MANONMANIAM SUNDARANAR UNIVERSITY,
TIRUNELVELI-12

SYLLABUS

UG - COURSES – AFFILIATED COLLEGES

Course Structure for B. Sc. Zoology
(Choice Based Credit System)
(with effect from the academic year 2023-2024 onwards)

Semester-V				
Part	**Subject Status**	**Subject Title**	**Subject Code**	**Credit**
III	CORE	ANIMAL PHYSIOLOGY AND BIOCHEMISTRY		4
III	CORE	ENVIRONMENTAL BIOLOGY		4
III	CORE	LAB ON ANIMAL PHYSIOLOGY AND BIOCHEMISTRY & ENVIRONMENTAL BIOLOGY		3
III	CORE	PROJECT		5
III	ELECTIVE	BIOSTATISTICS AND COMPUTER APPLICATION		3
III	ELECTIVE	AGRICULTURAL ENTOMOLOGY/ **SERICULTURE** / VERMITECHNOLOGY		3
III	ELECTIVE LAB	LAB ON BIOSTATISTICS AND COMPUTER APPLICATION, & ELECTIVE -VI		2
IV		INTERNSHIP / INDUSTRIAL VISIT / FIELD VISIT / KNOWLEDGE UPDATION ACTIVITY		2
IV	NAAN MUDHALVAN	(BASICS OF MARINE BIOLOGY*) * SUBSTITUTE PAPER EXCLUSIVELY FOR REAPPEARANCE ONLY.		2

Total Marks: 100 Internal Exam: 25 marks + External Exam: 75 marks

A. **Scheme for internal Assessment**:
Maximum marks for written test: **20 marks**
3 internal tests, each of **I hour** duration shall be conducted every semester.
To the average of the **best two** written examinations must be added the marks scored in. The **assignment** for 5 marks.

The break up for internal assessment shall be:
Written test- 20 marks; Assignment -5 marks Total - 25 marks

B. Scheme of External Examination
3 hrs. examination at the end of the semester
A – Part : 1 mark question two - from each unit
B – Part : 5 marks question one - from each unit
C – Part : 8 marks question one - from each unit

- **Conversion of Marks into Grade Points and Letter Grades**

S.No	Marks	Letter Grade	Grade point (GP)	Performance
1	90-100	O	10	Outstanding
2	80-89	A+	9	Excellent
3	70-79	A	8	Very Good
4	60-69	B+	7	Good
5	50-59	B	6	Above Average
6	40-49	C	5	Pass
7	0-39	RA	-	Reappear
8	0	AA	-	Absent

- **Cumulative Grade Point Average (CGPA)**

$$\mathbf{CGPA} = \frac{\mathbf{\Sigma\,(GP \times C)}}{\mathbf{\Sigma C}}$$

- **GP** = Grade point, **C** = Credit
- CGPA is calculated only for Part-III courses
- CGPA for a semester is awarded on cumulative basis

- **Classification**
  a) First Class with Distinction : CGPA $\geq$ 7.5*****
  b) First Class : CGPA $\geq$ 6.0
  c) Second Class : CGPA $\geq$ 5.0 and $<$ 6.0
  d) Third Class : CGPA$<$ 5.0

ANIMAL PHYSIOLOGY AND BIOCHEMISTRY

Course Objectives

- To familiarise students with the principles and basic facts of Animal Physiology.
- To give students an insight into the molecular and cellular basis of animal physiological functions.
- To give an idea about the regulation of organ system functions in a whole animal using a conceptual model of feedback to explain homeostasis.
- To make the students aware of how the structure-function relationships and its synchronisation with the molecular signals.
- To help students gain knowledge in the basic structure of carbohydrates, fats and proteins and to understand the role of biomolecules in metabolism and learn the metabolic pathway.

UNIT I

Nutrition & Respiration Nutrition: Gastrointestinal tract of man. Digestion - the role of enzymes and absorption of carbohydrates, proteins and lipids. Vitamins – their deficiency. Respiration: Structure of lungs in man. Respiratory pigments: structure of haemoglobin, Transportation and exchange of oxygen and carbon dioxide – Bohrs effect - bronchitis, asthma - Physiological effects of smoking.

UNIT II

Circulation & Excretion Blood- composition and functions, Mechanism of clotting. Types of Hearts – Heartbeat and its regulation - pacemaker – Cardiac cycle – ECG - Pulse and blood pressure. Structure of kidney Nephron structure & mechanism of urine formation, Excretory products.

