.

Unit II

1. Insect –orders (general characters)
2. Thysanura, Collembella,
3. Lepidoptera, Diptera,
4. Coeloptera and Hymenoptera.

Unit III

1. House hold and Human insect pests:-
2. Bed bugs, Mosquito, Rat Flea, House fly, Cockroach, Pediculus.
3. Metamorphosis in insect, types of metamorphosis with example.
4. Insect Culture (gross study)
5. Apiculture, Sericulture and lac culture

Suggested readings

1. The insect structure and function, 4th Edition 92008).Chapman, R.F. Publisher- Cambridge University Press, London.
2. General Textbook Entomology,10th Edn., (1977) Imms, A.D. Richard, O.W. & Davies, R.G. (Eds.) 1 : Champman & Hall, London
3. General Entomology, 2nd edition (1973) Mani M.S. Oxford & IBH Publishing Compony, Delhi.
4. Modern Entomology First edition: (1997) D.B. Tembhare, Himalay Publishing House Delhi
5. Principles of Insect Morphology, (1973). Snodgrass, R.E. Publisher – Tata McGraw Hill, Bombay.
7 The Insects: Structure, Function and Biodiversity, (2004). Ambrose D.P. Publisher- Kalyani Publishers, New Delhi.
8 Introduction to Insect Biology & Diversity" Daly, H.V.,J.T. Doyen & P.R. Ehrlich (1981): International Student Edn. McGraw- Hill, Kogakusha, Japan.
9 Insects: Textbook Entomology Evans. E. H. (1984) : Addison- Wesley. London.
10 . Insects Physiology" Henning, W. (1981) :. Wiley – Inrerscince Publ., John Wiley & Sons, Chichester,England.

ZOL 512 DSE-1A-2 (Theory paper X)
C2-- Fishery Science I
Course Credits: 2
Total No. of period-45 (3 per week)

CAPTURE FISHERY

Learning objectives:

1)To develop the scientific outlook and awareness in Inland and marine fisheries and its great potential for fish production.

2) To familiarize the students with finfish and shellfish fisheries

Learning outcomes:

By the end of course students will be able to

1)Identify the marine, brackish as well as freshwater fishes.

2)Develop knowledge on inland and marine fisheries resources of India

Unit – 1 Riverine Fisheries and Reservoir Fisheries of India

Riverine systems of India and their fishery – The Ganga river system, the East Coast river system, the West coast river system. Problems and management of riverine fisheries – problems, construction of dams, river pollution.

Reservoir Fisheries – Types of Reservoirs, Different reservoirs of river systems in India,Reservoir fisheries management, Reservoir Fisheries of Maharashtra .

Unit –II Estuarine Fisheries of India

Estuarine fisheries – Definition of an estuary. Origin and classification. Different estuaries in India i.e., Hooghly-Matlah estuary, Godavari estuary, Krishna estuary,Adyar estuary, Mahanadi estuary etc. Fisheries of Chilka lake, Pulicat lake and Kerala backwaters.

Unit – III Marine Fisheries of India

Fishery of Indian Oil Sardine, Mackerel, Ribbon fish, Bombay duck, Pomfret, Tuna – Taxonomy, General description, Food and feeding habits, reproduction, crafts and gears, general trends in fishery and its utilization.

Shellfish Fishery of India

Fishery of Prawns, crabs and mollusca – Taxonomy, General description, Food and feeding habits, reproduction, crafts and gears, general trends in fishery and its utilization.

Suggested Readings:

1.Marine Fisheries of India/D.V. Bal and K.V.Rao, Tata McGraw-Hill Publishing Company Ltd.

2.Marine Fisheries of India/S.L.Shanbhogue, Indian Council of Agricultural Research, New Delhi.

3. Fish and Fisheries of Indian Reservoirs/V.B.Sakhare, Daya Publishing House, New Delhi.

4.Inland Fisheries/V.B.Sakhare, Daya Publishing House, New Delhi.

5. A Textbook of Fish and Fisheries/G.S.Sandhu, Daya Publishing House, New Delhi.

6. A Textbook of Fish Biology and Indian Fisheries/R.P.Parihar, Central Publishing House, Allahabad.

7.Reservoir Fisheries of India/V.V.Sugunan, FAO Report No.345.

ZOL 512 DSE-1A-2 (Theory paper X)
D2-- Biotechnology I
Course Credits: 2
Total No. of period-45 (3 per week)

Learning Objective
To study different technologies which applicable for life sciences providing solution in research releted to DNA .

Learning Outcome Students will be able to
Ability to approach ,analyze and bring out scientific solution for problems releted to biological research.

Students will be able to understand technologies which can use in biological as well as medical sciences. It help to given practical approach to students .

Unit I

1. Introduction to biotechnology Definition and concept Old and new biotechnology
2. Scope and importance, Biotechnology in India.
3. Bacterial structure, Plasmid, cosmid, YAC, BAC, Cloning vectors,shuttle vector, bacteriophage, Agro bacterium

Unit II

1. Enzymes in gene cloning , Restriction enzymes (Nomenclature, type),
2. DNA Ligase, alkaline phosphates,Polymerase; taq polymerase, etc.
3. Polymerase chain reaction
4. Isolation & amplification of desired gene; Isolation of DNA from cell
5. Genomic library, cDNA library *In-vitro* synthesis of gene

Unit III

1. Genetic engineering Concept and definition, Steps involved in gene cloning and Application
2. Gene transfer methods -Transformation, conjugation, Electrophoration, transfection
3. Liposome mediated gene transfer, Gene gun, microinjection etc
4. Screening of cloned gene, Direct selection, Insertional inactivation method,
5. Immunological assay, Autoradiography
6. Colony and plaque blotting , Problems and solutions for gene cloning

Suggested Readings

1. Biotechnology by Trehan.
2. Comprehensive Biotechnology 4th edn.,2009, K.J.Ramawat and Shaily Goyal, S.Chand & company.
3. Principles of biochemistry 3rd and 4th edn., Lehninger.
4. Genetic Engineering University press, Science source books.
5. Experimental biotechnology,P.M. Philopose, Dominant publishers and distributors, New Delhi.
6. Culture of animal cells,R.I.Freshney 4th edn.
7. Pharmaceutical microbiology, Experiments and techniques,2nd edn. C.R.Kokare

Lab course ZOL 522

Lab course ZOL 522 Lab course 7 based on ZOL 512 **A2 Parasitology I**

Credits: 02 Marks : 25

1. Preparation of stains: Haematoxylin, Acetocarmine, Borax caramine and Bouins fluid.
2. Parasitological examination of fecal waste of poultry and wild birds, Mammals for protozoan parasites, helminth eggs, larvae and adult worms. Parasite population indices and its uses.
3.Parasitic Zoonosis: Examination of fecal waste of domestic animals (Cat, Dog) and wild animals, Rat, mice as reserves of parasites for occurrence of gravid eggs and embryonated stages, cysts and larval stages.
4 Morphology, taxonomy and their role as parasitic: Lice, Ticks, Mites, Flea and flies .
5. Parmanant slides of protozoa: Balantidium spp., Nyctotherus spp., Plasmodium spp, Trypanosoma spp., Entamoeba histolytica. Etc.

