Dr. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY,
CHHATRAPATI SAMBHAJINAGAR.

NAAC- 'A $^{+}$' Grade

CIRCULAR NO.SU/ Sci./College/NEP-2020/73/2025

It is hereby inform to all concerned that, the syllabi prepared by the Board of Studies/ Ad-hoc Boards/Committee and recommended by the Dean, Faculty of Science & Technology, the Academic Council at its meeting held on 09 May 2025 has been accepted **the following B.Sc. Course Structure & Curriculum** under the Faculty of Science & Technology as per National Education Policy – 2020 run at the Affiliated Colleges of Dr. Babasaheb Ambedkar Marathwada University as appended herewith.

Sr.No.	Courses	Semester
1	B.Sc. Physics	IIIrd and IVth Semester
2	B.Sc. Electronics	IIIrd and IVth Semester
3	B.Sc. Mathematics	IIIrd and IVth Semester
4	B.Sc. Industrial Chemistry	IIIrd and IVth Semester
5	B.Sc. Agrochemical and Fertilize	IIIrd and IVth Semester
6	B.Sc. Horticulture	IIIrd and IVth Semester
7	B.Sc. Biochemistry	IIIrd and IVth Semester
8	B.Sc. Botany	IIIrd and IVth Semester
9	B.Sc. Zoology	IIIrd and IVth Semester
10	B.Sc. Biotechnology	IIIrd and IVth Semester
11	B.Sc. Microbiology	IIIrd and IVth Semester
12	B.Sc. Diary Science and Technology	IIIrd and IVth Semester
13	B.Sc. Statistics	IIIrd and IVth Semester
14	B.Sc. Computer Science	IIIrd and IVth Semester
15	B.Sc. Geology	IIIrd and IVth Semester
16	B.Sc. Chemistry	IIIrd and IVth Semester
17	B.Sc. Analytical Chemistry	IIIrd and IVth Semester
18	B.Sc. Polymer Chemistry	IIIrd and IVth Semester
19	B.Sc. Environmental Science	IIIrd and IVth Semester
20.	B.Sc. Fisheries Science	IIIrd and IVth Semester

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21.	B.Sc. Home Science	IIIrd and IVth Semester
22.	B.Sc. Data Science	IIIrd and IVth Semester
23.	B.Sc. Information Technology	IIIrd and IVth Semester
24.	B.Sc. Networking and Multimedia	IIIrd and IVth Semester
25.	B.Sc. Automobile Technology	IIIrd and IVth Semester
26.	B.Sc. Forensic Science	IIIrd and IVth Semester
27.	B.Sc. Forensic Science & Cyber Security	IIIrd and IVth Semester
28.	B.Sc. Non-Conventional & Conventional Energy	IIIrd and IVth Semester
29.	B.Sc. Clinical Laboratory Science	IIIrd and IVth Semester
30.	Bachelor of Computer Application	IIIrd and IVth Semester

This is effective from the Academic Year 2025-26 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,
Chhatrapati Sambhajinagar
-431 004.
Ref.No. SU/Sci./2025/827-29
Date:- 26/05/2025

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Deputy Registrar,
Syllabus Section.

Copy forwarded and necessary action to :-

1] **The Principal of all Affiliated 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.

JD*26052025/-

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Dr. Babasaheb Ambedkar Marathwada University
Chhatrapati Sambhajinagar- 431001

B.Sc. Degree Programme

(Three Year / Four Years (Hons) /Four Years (Hons with Research)

Course Structure (Revised)

(AS PER NEP-2020)

Subject (Major): Zoology

BSc Second Year: (3rd Semester and 4th Semester)

Effective from 2025-26

B.Sc. Second Year: 3rd Semester - (Students will have to select / declare choice of **one major subject** and **one minor subject** from three major options M1, M2 and M3 (which were opted in the first year)