UNIT III

Neuromuscular Co-ordination – Neuron – Structure, types of neurons - Nerve impulse – Synaptic transmission – Neurotransmitters. Reflex action, Nerve disorders – epilepsy, Alzheimer's disease, Parkinson's disease. Muscles –Structure and Types of Muscles –Physiological properties of muscle contraction- Biochemical events of muscle contraction.

UNIT IV

Endocrine glands- structure, secretions and functions of endocrine glands of vertebrates, Feed-back mechanism – Pituitary, Thyroid, Parathyroid, Adrenal, Thymus, Islets of Langerhans, Ovary and testis. Receptors – Chemoreceptors - Photoreceptors – mammalian eye – visual pigments – physiology of vision – phonoreceptors – mammalian Ear- Organ of Corti – working mechanism- - equilibrium receptors.

UNIT V

Biochemistry: Structure and Classification of Carbohydrates, Protein, Amino acids, Lipids. Enzymes: classification - mechanism of action. Metabolism: Glycogenesis– Glycogenolysis- Gluconeogenesis and Glycolysis, Kreb's cycle, Cori cycle; Deamination & Transamination; β - oxidation of fats.

Text Books (Latest Editions)

1. Agarwal R A., Anil K Srivastava., Kaushal Kumar., (1978), Animal Physiology and Biochemistry, S. Chand & Co. Ltd., New Delhi Publishing.
2. Ambika Shanmugam, (2001), Fundamentals of Biochemistry for Medical Students, Karthik Offset Printers, Chennai.
3. Berry A.K.(1998), A text book of Animal Physiology and Biochemistry. Emkay Publications, New Delhi.
4. Parameswaran, Ananta Krishnan and Ananta Subramanian, (1975), Outlines of Animal Physiology, S. Viswanathan (Printers & Publishers) Pvt. Ltd., 329 p p.
5. Verma P.S., Tyagi B.S & Agarwal V.K., (2010), Animal Physiology, S. Chand & Co. Ltd., New Delhi Publishing., 417 pp.
6. Nelson, D.L. & Cox, M.M. (2017) Lehninger principles of Biochemistry (7th edition), W.H. Freeman and Co., New York.
7. Berg, J.M., Tymoczko, J.L. and Stryer, L. (2012) Biochemistry (7th edition) Freeman.

Reference Books (Latest editions, and the style as given below must be strictly adhered to)

1. Guyton, A.C. and Hall, J.B., (2011), Text Book of Medical Physiology, 9th Edition, W.B. Sanders Company, Prism Books (Pvt.) Ltd., Bangalore.
2. Ganong, W.F., (2019), Review of Medical Physiology, McGraw Hill, New Delhi., 340 pp.
3. Hill, W.R., Wyse, G.A and Anderson, M. (2016), Animal Physiology (4thedn). Sinauer Associates Oxford University Press; USA, 828 pp.
4. Hoar, W.S. (1983), General and Comparative Physiology. Prentice Hall of India, New Delhi, 928 pp.
5. Prosser C.L., (1985), Comparative Animal Physiology, Satish Book Enterprise, Agra - 282 003, 966 pp.
6. Sarada Subrahmanyam, Madhavan Kutty, K., & Singh H.D., (2018). Text Book of Human Physiology, S. Chand & Co, New Delhi.
7. Singh, H.R and Kumar, N. (2017), Animal physiology and biochemistry, Vishal publishing company, Jalandhar.
8. Sreekumar, S. (2010), Basic physiology, PHI learning private ltd., New Delhi.210 pp
9. Tortora G.J. & Derrickson B., (2016), Principles of Anatomy and Physiology, John Sons, Inc.
10. Wood, D.W., (1968), Principles of Animal Physiology, Edward Arnold Ltd, London.
11. Zubay,G. (2017) Biochemistry (4th edition) McGraw-Hill.
12. Jain,J.L.(2001) Fundamentals of Biochemistry, Chandra &CO. Pvt. Ltd. New Delhi.