[Note-1) Demonstration of Animal Dissections through Models, Charts and Computer Aided Techniques as per U.G.C. Guidelines]

2) Essential animal material should collected from slaughter house.

Lab course ZOL 522 Lab course 7 based on ZOL512 **B2 -- Entomology I**

1. General classification of Insects up to families of the orders mentioned in theory (At least 2 examples, other than the pests to be studied, of each order- Thysanura, Collembola, and Odonata , Orthoptera, Hemiptera, Coleoptera.)
2. Collection and preservation of insects
3. . Dissection –grasshopper-Digestive system, Nervous system, Reproductive system. .
4. Mounting: - Mouth parts of Grasshopper, Mosquito, Housefly, Cockroach.
5. . Museum study- five Human insect pest and representatives of orders: Lepidoptera, coleopteran, Odoneta, Hymenoptera, Orthoptera, with examples.
6. Collection of insects (at least 15 specimens should be collected and submitted at the time of examination by students)

Lab course ZOL 522 Lab course 7 based on ZOL 512 **C2 - Fishery Science I**

1. Identification of fishes up species level with suitable examples from each class
2. Analysis of water : Turbidity, pH, Dissolved oxygen, Carbon dioxide, Alkalinity, Chlorinity
3. Identification of plankton, nekton and benthos
4. Fishing crafts and gears, hatching happa.
5. Identification fish parasites.
6. Identification of food fishes (at least twenty)
7. Visit to fish breeding centre. Visit to local or any reservoir and marine fish landing centre and student should be submit a project report at the time of practical examination

Lab course ZOL 522 Lab course 7 based on ZOL512 **D2- Biotechnology I**

1. Principle and application of following equipments
   1) Gel electrophoresis
   2) Column chromatography
   3) High pressure liquid chromatography
   4) Centrifuge
   5) Laminar flow
   6) Spectrophotometer
2) Estimation of total DNA from animal tissue using Diphenylamine method.
3) Estimation of total RNA from animal tissue using orcinol method
4) Isolation of messenger RNA from animal source using affinity chromatography
5) Isolation of total DNA from tissue
6) DNA electrophoresis by agarose gel
7) Demonstration of Animinated methods of following ---

- Gene cloning
- Restriction digestion of DNA
- Southern blotting techniques
- Northern blotting techniqu

Skill Enhancement Course (SEC-3) ZOL 513

SEC-3 (E) Vermicompost and Vermiculture

Course Objectives:

To introduce the students about biology of some important species of earth worms used in vermiculture.

Learning Outcomes:

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

1. Acquire a critical knowledge on role of earth worms in making organic matter from biodegradable wastes.
2. Understand the biology of some important species of earth worms used in vermiculture.
3. Acquire skills on production of vermicompost.
4. Explain benefits and problems with vermiculture and vermicompost.

Unit -1: Introduction to vermiculture

1. Vermiculture - definition, meaning, history, economic importance, value in maintenance of soil structure, role as four r's of recycling (reduce, reuse, recycle and restore).
2. Role in bio transformation of the residues generated by human activity and production of organic fertilizers.
3. The matter and humus cycle (product, qualities). ground population, transformation process in organic matter.
4. Useful species of earthworms, local and exotic species of earthworms; complementary activities of auto-evaluation; key to identify the species of earthworms.

Unit -2: Biology of *Eisenia fetida*

1. Taxonomy Anatomy, physiology and reproduction of lumbricidae.
2. Vital cycle of *Eisenia fetida*: alimentation, fecundity, annual reproducer potential and limit factors (gases, diet, humidity, temperature, PH, light, and climatic factors).
3. Complementary activities of auto evaluation.

Biology of *Eudrilus eugeniae*

1. Taxonomy Anatomy, physiology and reproduction of Eudrilidae.
2. Vital cycle of *Eudrilus eugeniae*: alimentation, fecundity, annual reproducer potential and limit factors (gases, diet, humidity, temperature, PH, light, and climatic factors).
3. Complementary activities of auto evaluation.

Unit-3: **Vermicomposting**

1. Small scale earthworm farming for home gardens - earthworm compost for home gardens.
2. Conventional commercial composting - earthworm composting larger scale (pit, brick and, heap systems, and Kadapa slab method).
3. Earthworm farming, extraction (harvest), vermicomposting harvest and processing.
4. Vermiwash collection, composition and use.
5. Enemies of earthworms, sickness and worm's enemies; frequent problems – prevention and fixation. Complementary activities of auto evaluation.

Applications of vermiculture

1. Benefits of vermicompost, Use of vermicompost in agriculture.
2. Basic characteristics of earthworm suitable for vermicomposting.

3. Problems in vermicomposting, vermicomposting of dairy waste.

Suggested Readings

1. Bhatt J.V. & S.R. Khambata (1959) "Role of Earthworms in Agriculture" Indian Councilof Agricultural Research, New Delhi
2. Edwards, C.A. and J.R. Lofty (1977) "Biology of Earthworms" Chapman and Hall Ltd.,London.
3. Lee, K.E. (1985) "Earthworms: Their ecology and Relationship with Soils and Land Use"Academic Press, Sydney.
4. Wallwork, J.A. (1983) "Earthworm Biology" Edward Arnold (Publishers) Ltd. London.
5. Kevin, A and K.E.Lee (1989) "Earthworm for Gardeners and Fisherman" (CSIRO,Australia, Division of Soils).

Skill Enhancement Course (SEC-3) ZOL 513
SEC3 - (F) Apiculture
Credits: 02

Course Objectives:

To introduce the students about potential of useful insect the Bees for getting Honey and other byproducts from their scientific culture methods.

To educate the students about conservation of bees to increase the production in agriculture duce to effective pollination.

Course outcome:

Students can start their own business of Apiculture/Bee farming, train others and will be able to enter in private, Govt sectors or in the research related to Apiculture/Bee keeping.

Unit- I - Introduction of Modern bee keeping

1. Importance of beekeeping
2. Scope of beekeeping
3. Bee species
4. Cast differentiation, Colony organization
5. Division of labour in honeybee
6. Life cycle of honeybee and nuptial flight

Unit- II. Scientific bee keeping

1. Beekeeping equipment's a Equipment's for improving efficiency of honeybees
2. Equipment's for improving efficiency of bee's keepers c Equipment's for improving hygienic conditions
3. Methods of Swarm capturing. a. Capturing a Swarm from a tree branch. b Capturing a Swarm from Ground
4. Inspection and Handling the Colony
5. Hiving by dividing an established colony.
6. Establishment, Seasonal Management of apiary and inspection of bee colonies.