Course Type	Course Code	Examination Code(To be given by respective BoS)	Course Name	Teaching Scheme (Hrs / Week)		Credits Assigned		Total Credits
				Theory	Practical	Theory	Practical	
Major (Core) Mandatory DSC	ZOO/DSC/ T/200	SAC0309 2003T	Cell Biology	2		2		2+2+2 +2 = 08
	ZOO/DSC/ T/201	SAC0309 2013T	Animal Physiology-I	2		2		
	ZOO/DSC/ P/ 226	SAC0309 2263P	Practical based on Cell Biology		4		2	
	ZOO/DSC/ P/ 227	SAC0309 2273P	Practical based on Animal Physiology-I		4		2	
Minor (Choose any two from pool of courses) **It is from different discipline of the same faculty**	ZOO/Mn/ T/ 200	SCC0309 2003T	To be chosen from other discipline of same faculty	2		2		2+2 = 04
	ZOO/Mn/ T/ 201	SCC0309 2003T	To be chosen from other discipline of same faculty	2		2		2+2 = 04
Generic / Open Elective GE/OE) (Choose any one from pool of courses) **It should be chosen compulsorily from the faculty other than that of Major**	ZOO/GE/ OE/T/200	SDC0309 2003T SDC0309 2013T	To be chosen from other faculty	2		2		02
VSC(Vocational Skill Courses) (Choose any one from ZOO/VSC/T/ 200 and ZOO/VSC/T/ 201) and corresponding Practicals	ZOO/VSC/ T/ 200	SEC0309 2003T	Vermicomposting	1		1		1+1 =02
	ZOO/VSC/ T/ 201	SEC0309 2013T	Sericulture	1		1		
	ZOO/VSC/ P/ 226	SEC0309 2263P	Practical based on Vermicomposting		2		1	
	ZOO/VSC/ P/ 227	SEC0309 2273P	Practical based on Sericulture		2		1	
AEC, VEC, IKS			English Common for all the faculty)	2		2		2 + 2 = 04
			Environmental Studies	2		2		
OJT/FP/CEP/CC/RP			Cultural Activity / NSS,NCC(Common for all the faculty)		4		2	02
				15	**14**	**15**	**07**	**22**

Minor Courses for other Discipline

SUB/Mn/T/ 200 : This is a 2 credit theory course designed for other discipline(**Fundamentals of Biochemistry)**
SUB/Mn/T/ 201 : This is a 2 credit theory course designed for other discipline **(Value added products of Animals)**
Generic /Open Elective Courses for other faculty

SUB/GE/OE/T/200 : This is a 2 credit theory course designed for other faculty
(Wildlife conservation & Management)
(Environment & Public Health)

B.Sc. Second Year: 4th Semester

Course Type	Course Code	Examination Code (To be given by respective BoS)	Course Name	Teaching Scheme (Hrs / Week)		Credits Assigned		Total Credits
				Theory	Practical	Theory	Practical	
Major (Core) Mandatory DSC	ZOO/DSC/T/250	SAC030925 04T	Genetics	2		2		2+2+2+2 = 08
	ZOO/DSC/T/ 251	SAC030925 14T	Animal Physiology -II	2		2		
	ZOO/DSC/P/ 276	SAC030927 64P	Practical based on Genetics		4		2	
	ZOO/DSC/P/ 277	SAC030927 74P	Practical based on Animal Physiology -II		4		2	
Minor (Choose any two from pool of courses) **It is from different discipline of the same faculty**	ZOO/Mn/T/250	SCC030925 04T	to be chosen fromother discipline ofsame faculty	2				2+2 = 04
	ZOO/Mn/T/251	SCC030925 04T	to be chosen from other discipline of same faculty	2				2+2 = 04
Generic / Open Elective (GE/OE)(Choose any one from pool of courses)**It should be chosen compulsorily from the faculty other than that of Major**	ZOO/GE/OE/T/ 250	SDC030925 04T SDC030925 14T	to be chosen from other faculty	2		2		02
SEC(Skill Enhancement Courses) (Choose any one from ZOO/SEC/T/250and ZOO/SEC/T/ 251) and corresponding Practicals	ZOO/SEC/T/250	SEC030925 04T	Biological Techniques	1		1		1+1 =02
	ZOO/SEC/T/ 251	SEC030925 14T	Fish hatchery Management	1		1		
	ZOO/SEC/P/ 276	SEC030927 64P	Practical based on Biological Techniques		2		1	
	ZOO/SEC/P/ 277	SEC030927 74P	Practical based on Fish hatchery Management		2		1	
AEC, VEC, IKS			Modern Indian Language (MIL-2) (Choose any onefrom pool of language courses)	2		2		02
OJT/ FP/CEP/CC/RP			Field Project		4		2	2+2= 04
			(Fine/ Applied/ Visual/ Performing Arts) (Common for all the faculty)		4		2	
				13	18	13	09	22