Web Resources

1. https://microbenotes.com/category/biochemistry/
2. https://www.stem.org.uk/resources/collection/3931/animal-physiology
3. https://animalphys4e.sinauer.com
4. https://nptel.ac.in/courses/102/104/102104042/
5. https://biochem.oregonstate.edu

ENVIRONMENTAL BIOLOGY

Course Objectives

- To create an awareness to the students about the theories, concepts and basics of Environmental Biology
- To provide students about the idea of biogeochemical cycles and energy flow in ecosystems
- To make an awareness of the fresh water habitat and marine habitat
- To provide adequate explanation to students about the pollutions and population ecology
- To give an idea about natural resources and conservation

UNIT I

Ecosystem: Concept of an ecosystem-Structure and function of an ecosystem-Producers, consumers and decomposers-Energy flow in the ecosystem-Ecological succession-Food chains, food webs and ecological pyramids- Introduction, types, characteristic features, structure and function of the following ecosystem: Forest ecosystem-Grassland ecosystem-Desert ecosystem-Aquatic ecosystems (ponds, estuaries). Animal relationships: Mutualism, Commensalism, parasitism, Competition and Predation.

UNIT II

Population Ecology- Definition and characteristics: Density, Natality, Mortality, Migration, Emigration and Immigration, Population fluctuation- Age pyramid, growth and growth curve - factors affecting population growth -Carrying capacity. Population regulation and human population control.

UNIT III

Environmental Stresses And Management: Global climatic pattern, global warming, ozone depletion, Acid rain, Pesticides and other chemical in agriculture, industry and hygiene and their disposal. Bio indicator and biomarkers of environmental health. Biodegradation and bioremediation of heavy metals.

UNIT IV

Environmental Pollution: Definition- cause, effects and control measures of: -Air pollution - Water pollution -Soil pollution -Marine pollution - Noise pollution - Thermal pollution -Nuclear hazards.

UNIT V

Biodiversity Conservation: Biodiversity crisis – habitat degradation, poaching of wild life. - Socio economic and political causes of loss of biodiversity. - In situ and ex situ conservation of biodiversity -Hot spots of Biodiversity. Green peace movement -

Chipko Movement - Role of government agencies: Central and State Pollution Control Boards - Ministry of Environment and Forests- National Biodiversity Authority. Awareness, Programme, NGOs, Natural Disaster Management, Legislations for environmental Protection.

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1. Agarwal R A., Anil K Srivastava., Kaushal Kumar., (1978), Animal Physiology and Biochemistry, S. Chand & Co. Ltd., New Delhi Publishing.
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11. Zubay,G. (2017) Biochemistry (4th edition) McGraw-Hill.
12. Jain,J.L.(2001) Fundamentals of Biochemistry, Chandra &CO. Pvt. Ltd. New Delhi.

Web Resources

1. https://microbenotes.com/category/biochemistry/
2. https://www.stem.org.uk/resources/collection/3931/animal-physiology
3. https://animalphys4e.sinauer.com
4. https://nptel.ac.in/courses/102/104/102104042/
5. https://biochem.oregonstate.edu

Lab on ANIMAL PHYSIOLOGY & BIOCHEMISTRY AND ENVIRONMENTAL BIOLOGY

Learning Objectives

- To encourage the students to learn the usage of genetics experiments.
- To know the causes and effects of mutations.
- To encourage students to understand the significance of living fossils and know the contributions of famous evolutionists.
- To identify the variation in the animal kingdom and its role in evolution.
- To record the spotters and analyse the genetics and evolutionary theories.

UNIT I

Physiology:

1. Rate of Oxygen consumption of fish
2. Effect of temperature on the Opercular movement of a fish – Calculation of Q10.
3. Action of Salivary amylase in relation to enzyme concentration and temperature.
4. Demonstration of blood pressure using a Sphygmomanometer.
5. Qualitative test for Ammonia, Urea and Uric acid.
6. Protein estimation by Bradford method (Demo)
7. Qualitative tests for identification of carbohydrates, proteins and lipids.

UNIT II

Ecology:

1. Estimation of dissolved Oxygen – any 2 water samples.
2. Dissolved carbon-di-oxide – any 2 water samples
3. Estimation of total and phenolphthalein alkalinity – any 2 samples.
4. Determination of salinity of water samples,
5. Estimation of turbidity using Secchi disc.
6. Identification and mounting of any two marine / freshwater planktons

UNIT III

Spotters / Charts: Physiology: Intestinal villi, Haemoglobin, Myoglobin, neuron, Sphygmomanometer, Haemocytometer, ECG, Nephron, Cardiac muscle, striated

muscle and Non-striated muscle, Thyroid gland, Adrenal, Glucose, Amino acid. Ecology: Mutualism: Hermit crab and Sea anemone, Commensalism: Echeneis and Shark, Parasitism: Sacculina on Crab, Predation: Snake and rat, Ecosystem – Pond, Food chain – Forest ecosystem, grassland ecosystem, age pyramid