Unit III - Apiculture in Agriculture

1.Bee plants and floral calendar- Importance and qualities of good bee flora.

2. Pollination, Need of bee pollination Management of honeybees for pollination.

4 Migratory beekeeping

5 Honeybee products

a) Honey- Its constituents, methods of collection and uses.
b) Importance of other bee products to mankind
c) Pollen –Method of collection, constituents, uses.
d) Royal jelly- Method of collection, constituents, uses.
e) Propolis - Method of collection, constituents, uses.
f) Bee wax- Method of collection, constituents, uses.
g) Bee venom- Method of collection, constituents, uses.

Unit-IV Problems of beekeeping industries,

1. Natural Climate Condition,

2. Natural enemies, pest and diseases, human activities
3. Apiary and Hive Hygiene
4. Economics of beekeeping

References:

1) Introduction to disease of bee –Bailey, L
2) World of honeybee –Butter C. G.
3) Beekeeping in India –Sardar Sing (ICAR)
4) The Principle of Insect Physiology-Wigglesworth, V.S.
5) Applied Zoology- B. B. Waykar, A. Y. Mahajan, B. C. More . (Prashant Publication Jalgaon)
6) D. K. Belsare, Beekeeping for livelihood

Dr. Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar

Semester Pattern Curriculum under, Choice based Credit System (CBCS)

Under Graduate Bachelor Degree Programme (B.Sc.)

Faculty of Science and Technology

Subject- Zoology

Course Structure and Curriculum with Examination Scheme

(Effective from academic year 2024-25)

B. Sc. Third Year (Semester –VI)

Semester VI								
	Coursecode	Course Title	Total Perios (Teaching period/weeks)	Credits	Scheme of theExamination			
					Max Marks	CIA	UA	Min. Marks
Optional I DSE-1B – Discipline specific Elective	ZOL 611	DSE-1B -1 (Theory paper XI) Select any one from(A1 /B1 /C1 / D1) A1 - Animal Physiology II B1 -- Animal Behavior II C1 - Forensic Biology II D1 - Molecular Biology II	45(3/week)	2	50	10	40	20
	ZOL 612	DSE-1B-2 (Theory paper XII) Select any one fromA2/B2/C2/D2) A2 -- Parasitology II B2 -- Entomology II C2 - Fishery Science II D2- Biotechnology II	45(3/week)	2	50	10	40	20
	ZOL 621 Lab course	Lab course 8 based on ZOL 611 (A1/B1/C1/ D1) A1 - Animal Physiology II B1 -- Animal Behavior II C1 -- Forensic Biology II D1 - Molecular Biology II	45(3/week)	1.5	50	10	40	20
	ZOL 622 Lab course	Lab course 9 based on ZOL 612 (A2/B2/C2/D2) A2 - Parasitology II B2 -- Entomology II C2 - Fishery Science II D2- Biotechnology II	45(3/week)	1.5	50	10	40	20
Skill Enhancement Course (SEC-4)	ZOL 613	SEC-4.Any one skill to be chosen outof two- SEC-4 (G)Aquarium Fish keeping.SEC4 -(H) Sericulture	45(3/week)	2	50	10	40	20
			225	9	250	50	200	100
Total credits for semester VI ;: (Theory :6 ;Laboratory : 3)								

B.Sc. Sixth Semester
Course Code-ZOL- 611 DSE-1B -1
Zoology (Theory paper XI)
A1 - Animal Physiology II

Course Credits: 2

Total No.of period-45 (3 per week)

Learning Objectives of the Course:

i. To understand the structure of the different organ and receptor systems in man/mammals.
ii. To understand the mechanisms involved in the functioning of excretion, nerve and muscles, receptors and reproductive system.
iii. To learn the structure and physiological mechanism of excretion, nerve, muscles, receptos and reproductive cycles emphasis to mammals.

Course Outcomes (COs): After completion of the course, students will be able to –

i. understand the structure and functional anatomy of kidney, osmoregulation and homeostasis.
ii. describe the structure of nerve cells, and synaps muscles, and eye and ear and its physiology.
iii. learn the process of gametogenesis, r hormones, reproductive cycle and methods of contraception.

Unit I: Excretion

1. Classification of animals on the basis of excretory products: Ammonotelic, Uricotelic and Ureotelic
2. Structure of kidney. Structure and functions of uriniferous tubules.
3. Urine formation: - Ultra filtration selective, re-absorption and tubular secretion.
4. Counter current multiplier system.
5. Osmoreulation: Water and ionic regulation by fresh water and marine water animals.
6. Homeostasis: Concept and mechanism of homeostasis.

Unit II: Nerve and Muscles Physiology and Receptors:

1. **Nerve Physiology:** Brief introduction of the type of neurons based on the Structure and functions.
2. Restingn membrane potential, threshold potential, action potential, conduction of nerve impulse
3. Neurotransmitters.
4. Synapses: - Ultra structure and function.
5. **Muscles Physiology:** Types of muscles and their ultra-structure,
6. Sliding filament theory of muscle contraction, mechanism and energetics.
7. Twitch tetanus summation, Treppe fatigue
8. **Receptors:** Structure of a mammalian eye, Retina – visual pigments, Physiology of vision.
9. Structure of mammalian ear, Mechanism of hearing, Physiology of equilibrium, Chemoreceptors

Unit III: Reproduction

1. Structure of gonads, Gametogenesis(Spermatogenesis and Oogenesis)
2. Male and female hormones, Role of sex hormones in Reproduction.
3. Reproductive cycles – Oestrous and Menstrual Cycle and its hormonal control.
4. Methods of contraception, Sexually transmitted diseases.

Learning Resources:

1 A.K. Berry. –animal physiology

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

3 Dantzler, W.H. Comparative Physiology (Handbook of Physiology): Vol. 1, 2, (ed.)

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

4 Guyton– a book on medical physiology

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

6 Mohan Arora – animal physiology , Himalaya publication

7 Nagbhushnum R.,Sarojini R., Kodarkar M.S. –Animal Physiology Oxford University Press, New York, USA

8 Parameswaran, Anantakrishnan and Ananta Subramanyam, 1975. Outlines of Animal Physiology,

9 Prosser,C.L. Brown, 1985, Comparative Animal Physiology, Satish Book Enterprise, Agra

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

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

12 S. Viswanathan [printers & Publishers] Pvt. Ltd.

13 Sambasivaiah, Kamalakara rao and Augustine chellappa 1990. A Text book of Animal physiology and ecology, S. Chand & co., Ltd., New Delhi – 110 055.