Minor Courses for other Discipline

SUB/Mn/T/ 250 : This is a 2 credit theory course designed for other discipline **(Economic Zoology)**

SUB/Mn/T/ 251 : This is a 2 credit theory course designed for other discipline **(Agricultural Entomology)**

Generic /Open Elective Courses for other faculty

SUB/GE/OE/T/250 : This is a 2 credit theory course designed for other faculty **(Food Nutrition & Health)**

(Wildlife photography and Nature interpretation)

ZOO/DSC/T/200 : Cell Biology

Total Credits : 02 Total Contact Hours : 30 Hrs

Maximum Marks : 50

Learning Objectives of the Course:

- Cell Biology deals with the detailed study of a cell including cell structure, cell composition, cell organelles and the interaction of cells with other cells and the larger environment in which they exist

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

- Understand the importance of cell as a structural and functional unit of life.\
- The students understand and compare between the prokaryotic and eukaryotic system and Extrapolates the life to the aspect of development.
- The cellular mechanisms and its functioning depends on endo-membranes and structures. They are best studied with microscopy.

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	Cell theory, Prokaryotic and Eukaryotic cells, **Plasma membrane:** Chemical composition, Structure of Plasma membrane : Fluid Mosaic model Functions of Plasma membrane :Osmosis, Diffusion, Exocytosis, Endocytosis, Passive and Active transport **Cell junctions :** Tight junctions, Adherens junctions, Gap junctions **Cytoskeleton :** Structure and functions: Microtubules, Intermediate filaments , ` Microfilaments	**10 Hrs**
II	**Endomembrane System** Endoplasmic Reticulum: Structure, types and Functions. Golgi Apparatus: Structure and Functions Lysosomes : Structure and Functions Vesicular traffic and secretion of proteins. **Mitochondria:** Structure and function, Semi-autonomous nature of mitochondria, Role in oxidative phosphorylation and ATP generation **Peroxisomes:** Structure and functions **Ribosomes:** Structure and functions	**10 Hrs**
III	**Nucleus :** Structure and Functions: **Nucleolus :** Structure and Function **Chromosome:** Centrosome, telomere, Chemical composition of chromatin, structural organization of nucleosomes, heterochromatin. Euchromatin and DNA **Cell Cycle :** Cell cycle and its different phases, **Cell division**: Mitosis and Meiosis.	**10 Hrs**

Learning Resources:

- Karp, G. (2010). Cell and Molecular Biology: Concepts and Experiments. VI Edition. John Wiley and Sons. Inc.
- De Robertis, E.D.P. and De Robertis, E.M.F. (2006). Cell and Molecular Biology. VIII Edition.

Lippincott Williams and Wilkins, Philadelphia.
- Cooper, G.M. and Hausman, R.E. (2009). The Cell: A Molecular Approach. V Edition. ASM Press and Sunderland, Washington, D.C.; Sinauer Associates, MA.
- Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. (2009). The World of the Cell. VII Edition. Pearson Benjamin Cummings Publishing, San Francisco.
- Bruce Albert, Bray Dennis, Levis Julian, Raff Martin, Roberts Keith and Watson James (2008). Molecular Biology of the Cell, V Edition, Garland publishing Inc., New York and London.
- James E. Darnell, Harvey Lodish, David Baltimore,(1999) Molecular Cell Biology Hardcover
- Practical Cell Biology" by R. S. Verma
- Practical Zoology" by B. K. Sinha
- Cell and Molecular Biology: Concepts and Experiments" by Gerald Karp
- Practical Manual of Cell Biology" by S. J. Gautham
- Web links and Video Lectures (e-Resources):
  https://www.youtube.com/watch?v=LFyjJBiltFI and
  https://www.biologyonline.com/tutorials/biological-cell-introduction
  https://study.com/academy/topic/cell-biology.html and
  https://www.edx.org/learn/cellular-biology
  https://onlinecourses.swayam2.ac.in/cec19_bt12/preview and
  https://www.youtube.com/@bamusbiogenius8738

ZOO/DSC/T/201 : Animal Physiology-I

Total Credits : 02 Total Contact Hours : 30 Hrs

Maximum Marks : 50

Learning Objectives of the Course:

- To enable the students, know about all the physiological processes controlling the human body, Explore the basic physiological principles common to animals, relating structure to function.
- Compare physiological systems across the animal kingdom, including through in- depth topic presentations, to provide an understanding of the fundamental principles of animal physiology;