UNIT IV

1. Visit to a local polluted site- Urban/ Rural/ Industrial/ Agricultural.
2. Study of a simple ecosystems - pond / river /hill slopes, etc.
3. Visit to Sanctuaries and National Parks – Report (Mandatory)

UNIT V

Record / Observation Note (SUBMISSION IS MANDATORY)

Text Books (Latest Editions)

1. Surya Nandan Meena, Milind Naik, (2019), Advances in Biological Science Research: A Practical Approach, Academic Press, New York, USA.
2. Michael Perlin, William Beckerson, Adarsh Gopinath, (2017), Cell, Genetics, and Molecular Biology: A Lab Manual (First Edition), Cognella Inc., USA.
3. Mammata Behera, Rinny Swain, Aditya Pratap Singh, (2024), A Practical manual of fundamentals of Genetics, Bigfoot Publications.
4. Stricberger, M.W., (1996), Evolution. Jones& Bartlett, USA
5. Dadson E.O. (1960), Evolution: Process and Product. Reinhold Pub.

Reference Books (Latest editions, and the style as given below must be strictly adhered to)

1. Robert F. Schleif, Pieter C. Wensink, (2012), Practical Methods in Molecular Biology, Springer-Verlag, NY, USA.
2. Sarah Stauffer, Aaron Gardner, Wilko Duprez, Dewi Ayu Kencana Ungu, Philip Wismer, (2018), Labster Virtual Lab Experiments: Basic Genetics, Springer Publishers, NY, USA.
3. Harth and Jones EW. 1998. Genetics – Principles and Analysis. Jones and BarHett Publ. Boston.
4. Dr. Kishore R. Pawar, Dr. Ashok E. Desai, 2019. A text book of Organic Evolution, Nirali Prakashan,
5. Minkoff, E. C. (1983). Evolutionary biology. Reading, MA: Addison-Wesley Publishing Company

Web Resources

1. https://nbb.gov.in/
2. https://icar.org.in/
3. https://nisa.icar.gov.in/
4. https://www.nationalgeographic.com/animals/invertebrates/

PROJECT

Guidelines:

1. It shall be a Group activity with 4-6 students in each group.
2. A Group project report should be submitted at the end of 5th semester, during the practical examination.
3. The Group Project Report shall have a minimum of 25 to 100 pages.
4. Evaluation scheme for the Project - (50:50 for Internal: External)
5. The external examiner will evaluate the external 50 marks.

BIOSTATISTICS AND COMPUTER APPLICATION

Learning Objectives

- To get the basic knowledge about collection and presentation of data
- To calculate standard deviation, correlation coefficient, chi-square analysis and to understand hypothesis testing.
- Use the technique to analyze the results of the experiments.
- To gain basic knowledge about computers.
- To acquire the knowledge about the office automation.

UNIT I

Introduction and Basics: Definition and Scope: Population and Samples – Types of variables. Collection and sources of data: Primary and secondary data. Sampling methods & Sampling procedures. Classification and Presentation of data: Frequency distribution. Tabulation & Diagrammatic representation of data: tables - parts- types; diagrams – line diagram – bar diagram – pie diagram- histogram – graphs. Measures of Central tendency – Calculation of Mean, Mode and Median (Grouped and Ungrouped Data).

UNIT II

Measures Of Dispersion: Range, Standard Deviation and Standard Error, Variance, Coefficient of Variation. Hypothesis Testing- Null hypothesis- Level of significance - Chi–square test – Calculation and application, Students-t Test - Calculation and application.

UNIT III

Correlation: Introduction, Types, Perfect positive and negative, Linear and Non-Linear methods; Scatter diagram, Karl Pearson's correlation coefficient, Interpretation of the Correlation coefficient. Regression Analysis –Regression line, Regression equations.

UNIT IV

Introduction to Computer – Application of Computer – Generation of computer - Components of Computer: Input devices and Output devices – CPU – Memory: Primary and Secondary Memory - Operating system – Windows – Linux – Unix – Android. Multimedia, AI, Cyber Security.

UNIT V

Introduction to Office Automation: Word Processing: Open, Save and close a Word document; Edit text – formatting, bullets, Spell Checker - headers and footers, numbering, printing. Spreadsheets: MS Excel – entering and editing text and data – adjusting row and column height – Pie- bar- line chart preparation. PowerPoint: Introduction to PowerPoint – slide typecasting & viewing slides – creating slide shows. Uses of Internet – Email, Internet Browsing; e-learning tools & resources, World Wide Web (WWW).