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

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

16 Veer Bal Rastogi, Text Book of Animal Physiology

17 Verma ,Agarwal & Tyagi-animal physiology

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

19 William S. Hoar, 1976. General and comparative physiology, prentice Hall of India Pvt. Ltd., New Delhi. 110 001.

20 Wood E.W. Principle of Animal physiology

21 Xnut Scmidt-Nieison, Animal Physiology, Sth ed, Cambridge Low Price Edition.

Course Code-ZOL- 611 DSE-1B -1
Zoology (Theory paper XI)
B1 -- Animal Behavior II
Course Credits: 2
Total No.of period-45 (3 per week)

Learning Objective

To study the complex and diverse approaches of animal behavior.

To study different types of animal behavior and Communications in animals.

Learning Outcome

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

1 Have ideas that how observe and collect data on animal behavior.

2. Understand the main historical ideas that underpin animal behavior theory

3. Understand different methods for collecting data on animal behavior.

Unit I

1. Behavior- Innate behavior. Learning, resoning , motivation, conflict and sexual behavior
2. Migration and homing with special reference of birds
3. Communication in animal : Visual olfactory, auditory and tactile
4. Camouflage and mimicry -Types of mimicry

Unit II

1. Ecological aspect of behavior, Habitat selection, food selection and optional foraging theory,
2. Anti predator defense mechanism, aggression territoriality and dispersal.
3. Biological rhytms : Circardian, Circannual, tidal/lunar ultradian, infradian rhythm, synchronization of biological rhythm phase shift
4. Photoperiodism with reference to birds and mammals-human circardian rhythm

Unit III

1. Reproductive behavior- Evolution of sex, reproductive strategies, mating system, courtship, sexual selection and parental care.
2. Harmones and behavior, Pheromone and behavior.

Suggested readings

1. Biological Rhythms: Vinod Kumar (2002) Narosa Publishing House, Delhi/ Springer-Verlag, German

2. Animal behavior and Evolutionary Approach by Alcock

3 Perspectives in animal behavior Goodenough , Wiley 1993

4 An introduction to animal behavior 5 th ed. Cambridge Univ Press. By Manning Dawkins

Course Code-ZOL- 611 DSE-1B -1
Zoology (Theory paper XI)
C1 - Forensic Biology II
Course Credits: 2
Total No. of period-45 (3 per week)

Learning objectives:

To demonstrate the Forensic Biology and their role in crime scene investigation.

Course Outcomes:

i. To develop the deep understanding and knowledge about basics concepts of forensic entomology and evidence during death investigations.
ii. Understand the forensic dentistry, bite marks and the importance of forensic ornithology.
iii. To learn the fundamentals and significance of wildlife forensic and wild life protection act.

Unit 1: Forensic Entomology:

1. Introduction, General entomology and arthropod biology, Insects of forensic importance. Role of aquatic insects in Forensic investigations,
2. Collection of entomological evidence during death investigations.
3. Determining the age of blow fly life cycle stages, forensic entomological application and factors influencing of insect succession on carrion and its relationship to determine time since death.

Unit 2: Forensic Odontology

1. Introduction and definition of forensic dentistry (Odontology), Dentition, pattern and types of teeth. Body Identification by Dental Records, Post Mortem Examination & Records, Collection of Bite mark evidence & comparison.
2. **Microbial Forensic and Forensic Ornithology:** Introduction, identification, types and forensic significance of microbial organisms. Bioterrorism.
3. Forensic Ornithology: Introduction, flight and means of locomotion, forensic significance. Feather structure and topography.

Unit 3: Wild life Forensic:

1. Introduction and Significance of wildife forensics.
2. Types of wildlife evidences, such as skin, fur, bone, horn, teeth, pollen grains, flowers, plants etc.
3. Wildlife crime, commodities in the trade, Trade level, value of trade, prevention of wildlife crime. Importance of Wildlife (Protection) Act – 1972(flora and fauna species).
4. Identification of pug marks of various animals

Suggested readings

1. Forensic Biology by Richard Li CRC Press; 2 edition (27 April 2015).
2. A textbook of medical jurisprudence and toxicology- Modi Lexis Nexis; First edition (22 April 2016).
3. Wildlife forensic investigation-Principles and practice: Cooper and Cooper, CRC press ,2013.
4. Forensic Palynology in the United States of America (1990)- Bryant, V.M. Jr, Milden Hall, D.C. and Jones, J.G.14. PP.193-208.
5. Microbial forensics -Roger Breeze, Bruce Bud Owle, Steven E. Schutzer, Elsevier.
6. B. R. Sharma, Forensic Science in Criminal Investigation and Trials (6th Edition).

7. Saferstein, Richard, Criminalistics - An Introduction to Forensic Science, 6th Ed. Prentice-Hall, New Jersey.
8. R. Krushnamurthy, T. Khedkar and S. Lade Forensic Biology, S. S. B. Publication.
9. Houck, M.M & Siegel, J.A; Fundamentals of Forensic Science, Academic Press, London, 2nd Edition 2010.
10. Sharma, B.R; Forensic Science in Criminal Investigation & Trials, Universal Publishing Co., New Delhi, Fifth edition 2016.
11. Nanda B.B and Tewari, R.K; Forensic Science in India- A vision for the Twenty First Century, Select Publisher, New Delhi, Select publishers (2014).
12. Robertson and Vignaux; Interpreting Evidence, John Wiley, New York, 1995.

Course Code-ZOL- 611 DSE-1B -1
Zoology (Theory paper XI)
D1 - Molecular Biology II
Course Credits: 2
Total No. of period-45 (3 per week)

Learning objectives:

Introduce the learners to chemical and molecular process regarding protein synthesis which is most important process for life. It alsointends to make them understand the concept of gene regulation

Learning outcome:

The course will prepare learners to recognize the significance of molecular biology as a basis for the study central dogma of life.

Students will be able to understand importance of transcription, translation and gene regulation which building block processes in our body.

Unit – I

Transcription:

1. Prokaryotic Transcription: Transcription in prokaryotes
2. Initiation, Elongation and Termination

Eukaryotic Transcription:

1. RNA Polymerases, Initiation, Elongation, Termination,
2. Synthesis of hnRNA,
3. Processing of RNA (Capping,Poly A tail addition, Splicing,)

Unit – II

1. **Translation:**
2. Genetic code, Properties of Genetic code, Wobble hypothesis
3. Transfer RNA – Structure, Activation of amino acid,
4. Ribosome – Molecular structure, active sites, function
5. Mechanism of protein biosynthesis – Initiation, elongation, termination,
6. Difference between prokaryotic and eukaryotic protein synthesis.