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

- Know mechanism of body functions and the basic knowledge of chemistry of biomolecules.
- Students can enlist various sensory receptors in human body and describe the structure and Functioning of the sense organs–eye, ear, nose, tongue and skin.
- To understand the functions of important physiological systems including the digestive, cardio-respiratory, renal, reproductive, nervous and muscular systems.
- To analyze the life sustaining, controlling and coordinating systems

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	**Digestive system:** Anatomy of digestive system ex. Human Mechanical and Chemical breakdown of Food,(Digestion of Carbohydrates, Proteins and Fats, Enzymes involved in digestion) Absorption(Carbohydrate, Proteins and Fats) and Egestion (Peristalsis mechanism) Hormones involved in Digestion **Circulatory System: Blood and circulation:** Blood corpuscles and formed elements, Plasma function and Immune cells. Role of Haemoglobin Blood pressure and conditions related to it. **Heart : Structure and function** Anatomy of mammalian heart, Cardiac cycle and Heart as a pump. ECG – its principle and significance,	**10 Hrs**
II	**Respiratory system:** Structure and function of mammalian Lungs Exchange of gases in lungs and transport of O_2 and CO2, Bohr effect Neural and chemical regulation of respiration. **.Excretory system:** Kidney: Structure and function : Mechanism of Urine formation in mammals(Countercurrent multiplier system) Urine concentration Blood volume and blood pressure regulation (Renin-Angiotensin system)	**10 Hrs**

III	**Nervous system:** Structure of Brain Structure of Neuron , Mechanism resting membrane potential and impulse transmission Origin of action potential and its propagation across the myelinated and unmyelinated nerve fibers; Structure of Synapse , Molecular mechanism of Synaptic transmission and Neuromuscular junction **Sense organs:** Structure of ear and physiology of hearing and Structure of eye and physiology of sight.	**10 Hrs**

Learning Resources:

- A.B. Sharma & S.K. Verma (2008). "Experimental Animal Physiology"
- Christopher D. Moyes & Patricia M. Schulte (2006). "Principles of Animal Physiology"
- Guyton, A.C. & Hall, J.E. (2006). Textbook of Medical Physiology. XI Edition. Hercourt Asia PTE Ltd. /W.B. Saunders Company.
- Tortora, G.J. & Grabowski, S. (2006). Principles of Anatomy & Physiology. XI Edition John Wiley & sons
- Victor P. Eroschenko. (2008). diFiore's Atlas of Histology with Functional correlations. XII Edition. Lippincott W. & Wilkins.
- Animal Physiology by N. Arumugam
- Practical Physiology by D. V. N. K. Raju
- Practical Physiology by S. K. Sharma
- Laboratory Manual of Animal Physiology by R.S. Verma

Practical Manual of Animal Physiology" by D. P. Mistry

ZOO/DSC/P/226 : Cell Biology(Practical)

Total Credits : 02 Total Contact Hours : 60 Hrs

Maximum Marks : 50

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	1. Study of light microscope: Handling, focusing, and magnification 2. Study of prokaryotic and eukaryotic cells using a compound microscope 3. Preparation of temporary stained squash of onion root tip to study various stages of mitosis. 4. Study of permanent slide of various stages of meiosis. 5. Study of cell organelles by permanent slide.	**20 Hrs**
II	6. Microscopic observation of animal cells (cheek epithelial cells) 7. Study of bacterial cells using simple staining 8. Temporary and permanent squash preparation of testis of Grasshopper/Cockroach for the study of various stages of meiosis.	**20 Hrs**
III	9. Study of permanent slide to show the presence of Barr body in human female blood cells/cheek cells. 10. Activity Based Learning (Suggested Activities in Class)/ Practical Based learning 11. Group Discussion of Case studies (Disease related to cell.) 12. Model Making and poster presentations (Cell Organelles) Practical record	**20 Hrs**

ZOO/DSC/P/227 : Animal Physiology-I (Practical)