Text Books (Latest Editions)

1. Daniel, W.W. (2012) Biostatistics: A Foundation for Analysis in Health Sciences (10^{th} edition) John Wiley.
2. Zar, J.H. (2013) Biostatistical Analysis (5th edition) Pearson.
3. Milton, J.S. and Tsokos, J.O. (1992) Statistical Methods in the Biological and Health Sciences (2 nd edition) McGraw Hill.
4. Gurumani,N. 2005. Biostatistics, 2 nd edition, MJP Publishers India.
5. Palanichamy, S and M. Shanmugavelu, (1991), Principles of Biostatistics. Palani Paramount. India.
6. Adabala N., and Rajaram, V. (2014), Fundamentals of Computers, PHI Learning
7. Peter Norton, (2002), Introduction to Computers, McGraw-Hill Education.

Reference Books (Latest editions, and the style as given below must be strictly adhered to)

1. Antonisamy, B., Solomon Christopher and P. Prasanna Samuel, (2011). Biostatistics: Principles and practices. MacGraw Hill Education Pvt. Ltd. New Delhi.
2. Daniel, W. W., (2000), Biostatistics: A foundation for analysis in the health sciences, 7^{th} Ed. John Wiley & Sons Ltd. New York.
3. MichaelC., Whitlock and Dolph Schluter, (2009). The analysis of biological data, 2^{nd} Ed. MacMillan Publishers, NewYork, USA.
4. Ronser,B., (2006), Fundamentals of Biostatistics, Thomson Brooks/Cole, 6^{th} Ed. Duxbury press, Singapore.
5. Reema Thareja, (2019), Fundamentals of Computers, Oxford University Press.
6. Bright Siaw Afriyie, (2006), Introduction to Computer Fundamentals, Trafford Publishing.

Web Resources

1. https://bit.ly/2VYWOM5
2. https://bit.ly/2VZQFiT
3. https://bit.ly/3kqdXYA
4. https://bit.ly/39rvvgt

ELECTIVE LAB - V - BIOSTATISTICS AND COMPUTER APPLICATION - PRACTICALS

Practical:

1. Find out the Mean, Median, Mode, Standard deviation, Standard error and Coefficient of variance using serrations of neem leaves.
2. Calculation of correlation from Length and width of leaves.
3. Spotters: Bar diagram, Histogram, Pie diagram and Frequency curve and polygon, Computer Mouse, CPU, Keyboard, Monitor.
4. Visit to a Computer centre to learn internet browsing and email sending – Compulsory for each student.

ELECTIVE: AGRICULTURAL ENTOMOLOGY/ SERICULTURE / VERMITECHNOLOGY

AGRICULTURAL ENTOMOLOGY

Learning Objectives

- Explain the basic concepts of entomology and observe the pest status of agriculture.
- Illustrate and examine the systemic and functional morphology of various group of agricultural insect pests.
- Differentiate and classify the various groups of insect animals and estimate biodiversity.
- To compare and distinguish the general and specific characteristics integrated pest management.
- Infer and integrate the economic importance of insect species.

UNIT I

Outline classification of insects - Causes for insect assuming pest status - Methods of collection, mounting and preservation of insect pests

UNIT II

Insect vectors of plant diseases, Insect pests of stored grains their preventive and curative methods, Most common insect pests of the following plants and their control measures: Paddy, Sugarcane, Groundnut, Coconut and Cotton. Locust and its control.Insect pollinators and scavenger.

UNIT III

Apiculture: Introduction, types of honey bees, hive, apiary, selection of bees for apiary, Newton's bee hive, enemies and diseases of honey bees. Sericulture: Introduction, types of silk worms, silk worm races, life history of mulberry silk worm, features of sericulture industry, pests and diseases of silk worm. Lac Culture.

UNIT IV

IPM, physical, mechanical, chemical and biological control methods, Pesticide application equipment.

UNIT V

Introduction and steps towards IPM, Pheromones, antifeedents, repellents and biopesticide.

Text Books (Latest Editions)

1. David,B and Ananthakrishnan,T.N. (2006), General and Applied Entomology, Second edition, Tata McGraw hill publishing company Ltd., New Delhi, India.
2. Vasanthraj David, B. and Ramamurthy, VV. (2012), Elements of Economic Entomology, Seventh edition, Namrutha publications, Chennai.
3. Pruthi,H.S. (1969), Textbook on Agricultural Entomology, I.C.A.R. Publication, New Delhi.
4. Awasthi, V.B. (2012), Introduction to General and Applied Entomology, third edition, Scientific publishers.