Unit – III

1. **Regulation**
   a. Regulation of protein synthesis,
   b. Inhibitors of protein synthesis
2. **Concept of Gene**
3. **Gene regulation in prokaryotes :**
   a. Operon concept
   b. Lac operon- organization, regulation

REFERENCES

Molecular Biology

1 Genetics – The continuity of life; Daniel Fairbanks and Ralph Andersen; Brooks/ Cole Publishing Company; 1999
2 Introduction to Molecular Biology; Peter Paolella; Tata McGraw Hill; 2010
3 Molecular Biology; David Freifelder; Narosa Publishing House; 2008
4 Genetics; Robert Weaver and Philip Hedrick; McGraw Hill; 2001
5 iGenetics – A Molecular Approach; Third Edition; Peter J. Russell; Pearson Education, Inc. (Benjamin Cummings), San Francisco; 2010

6 Molecular Biology – Academic Cell Update; Update Edition; David Clark; Elsevier, Inc.; 2010
7 Genetics; M.W. Farnsworth; Harper and Row Publishers, Inc., USA; 1978
8 Principles of Genetics; Eighth Edition; Gardner, Simmons and Snustad; John Wiley and Sons (Asia) Pte. Ltd., Singapore; 2002
9 The Science of Genetics – An Introduction to Heredity; Fourth Edition; George W. Burns; Macmillan Publishing Co., Inc., New York; 1980 15
10 Molecular Biology – Bios Instant Notes; Fourth Edition; Alexander McLennan, Andy Bates, Phil Turner & Mike White; Garland Science; 2013
12 The Gene: An Intimate History; Siddhartha Mukherjee; Scribner, New York; 2016
13 The Handling of Chromosomes; Sixth Edition; C.D. Darlington & L.F. La Cour; George Allen & Unwin Ltd., London; 1976
14 Molecular Cell Biology; Fifth edition; Harvey Lodish, Arnold Berk, Paul Matsudaira, Chris A. Kaiser, Monty Krieger, Matthew P. Scott, S. Lawrence Zipursky & James Darnell; W.H. Freeman & Company, New York; 2004 Genetic Engineering
15 Current Protocols in Molecular Biology; Frederick M. Ausubel, Roger Brent, Robert E. Kingston, David D. Moore, Seidman J. G., John A. Smith and Kevin Struhl; John Wiley& Son, Inc.; 2003
16 Introduction to Proteomics; Daniel C. Liebler; Humana Press; 2002
17 Molecular cloning; Joseph Sambrook, David William Russell; Third Edition; CSHL Press; 2001
18 Gene Cloning – An Introduction; Brown .T.A; Fourth Edition; Wiley-Blackwell; 2011
19 Recombinant DNA - Genes and Genomes- A short course; 3rd Edition; Watson, J.D., Myers, R.M., Caudy A., Witkowski, J.K.; Freeman and Co. NY; 2007
20 Principles Of Gene Manipulation & Genomics; Primrose SB and R. Twyman; Blackwell Science Publications; 2006
21 Methods In Enzymology, Vol 152; Berger SI, Kimmer AR; Academic Press; 1987
22 Genomes 3; Third Edition; T.A.Brown; Garland Science Publishing; 2007
23 Molecular Biology – Bios Instant Notes; Fourth Edition; Alexander McLennan, Andy Bates, Phil Turner & Mike White; Garland Science;
24 Introduction to Protein Structure; Second Edition; Branden C. and Tooze J.; Garlan Publishing; 1999
25 Proteins; Second Edition; Creighton T.E.; W.H. Freeman; 1993
26 Proteomics - Protein Sequence to Function; Pennington, S.R and M.J. Dunn; Viva Books; 2002
27 Sinnot, Dunn and Dobzhansky- Principles of Genetics
28. Alberts B., Bray D., Lewis J., Rabt M., Robert K. and J. D.Watson. Molecular Biology of the Cell, Garland Publishing Inc. London.
29. Lewin Benjamin Genes VII Oxford University Press.
30 Winchester A.M. Genetics Oxford and IBH Publishing co New Delhi.

Lab course ZOL 621

Lab course 8 based on ZOL611 **A1 - Animal Physiology II**

1. Detection of nitrogenous waste products (Ammonia, urea and uric acid) in fish tank water, frog tank water, bird excreta and mammalian urine.
2. Qualitative estimation of glucose, albumin and ketone: bodies from the urine sample.
3. Estimation of muscle glycogen (Sample-Meat/chicken muscles) by Anthron method.
4. Determination of urea-urease reaction.
5. Study the structure of Pecten of eye (fowl/birds/any animal) (Demonstration)
6. To perform surgical procedures in rats/mice: Ovariectomy, Tubectomy and Vasectomy. (Demonstration/video).
7. To study the structure of human sperm and ovum.
8. Study of contraceptive devices Condom, Diaphragm, Cervical Caps, Copper-T (Photographs/Models).
9. To Study the histological sections of Rat (Slide/Chart/Model/ Photograph)
   - T. S. and L. S. of Kidney
   - T.S. of mammalian testis,
   - T.S. of mammalian ovary
10. To study the structure of the following, (Slide/Chart/Models/Photograph)
    - Neurons
    - Striated muscle
    - Non striated muscle
    - Eye (Cross section)
    - Ear (Internal, median, and external structure)

Lab course 8 based on ZOL 611 **B1 -- Animal Behavior II**

1. To study the communication in different animal.
2. To study mimicry of animals.
3. To study the Phototaxis behavior in insect larvae.
4. To study the kinship and altruism with examples.
5. To study the colonial behavior in honeybee.
6. To study the parental care of fishes and amphibians.
7. To study the migration of bird in your locality.

Lab course 8 based on ZOL 611 **C1 -- Forensic Biology II**

1. To study the general characters and classification of insect up to the order.
2. To study the life cycle of forensic insects.
3. To prepare a case report on problems of wildlife forensics.
4. To study the different types of teeth and teeth patterns of human and animal.
5. To study the bite marks and identification of teeth.
6. To study the human skeleton and bones.
7. Perform the Pug marks identification and examination.
8. To study the characteristics of different birds feather.
9. To carry out the microscopic examination of pollen grains.

10. To carry out the microscopic examination of bacterial culture. (E. coli.)
11. To prepare a case report.

Lab course 8 based on ZOL 611 **D1 - Molecular Biology II**

1 Cleaning , washing and drying of glassware.
2. Glassware Sterilization techniques.
3. Extraction of DNA from Animal /plant/bacteria.
4. Estimation of DNA by Diphenyl amine method.
5. Estimation of RNA by Orcinol method.
6. Study of *E.coli* growth curve.
7 To separate immunological proteins (Alpha, beta and gamma) from serum by sodium dodecyl sulphate polyacrylamide gel electrophoresis.(SDS-PAGE
8 .Demonstration of plastids in the gel by gel electrophoresis.
9.To isolate and clearing of the DNA fragment of interest from the agarose gel.