Total Credits : 02 Total Contact Hours : 60 Hrs

Maximum Marks : 50

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	1. Estimation of salivary amylase activity 2. Qualitative tests for identification of carbohydrates, proteins and lipids. 3. Qualitative tests for identification of Vitamin A and C. 4. Qualitative tests for identification of ammonia, urea and uric acid (Nitrogenous excretory products .	20 Hrs
II	5 Unit Oxygen Consumption in an aquatic animal (fish or crab) 6. Measurement of lung capacity using a spirometer 7 Study of Heart Rate and Blood Pressure using a Blood Pressure Monitor 8 Determination of Blood Group 9 Preparation of haemin crystals .	20 Hrs
III	10 Study of permanent slides of Mammalian skin, Squamous epithelium, Striated muscle fibres and nerve cells, Cartilage, Bone, Spinal cord. 11 Microtomy: Preparation of permanent slide of any five vertebrate tissues 12. Field Visits: Visit to medical college/ blood bank /IVF center, / Pranayam and yoga meditation center for study and submission of report. Practical record	20 Hrs

ZOO/Mn/T/200 : Fundamentals of Biochemistry

(This course will be for the students from other discipline of the same faculty, Students are expected to choose the minor from other discipline of the same faculty)

Total Credits : 02 Total Contact Hours : 30 Hrs

Maximum Marks : 50

Learning Objectives of the Course:

- Ability to understand basic principles of chemistry to biological systems and molecular biology.
- To acquaint the students with the structure, chemical properties and biological significance of macromolecules of physiological importance.

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

- Understand the principles of various fields of chemistry and biology (organic chemistry,analytical chemistry, biochemistry, genetics, metabolism, and molecular biology).
- Apply modern instrumentation theory and practice to biochemical problems.
- On completion of the course the student should be able to know mechanism of body functions and the basic knowledge of chemistry of biomolecule.

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	**Energy :** Transformation of Energy through organisms, • Entropy in organisms, • Energy coupling reactions in Biology. **Biomolecules and the cells : Water :** Polarity of water molecules, • Solvent properties of water, • Hydrogen bonds in water, • Acids, bases and buffers. • Importance of water as a medium for living organisms. **Carbohydrates:** Structure and Biological importance: • Monosaccharides, Disaccharides, Polysaccharides , • Forms of starch ex. Glycogen, starch. **Metabolism of Carbohydrate:** Glycolysis, • Pentose phosphate pathway, • Citric acid cycle and its Control • Electron transport and Oxidative phosphorylation	**10Hrs**
II	**Lipids: Structure and Significance:** • Physiologically important saturated and unsaturated fatty acids, Triacylglycerols, • Phospholipids, • Glycolipids and Steroids.	**10 Hrs**

	• Lipid metabolism : Oxidation of lipids **Proteins :** • Classification and General properties of α-amino acids; • Physiological importance of essential and non-essential α-amino acids. • Levels of organization in proteins(Primary, Secondary, Tertiary and Quaternary) • Structure function and occurrence of Globular and fibrous protein.	
III	**Enzymes :** • Nomenclature and classification; Specificity of enzyme action; sozymes; • Mechanism of enzyme action; • Enzyme kinetics; Factors affecting rate of enzyme-catalyzed reactions; • Derivation of Michaelis-Menten equation and Concept of Km and Vmax, **Regulation of enzyme action:** • Enzyme inhibition .Allosteric enzymes **Nucleic Acids :** • Structure: Purines and pyrimidines, • Nucleosides, Nucleotides, • Nucleic acids, Base pairing. • Cot Curves: • Denaturation and Renaturation of DNA • Types of DNA and RNA, • Complementarity of DNA,	**10 Hrs**

Learning Resources:

- Campbell and Farrel Biochemistry 5th Edition Thomson brook publications, 2006
- U Satyanarayan, Biochemistry
- David L. Nelson, Michael M. Cox, Lehninger Principles of Biochemistry, Macmillan WorthPublishers.
- Rober K. Murray, Daryl K. Grammer, Harper's Biochemistry- McGraw Hill, Lange Medical Books. 25th edition.
- J. L. Jain, Sunjay Jain, Nitin Jain, Fundamentals of Biochemistry S. Chand & Company.
- Dr. Amit Krishna De, Biochemistry S. Chand & Co., Ltd.
- Dr. Ambika Shanmugam Biochemistry , Published by Author.
- C. Kannan, Biomolecules - MJP Publishers, Chennai-5.

ZOO/Mn/T/201 : Value added products of Animals

(This course will be for the students from other discipline of the same faculty, Students are expected to choose the minor from other discipline of the same faculty)

Total Credits : 02 Total Contact Hours : 30 Hrs

Maximum Marks : 50

Learning Objectives of the Course: Learn various product of honey bees and value addition in these products To impart knowledge about fish resources, structure and composition of fish muscles, preservation and processing of fish, marketing of fish products,

To impart knowledge about the status of egg production, composition, nutritive value, preservation, grading, processing packaging and marketing of eggs and egg products.