Reference Books (Latest editions, and the style as given below must be strictly adhered to)

1. Abishek Shukla, D. (2009), A Hand Book of Economic Entomology, Vedamse Books, NewDelhi.
2. Ministry of Agriculture, Government of India, (1995), Manual on Integrated Pest Management in Rice and Cotton.
3. John William S. (1995), Management of Natural Wealth, Loyola College Publications, Chennai.

Web Resources

1. http://www.fao.org
2. http://flybase.bio.indiana.edu/
3. http://www.ipm.ucdavis.edu
4. http://www.ent.iastate.edu/list/
5. www.entsoc.org

AGRICULTURAL ENTOMOLOGY - PRACTICALS

1. Methods of collection of insects.
2. Study of insect segmentation, various tagmata and their appendages
3. Preparation of permanent mounts of different body parts and their appendages.
4. Dissection of silk glands, digestive and nervous system – silk worm.
5. Mounting of legs, mouth parts and sting of worker bees.
6. Report on a field visit to a Sericulture farm / Apiary farm (Mandatory)
7. **Spotters:** Rice stem borer (Scirpophaga incestuous), Pest of Sugarcane: The shoot borer (Chilo infuscatellus), Pest of coconut: The rhinoceros beetle (Oryctes rhinoceros), Locust, Newtons bee hive, Bee comb, queen bee, worker bee, silkworm egg, larva, pupa and adult, Chandrika and Netrika.

SERICULTURE

Learning Objectives

- Study the scope and importance of Sericulture for the betterment of human welfare.
- Introduce the concepts of sericulture and mulberry cultivation.
- To get deep knowledge on diseases of silk worm and pests of mulberry plants.
- Understand the methods of harvesting, and cocoon marketing.
- Adopt sericulture as a vocation as it is rural agro based based cottage industry.

UNIT I

Importance of sericulture: Sericulture industry in India, sericulture as cottage industry, role of Central Silk Board, Moriculture, Mulberry varieties – High yielding varieties – Varieties for rainfed conditions. Morphology of mulberry plant, methods of propagation, irrigation, manuring – Biofertilizers – Green manuring – Triacontanol for increased mulberry productivity – Seriboost, pruning, harvesting and storing of mulberry leaves, package of practices for mulberry cultivation.

UNIT II

Diseases of mulberry: Fungal diseases – fungal root diseases, fungal shoot diseases, Bacterial diseases – leaf blight disease, rot disease, Viral disease – mulberry leaf mosaic disease, dawn disease, Neamatode disease - root knot disease, Deficiency diseases – nitrogen deficiency, phosphorus deficiency, potassium deficiency, magnesium deficiency and calcium deficiency. Pests of mulberry – leaf eating insect pests and borer pests one example each

UNIT III

Classification of mulberry: Silkworm, habit and habitats of silkworm, voltinism, races of silkworms, life cycle of mulberry silkworms, structure of egg, larva, pupa and adult, sexual dimorphism digestive system, circulatory system, excretory system, respiratory system, nervous system and reproductive system, endocrine glands, glands of silkworm.

UNIT IV

Rearing of silkworm: Rearing house – Rearing appliances – Rearing operation – Disinfection – Brushing – Maintenance of optimum conditions, Feeding – bed cleaning – spacing. Rearing of young ages – Chawki rearing - Rearing of late age larva: Shelf rearing. Floor rearing, shoot rearing. Application of sampoorna. Mounting: Methods – precautions, Cocoon marketing: Characteristics of cocoon – defective cocoons – methods of harvesting.

UNIT V

Diseases of silkworm: Protozoan – pebrine, Viral – Flacherie, gattine, grasserie Bacterial – Flacherie, septicemia, sotto, court, Fungal – Muscardine, Pests – Uzy fly, dermestid beetle of silkworm. Silk reeling: cocoon stifling – types, storage of stifled cocoons, sorting, cocoon, boiling and deflossing – brushing, Process of reeling: Different methods, silk waste and byproducts of silk reeling. Raw silk and marketing.