Course Code-ZOL- 612 DSE- 1B -2
Zoology (Theory paper XII)
A2 -- Parasitology II
Course Credits: 2
Total No. of period-45 (3 per week)

Medical and Applied Parasitology

Course Objectives:

1. To acquaint the students about parasites of human health and veterinary importance to prevent huge economic and health losses due to parasitic infection to major parts of world population.
2. To educate the students on basics of Parasitology and its applied issues of ecological and human health importance.

Course outcome:

The students may join the parasitological research institute, may be a scientist in the WHO, UN Parasitological researcher, scientist.

The students May join as Parasitologist in the state and central government public health programs as officer. May get appointment in the pathological labs as Parasitologist.

Unit I. General Characters of Helminthes.

Trematodes

1. General organization of Trematodes and its classification up to family level.
2. Larval forms in Trematodes
3. Immunology, Basic concept, Antigen Antibody reaction, Innate and Acquired resistance.
4. Study of Morphology, Life cycle, Pathogenicity, Prophylaxis of following parasites:

a. Fasciolopsis buski b. Schistosoma mansoni.
c. Clonorchis sinensis d. Paragonimus wetermani.

Unit II. Cestodes

1. General organization of cestodes and its classification up to order level.
2. Structural organization of cestodarians.
3. General important features of the following orders: a) Proteocephalidea. b) Tetraphyllidea c) Davaineidea. d) Hymenolepidea
4. Study of following important parasites with respect to their geographical distribution, habitat, morphology, Life cycle, Pathogenicity, Diagnosis, Treatment and Prophylaxis.

a) Taenia Solium b) Echinococcus granulosus
c) Diphyllobothrium latum d) Hymenolepis nana e) Dipylidium caninum .

Unit III. Nematodes

1. General organization and Classification of Nematodes.
2. Study of following important parasites with respect to their Geographical Distribution, Habitat, Morphology, Life-cycle, Pathogenicity, Diagnosis, Treatment and Prevention.

a) Ancylostoma duodenale b) Wuchereria bancrofti
c) Dracunculus medinensis d) Trichinella spiralis,
e) Strongyloides stercoralis.

3. Plant parasitic Nematodes – symptoms of nematode injuries to plants. a) Above ground symptoms. b) Below ground symptoms.

3.Controlling on Nemic Diseases of Plants – Heat, fallow crop rotation, Biological control, organic matter and mulching, Root Diffusates, natural enemies. Chemical Control:

a) Nematicidal chemicals. b) Application of Nematicides. c) Procedure in soil fumigation.

4. Structure, Life cycle and Control of the following Nematodes.
a) Anguina (Seed Gall- nematode) b) Meloidogyne (Root knot nematode)
c) Heterodera (cyst nematode) d) Tylenchulus (citrus nematode)

References:

1. 'Infectious Disease Epidemiology: theory and practice' 2nd edition. Nelson & Williams (Eds.).2007.
2 . Medical Parasitology by Markell, Voge and John, 8th ed. W.B. Saunders Co.
3. Reingold, A.L. Outbreak Investigations – A Perspective. Emerging Infectious Diseases 1998; 4(1): 21-27.
4. The Trematode - Dausese B
5. Taxonomy of Cestode Parasites of vertebrates: Khalil and Bray (CABI Publication, London)
6. An introduction to Nematodology -Chitwood
7. Helminth, Arthropod and Protozoa of domesticated animal -Solbsy E.J.W
8. Laboratory methods of work with plant and soil nematodes -Southey
9. Human helmintology Manual for Clinicals, Sanitarians Medical Zoologists –Faust, Emerest Caroll
10. Practical exercise in Parasitology -Halton, Behave, Marshall.
11. Chatterjee K. D. (1969) -Parasitology (Protozoology and Helminthology)
12. Cheng T.C. (1964)-The Biology of animal parasites, Saunders International Student Edition.
13. The Invertebrates Vol II, McGraw Hill, New York.- Dawes B. (1946).
14. Text book Medical Parasitology of Jaypee Brothers, - Panikar C.K.J (1988)
15. Medical Publishers, New York. - Panikar C.K.J (1988)
16. The Parasitology of Trematodes Oliver and Boyd Ltd. Edinburgh - Smyth J.D (1977)
17.The Zoology of Tapeworm. - Wardle and Mcleod (1952)
18. The advances in the Zoology of tapeworm from - 1970- Wardle and Mcleod
19. Systema Helminthum Vol. II Cestoda. - Satyu Yamaguti (1959)

Course Code-ZOL- 612 DSE-1B -2
Zoology (Theory paper XII)
B2 -- Entomology II
Course Credits: 2
Total No. of period-45 (3 per week)

Learning objective

To develop scientific outlook and awareness the pest and pest management system.

To give deep knowledge about different types of pest and their role .

Learning outcome

By the end of course students will be able to

To identify different insect pest.

To prepare and aware for pest diseases.

To develop approach towards pest management system.

Unit I.

1. Pest –Definition, types of agricultural pests, Insects of veterinary and medical importance.
2. study of major crop pest: - Occurrence, host, damage, symptoms and control of.
   Jawar- Stem borer, Midge flies
   Cotton- Red cotton bug, pink bollworm
   Groundnut-White grub, pod sucking bug
   Sugarcane- Pyrilla, Stem borer.

Unit II

1. Study of Stored grain pests: Rice weevil, pulse beetle
2. . Insects as vectors of human pathogens and domestic animals,
3. . Study of insect vectors like mosquito, bed bug, flea, body louse, rat flea etc.

Unit III

1. Methods of Insect pest management-Chemical and Biological control,
2. Migration of insect. Insecticides and plant protection appliances like Hand compression spray, Hand rotating duster, bucket pump.
3. Modern trends in pest control.
4. Integrated pest management (IPM) Principles and application.

Suggested readings

1. The insect structure and function, 4th Edition 92008).Chapman, R.F. Publisher- Cambridge University Press, London.

2. General Textbook Entomology,10th Edn., (1977) Imms, A.D. Richard, O.W. & Davies, R.G. (Eds.) 1 : Champman & Hall, London

3. General Entomology, 2nd edition (1973) Mani M.S. Oxford & IBH Publishing Compony, Delhi.

4. Modern Entomology First edition: (1997) D.B. Tembhare, Himalay Publishing House Delhi

5. Principles of Insect Morphology, (1973). Snodgrass, R.E. Publisher – Tata McGraw Hill, Bombay.

Additional Reference Books:-

1.The Principles of Insect Physiology, 2nd edition (2007) Wigglesworth, V.B. Publisher

– English Language Book Society and Methuen and Co. Ltd.
2. The Insects: Structure, Function and Biodiversity, (2004). Ambrose D.P. Publisher- Kalyani Publishers, New Delhi.
3. Introduction to Insect Biology & Diversity" Daly, H.V.,J.T. Doyen & P.R. Ehrlich (1981): International Student Edn. McGraw- Hill, Kogakusha, Japan.