REFERENCE BOOKS:

1. Ganga, G. and I. Sulochana Chetty, (2023), An introduction to Sericulture, Oxford & IBH Publishing Company Private Limited,S -155,Panchshila Park, NewDelhi.
2. Ganga,G. (2003), Silkworm Rearing and Silk Realing (Comprehensive Sericulture, Volume – 2, Science Publishers, US
3. Dandin, S.B, Jayant Jayaswal and K. Giridhas, (2003), Hand Book of Sericultural Technologies, Central Silk Board, Madivala, Bangalore –68.
4. Kamile Afifa. S and Masoodi M. Amin, (2004), Principles of Temperate Sericulture, Kalyani Publishers, B – 1/1292, Rajinder Nagar, Ludhiana.
5. Kesary, M and M.Johnson, (2019), Sericulture, (NMCC), Saras Publications.
6. Manisha B., (2019), Economics of Sericulture, Rajesh Publications.
7. Amardev Singh, (2013), Sericulture Extension, Biotech Books.

SERICULTURE PRACTICALS

1. Dissection of silk glands of a silkworm.
2. Dissection of the digestive system of a silkworm.
3. Dissection of the nervous system of a silkworm
4. Selection of mulberry leaves according to different stages.
5. Life history – egg, larva, pupa and adult.
6. Sexual dimorphism in larva, pupa and adult.
7. Mulberry varieties such as MR2, S30, S36,V2.
8. Chandrika
9. Netrikka
10. Rearing tray and reading stand.
11. Raw silk.
12. Report on a field visit to a sericulture farm.(Mandatory)

VERMITECHNOLGOY

Learning Objectives

- Gain the knowledge about the types of earthworms.
- To understand the culture techniques of earthworms
- Understand the production of vermicompost.
- Understand the environment conservation process and its importance and protection of earthworms through vermiculture.
- To gain the knowledge about the marketing of vermicompost.

UNIT I

Earthworm taxonomy: Morphological and anatomical – Classification of earthworms – Food habits – Digestive system – Excretion – Reproduction and Life cycle – Earthworm as farmers friend.

UNIT II

Types of earthworms: Exotic and native species – South Indian and North Indian species used in Vermicomposting – Collection and Preservation of earthworms for vermicomposting – Culture techniques of earthworms.

UNIT III

Vermicompost production: – Requirements – Different methods of Vermicomposting – Heap method – Pot method and Tray method – changes during Vermicomposting.

UNIT IV

Role of Earthworms in soil fertility: Use of Vermicompost for crop production – Use of earthworms in land improvement and land reclamation – Economics of Vermicompost and vermiwash production. Earthworms as animal feed – Medicinal value of earthworm meal – Role of Earthworms in Solid Waste, Sewage and faecal waste management and Vermifilters. Earthworms as bioreactors.

UNIT V

Interaction of earthworms: Interaction of earthworms with other organisms – Influence of chemical inputs on earthworm activities – Large scale manufacture of Vermicompost, packaging of vermicompost and its marketing – Financial supporting – Government and NGOs for vermiculture work.

REFERENCE BOOKS:

1. Bhatt J. V. & S. R. Khambata (1959), Role of Earthworms in Agriculture, Indian Council of Agricultural Research, New Delhi.
2. Edwards, C.A. and J.R. Lofty (1977), Biology of Earthworms, Chapman and Hall Ltd., London.
3. Clive A Edwards, (2004), Earthworm Ecology, CRC Press.
4. Rhonda L Edwards and Clive A., (2010), Vermiculture Technology, CRC Press Inc
5. Lee, K.E. (1985), Earthworms: Their ecology and Relationship with Soils and Land Use, Academic Press, Sydney.
6. Kevin, A and K. E .Lee (1989), Earthworm for Gardeners and Fisherman, (CSIRO, Australia, Division of Soils)
7. Satchel, J.E. (1983), Earthworm Ecology, Chapman Hall, London.
8. Wallwork, J.A. (1983), Earthworm Biology, Edward Arnold (Publishers) Ltd. London.
9. Christy, M. V. (2008), Vermitechnology, 1st edition, MJP Publishers.
10. Lekshmy, M. S., Santhi R. (2012), Vermitechnology, Sara Publications, New Delhi, India,

VERMITECHNOLOGY - PRACTICALS

1. Comparison of morphology & life stages of Eisenia fetida & Eudrilus eugeniae.
2. Dissection digestive system of earth worm (Demo)
3. Dissection nervous system of earth worm (Demo)
4. Mounting of Body setae
5. Mounting of Peniel selate
6. Preparation of waste mix for Vermicomposting
7. Vermiwash preparation.
8. Report on a field visit Collection of native earthworms & their identification. (Mandatory)
9. **Spotters:** Eisenia fetida, Eudrilus eugeniae, Megascolex mauritti, Cocoon, Tunnel trap, Vermiwash, Vermifilter, Vermitech 200, Vermicompost pit, Vermi reactor, Enemies of earthworm: ant, centipede

Internship / Industrial Visit / Field Visit / Knowledge updation activity Guidelines:

1. Evaluation scheme - Internal mark 50 and external mark 50
2. A report should be submitted during the practical examination at the end of the 5th semester.
3. A report shall have a minimum of 10 to 25 pages.
4. The external examiner will evaluate the external 50 marks.
5. Submit Attendance certificate along with the report.

NAN MUDTHALVAN/ BASICS OF MARINE BIOLOGY

*** * Substitute paper exclusively for reappearance only**

Learning Objective

- To understand and learn the physical, chemical and biological aspects of marine environment and to gain knowledge about the management of oceans.
- To introduce students to the marine environment and its indigenous organisms.
- To study the principles, concepts and facts through which the student can better understand and appreciate the nature of the sea and its inhabitants.
- To acquaint the student with the characteristics used to identify and classify marine plants and animals and to develop an awareness of the career possibilities available to students in this area.

Unit I

Marine Ecology: Marine environment- ecological factors- light, temperature, salinity, pressure; Classification of marine environment; Pelagic environment – Planktonic and Nektonic adaptations; Benthic environment - intertidal, interstitial and deep sea adaptations

Unit II

Physical Oceanography: Physical Properties of Seawater- density, viscosity, surface tension, conductivity and their relationship; temperature distribution in the sea - Dynamics of the ocean-general surface circulation, Waves, Currents and Tides, Tsunami.

Unit III

Chemical Oceanography: Chemical composition of seawater- ionic, major and minor constituents, constancy- ionic compositions and factors affecting constancy- major and minor elements, trace elements- their importance, distribution. Chemistry of seawater constituents- concept of chlorinity and salinity - methods of measurements, nutrients - biogeochemical cycles.

Unit IV

Biological Oceanography: Sea as a biological environment- Plankton- classification based on size, mode of life and habitat. Phytoplankton and Zooplankton - methods of collection, estimation of standing crop-wet and dry weight estimation-– estimation and factors affecting primary productivity.

Unit V

Marine Pollution and Ocean Management: Ocean pollution- kinds and quantities of pollutants, toxic effects and control measures – oil spills, plastics, nuclear waste disposal in the marine environment, and Eutrophication. Role of National and international agencies and organizations in ocean management, UNEP, DOD, WOCE, WHOI.

Text Books

1. Thurman, Harold., (2001), Introduction to Oceanography, Prentice Hall Inc. New Jersey.
2. Bertness, M.D, S. D. Gaines and M.K. Hay (2000), Marine Community Ecology, Sinauer Associates.
3. Grant Gross, M., (1993), Oceanography: A view of the earth (sixth edition). Prentice Hall Inc. New Jersey.
4. Fincham A. A, (1984), Basic Marine Biology, Cambridge University Press, England.
5. John Resech Jr. (1979), Marine Biology. Reston Publishing Company, Virginia.

Suggested Readings

1. Barbara E. Curry, (2016), Advances in Marine Biology, Volume 74, Ist Edition. Academic Press ISBN: 9780128036075
2. Peter Castro, Michael E. Huber, (2015), Marine Biology; Series Botany, Zoology, Ecology and Evolution. McGraw-Hill Education.
3. Philip V. Mladenov, (2013), Marine Biology: A very short introduction, Ist Edition. Oxford University Press.
4. Venkataraman K, Raghunathan C, Raghuraman R, Sreeraj C. R, (2012), Marine diversity in India. Zoological Survey of India, Kolkata.178 pp.
5. Amy Hill. (2002), Marine Biology: An Introduction to Ocean Ecosystems (Marine Biology Ser) Walch publishing.
6. Pickard, G.L. and W.J. Emery (1995), Descriptive Physical Oceanography, Pergamon Press, London.
7. Gage. J.D. and P.A. Tyler, (1991), Deep Sea Biology, Cambridge University Press, Cambridge
8. Raymont J. E. G., (1980), Plankton and Productivity in the oceans: Volume 1: Phytoplankton, Pergamon Press.

Web Resources

1. https://www.livescience.com
2. https://www.icriforum.org
3. https://www.cbd.int