Course Code-ZOL- 612 DSE-1B -2
Zoology (Theory paper XII)
C2 - Fishery Science II
Course Credits: 2
Total No. of period-45 (3 per week)

CULTURE FISHERY

Learning objectives:

1)To develop the scientific outlook and awareness on freshwater fish farming.
2) To familiarize the students with fish hatcheries, their operations & fish diseases.
3) To aware students about impact of exotic fishes on Indian fish fauna.

Learning outcomes:

By the end of course students will be able to
1)Identify the freshwater fishes.
2)Develop knowledge on freshwater fish farming and fish seed production techniques.
3) Familiar with fish diseases and their control

Unit- I

1.Types of ponds and their management

1. Types of ponds (Nursery, Rearing and stocking ponds)
2. Management of fish pond: Control of aquatic weeds, control of weed fishes, control of predatory fishes, control of aquatic insects, soil quality analysis, application of lime, application method and schedule of manure and fertilizers, culture of fish food organisms in pond.

Unit –II a) Fish seed

1. Selection criteria of quality seed
2. Transportation techniques of fish seed
3. Acclimatization of seed
4. Techniques of seed identification

b)Culturable fishes and types of fish culture

1. Biology of Indian major carps
2. Monoculture and polyculture
3. Cage culture and pen culture
4. Exotic fishes introduced in India and their impact

Unit – III a.Fish Breeding

1. Natural breeding of fishes
2. Induced breeding by hypophysation
3. Bundh breeding: Types of bundhs i.e., Dry and Wet bundh breeding
4. Synthetic hormones used in induced breeding

b)Hatcheries and their management (Principle, structure and management)

1. Hatching hapa
2. Glass jar hatchery
3. CIFE D 80 Model (Dwivedi-80) CIFE D-81 model (Dwivedi-81) Chinese hatchery.

c. Fish Diseases

1. Symptoms of fish diseases
2. Fungal, bacterial and viral diseases
3. Protozoan and worm diseases

Suggested Readings:

1.A Hatchery Manual for Common, Chinese and Indian Major Carps/V.G.Jhingran & R.S.V. Pullin, Asian Development Bank, Manila, Philippines.
2.Fish and Fisheries/Pandey & Shukla, Rastogi Publications, Meerut.
3.An Introduction to Fishes/S.S.Khanna, Surjeet Publications, Delhi.
4.Inland Fisheries/V.B.Sakhare, Daya Publishing House, New Delhi.
5.Biology of Inland Fishes/V.B.Sakhare, Discovery Publishing House, New Delhi.
6.Handbook of Fish Diseases and Diagnosis/F.A.Saha & M.H.Balkhi, Narendra Publishing House, Delhi.
7.A Handbook of Fish Farming/S.C. Agarwal, Narendra Publishing House, Delhi.

Course Code-ZOL- 612 DSE-1B -2
Zoology (Theory paper XII)
D2- Biotechnology II
Course Credits: 2
Total No. of period- 45 (3 per week)

Learning Objective

1. To explore various method for application of genetic material for humen welfare.
2. To develop scientific approach cell culture ,transgenic animal and gene therpy

Learning Outcome

By the end of these course student will able to

1. Learn different method to manipulate genetic material for human welfare
2. Aware about advance techniques use in biotechnology.
3. After learning this course student able to apply various research lab and government institutes.

Unit I

1. Animal cell culture
2. Basic requirements, Culture media & sterilization Contamination and sterilization of laboratory.
3. Application and limitations of cell culture.

Unit II

1. Manipulation of reproduction and transgenic animals Invitro fertilization, nuclear transplantation (Dolly sheep) Transgenic animals-methods (Retroviral vector method, microinjection and ES cell methods).
2. Protein engineering, Site-directed mutagenesis (Cassette mutagenesis oligonucleotide directed)
3. Applications of mutagenesis, Hybridoma technology Commercial production of enzymes

Unit III

1. Gene therapy and DNA fingerprinting.
2. Introduction, *e- vivo*, *in-vivo* gene therapy, Antigen & antisense gene therapy, DNA fingerprinting.
3. Human disease-diagnosis using biotechnology.
4. Applications of biotechnology, Agriculture Medicine Industry.

Reference books

1. Instrumentation and Techniques by Chatwal and Chatwal
2. Biophysical chemistry by Upadhyaya and Upadhyaya.
3. Principles of Biochemistry by Lehninger
4. Harper's Biochemistry.
5. Molecular biology of Gene. By Watson.
6. Molecular cell biology by Lodish.
7. Biochemistry by Voets and Voets
8. Hand book of molecular and cellular methods in biology by Leland J Cseke et al

9 Genetic engineering – Principles and Practice; Sandhya Mitra; Macmillan India Ltd., New Delhi

10 Biotechnology – Fundamentals and Applications; Third Enlarged Edition; S.S. Purohit;

Student Edition, Jodhpur; 2005
11 Biotechnology – Expanding Horizons; B.D.Singh; Kalyani Publishers, Ludhiana
12 A textbook of Biotechnology; R.C.Dubey; S.Chand and Company Ltd., New Delhi
13 Molecular Biotechnology - Principles and applications of recombinant DNA; Glick, B.R. and Pasternak, J. J.; ASM press, Washington; 2010

Lab Course ZOL 622

Lab course 9 based on ZOL 612 **A2 - Parasitology II Credits: 2**

1. Preparation of stains: Haematoxylin, Acetocarmine, Borax caramine and Bouins fluid.
2. Parasitological examination of fecal waste of poultry and wild birds for protozoan parasites, Helminth eggs, larvae and adult worms.
3. General principles of Collection, Preservation, Staining and Mounting of Trematodes and Cestodes.
4. Collection of Trematodes and Cestode parasites from locally available different hosts.
5. Preparation and identification of collected helminth parasites (Trematodes and cestodes At least Ten.)
6.Fixation of Helminth parasites for SEM and TEM studies and its importance in modern Taxonomy.
7. Study of permanent mounts of Trematodes and cestodes viz. 1.. Gyrodactylus 2.Paramphistomum 3. Fasciola hepatica 4. Fasciolopsis buski 5. Schistosoma Japonicum 6. Schistosoma mansoni.7. Paragonimus wetermani.
8. Taenia solium& Taenia saginata 9. Moniezia expansa 10. Railletina 11 . Cotugnia 12 Echinococcus granulosus 13. Diphyllobothrium latum 14. Dipylidium caninum 15. Hymenolepis nana 16. Gyrocotyle
8. General principles of collection, preservation, staining and mounting of Animal parasitic Nematodes.
9 .Collection of Animal and plant parasitic Nematodes from locally available different hosts/sources.
10 . Preparation and identification of collected Animal parasitic Nematodes and plant parasitic Nematodes (At least Ten).
11. Study of permanent slides of Animal parasitic and plant parasitic Nematodes viz.
1. Ascaris lumbricoides 2. Oxyuris 3. Ancylostoma duodenale 4. Wuchereria bancrofti
5. Dracunculus medinensis 6. Trichinella spiralis, 7. Enterobius vermicularis.
8. Anguina (Seed Gall- nematode) 9. Meloidogyne (Root knot nematode) 10. Heterodera (cyst nematode) 11. Tylenchulus (citrus nematode)
12.Collection Techniques- Baerman's funnel technique., Oostenbrinks elutriator, Sieving, Fixation, Dehydration.
stages, cysts and larval stages.
[Note-1) Demonstration of Animal Dissections through Models, Charts and Computer Aided Techniques as per U.G.C. Guidelines]
2) Essential animal material should collected from slaughter house.

Lab course 9 based on ZOL 612 B2 -- Entomology II

1)Collection, preservation and identification of Major crop pests (any five)
Jawar- Stem borer, Midge flies.
Cotton- Red cotton bug, pink bollworm
Groundnut-White grub, pod sucking bug
Sugarcane- Pyrilla,
2. Identification of common stored grain pests.
A- Rice Weevil,B- Rice bettle, C- Grain moths
3. Study of common plant protection appliances like Sprayers and dusters.
4. Collection of major crop pests in locality and submission at the time of examination.
5 Study of insect vectors like mosquito, bed bug, flea, body louse, rat flea.
6. Visit of an agricultural Field and field study report.

Lab course 9 based on ZOL 612 **C2 - Fishery Science II**

1.Primary productivity of ponds (plankton studies).
2 identification, classification and culturaable significance of following.
Catla, rohu, mrigal, catfishes, exotic canoj
3 Collection and identification of fish parasites and worms.
4 Removal of fish pituitary gland and preparation of pituitary extract
5 Identification of crafts and gears.
Gill net, Rampanni, Satpalti, Machwa, Catamaran.
6. A visit to fish farm and fish processing centre is compulsory.

Lab course 9 based on ZOL 612 **D2- Biotechnology II**

A- Sterilization of glassware and chemicals in tissue culture
B- Preparation of culture media and sterilization
C- Assay of cell viability using dye.
D- Effect of pH on acid phosphatase activity
E- Study of chromosomal aberration
F- Pure Culture of airborne/water bacteria
G- Study of antibiotic resistant /susceptibility of bacterial culture
H- Demonstration of Animinated methods of following Nuclear transplantation Hybridoma technique DNA fingerprinting, Bt-cotton

ZOL 613 (SEC-4)

Any one skill to be chosen outof two-

ZOL 613 SEC-4 (G)

Aquarium Fish keeping.

Credits - 2

Course objective: To learn details about skills in aquarium construction, fish keeping and maintenance.

Course outcome: The studies learn details of aquarium , fish keeping and maintenance

Unit 1

1. Introduction to Aquarium keeping
2. Commercially important freshwater aquarium fishes
3. Water quality management in Aquarium
4. Accessories used in Aquarium
5. Aquarium plants

Unit 2

6. Aquarium construction and setting up of Aquarium
7. Maintenance of an Aquarium
8. Fish feed for Aquarium Fishes
9. Diseases in Aquarium Fishes

Suggested Readings:

1. Mathur,S., Sharma,L.L. and Mathure,A.K.2006.Hand Book of Freshwater Ornamental Fishes,Yash Publishing House, Bikaner.

2. Hem Raj.2022.A Text Book of Aquarium Fish Keeping, S.Vinesh & Co.

3. Sanjib Saha.2022.Concept of Aquarium fish keeping, Techno World Publishers.

4. Jayashree, K.V., Thara Devi, C.S. and Arumugam, N.2020.Home Aquarium and Ornamental Fish Culture, Aras Publication, Nagercoil,Tamil Nadu.

5. Sakhare, V.B.2018.Inland Fisheries, Daya Publishing House, Delhi.

ZOL 613
SEC 4 (H) Sericulture
Credits - 2

Basics of Sericulture and Management

Learning Objectives:

To develop the knowledgeful human resource for the management of growing silk industry as agro-based business in India.

Course Outcome:

1.The students will get the knowledge about what is sericulture, types of sericulture and its importance as agrobased, employment generating industry.

2. The students will get knowledge about Life cycle of silk worm, Cocoon formation and Silk thread.

3. The students will acquire skill of how to manage a sericulture farm: Rearing shade, Mulbery garden, Silk and cocoon market and other value added and byproducts from sericulture.

Unit-I INTRODUCTION TO SERICULTURE AND LIFE CYCLE OF SILK WORM

1. History of sericulture, sericulture in India and importance of sericulture. Sericulture products and byproducts.
2. Silk producing species of insects and their food.
3. Mulbery silk worm: characters and life cycle.
4. Food and feeding to different stages of silk worm.
5. Methods of silk worm rearing.
6. Equipments and their uses in sericulture and its practical demonstration.

Unit-II MANAGEMENT OF SERICULTURE UNIT

1. Mulberry garden: Plantation, harvesting, irrigation, disease management
2. Sericulture House: Various models, Ideal regional model and its construction.
3. Management of Sericulture House/Shade: disinfection, control on insect pests, rodent pests and bird pests.
4. Management of bacterial, viral and protozoan diseases of silk worm.
5. Management and maintenance of cocoons, Cocoon markets and sale.
6. Economics of investment, expenditure, Sale and profit from sericulture.
7. Visit to sericulture farm and report writing.

References:

Reference Books:

1. Sericulture Manual. R. K. Patnaik
2. Silk Culture. Ananthnarayan
3. Silk Reeling. S. K. Ananthanarayan
4. Silk Worm Rearing. S. K. Ananthnarayan.
5. Silk Production and Export. Td. Koshey.
6. Sericulture and Pest Management. T.V. Sathe and A. D. Jadhav
7. Silk Reeling and Testing. Yong Woo Lee.
8. Textbook of Sericulture. S. K. Sehegal.
9. Tropical Wild Sericulture. P. K. Mohanty.
10. Silk and Sericulture. Chowdhary S. N.
11. Silk Culture: A Manual with complete Instructions in Sericulture. M. C. Buckner.

Principles of Sericulture. Hisao Aruga. CRC Press.