To impart knowledge about the organization of dairy plants, basic milk operations, cleaning and sanitization of milk processing plants, milk products processing.

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

Apply knowledge and skill to establish its own apiary or provides services to apiary. Learn various product of honey bees and value addition in these products, create scope for entrepreneurship.

Meat products and milk products and Poultry Products processing help in boosting entrepreneurial attitude amongst students wherein they can generate resources of their own.

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	**1)Value added products of honey** – Bee Wax, Bee propolis, Bee Venom, Bee Pollen, etc. Fermented honey (mead), honey paste for dressing wounds, honey jelly, honey caramels, creamed honey, comb honey, honey beer, honey fruit syrup, honey with fruits and nuts and honey gums their manufacture. **2) Value added products of fishes** – Fish protein concentrate, fish oils- fish liver oil and body oil, squalene from shark liver oil, fish gelatin, fish glue, fish maws and isinglass, fish wafers, fish silage, fish skin leather, shark cartilage, fertilizer from fish waste, chitin and chitosan, surumi, roe, ambergris-ready to cook and ready to eat products.	**10 Hrs**
II	**3) Different kinds of goat meat products**-Curried goat, Goat Sausage, Goat Hamburger – Curried goat burrito; Organ products for food and pharmaceuticals. Meat Products: Canned meat, Frozen meat, Cooked and Refrigerated meat, Dried and preserved meat, Cured meat, Prepared meat products, Production methods for Intermediate moisture and dried meat products, **4) Poultry Products:** Poultry meat processing operations in detail along with equipment used – Packaging of poultry products, refrigerated storage of poultry meat, by products – eggs, egg products, Whole egg powder, Egg yolk products, their manufacture, packaging and storage.	**10 Hrs**
III	**5) Milk Products:** Testing and grading of raw milk. Pasteurized, standardized, toned, double toned, sterilized, homogenized, reconstituted, recombined and flavoured milks. Preparation of cultured milks, cultures and their management, yoghurt, Dahi, Lassi and	**10 Hrs**

	Srikhand. Milk products such as Cream, Butter, Ghee, Khoa, Cheese, condensed, evaporated,dried milk and baby food, Ice cream and Kulfi, butter milk, lactose and casein.	

Text Books: Name Authors (as appear on the book), "Title of text Book", Vol…, Edition, Name of Publisher, Year of Publications

ReferenceBooks:

1. Krell,1996. Value-added products from beekeeping.FAO agricultural services bulletin no.124, FAO, United Nations,Rome.http:/www.fao.org/docrep/woo76Eoo.htm.

2. La Bell, F. 1988. Honey :Traditional food finds new uses.Food Process.11:111-114.

3.Spottel,W.1950. (Honey and dried milk). J.A. Barth,Leipzig, Germany,p.323.

4. Gopakumar, K.1997. Tropical Fishery Products. Oxford & IBH Publications.

5. Chandran, K.K., 2000. Post Harvest Technology of Fish and Fish Products. Daya publishing House, New Delhi.

ZOO/GE/OE/T/200 : Wildlife conservation & Management

(It should be chosen compulsorily from the faculty other than that of Major)

Total Credits : 02 Total Contact Hours : 30 Hrs

Maximum Marks : 50

Learning Objectives of the Course:

- The course is an introduction to wildlife management.
- Topics covered are to equip students with adequate knowledge of various biodiversity monitoring methodologies, conservation and management issues of vertebrate pests, wildlife conflict and over abundant species, wildlife health and diseases.

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

- To know the current status and conservation strategies for wildlife conservation and management.
- Develop the ability to work collaboratively on team-based projects.
- Gain an appreciation for the modern scope of scientific inquiry in the field of wildlife conservation management.

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	**Introduction to Wild Life Values of wild life –** • Importance of conservation; World conservation strategies Evaluation and management of wild life Habitat analysis, • Physical parameters: Topography, Geology, Soil and water; • Biological Parameters: food, cover, forage, browse and cover estimation; • Standard evaluation procedures: remote sensing and GIS. • Definition, Levels, Values, Measurement of Biodiversity; Concept of Wildlife. • Man-animal conflict in India; Human-wildlife Coexistence; Eco-tourism; Wildlife Crimes, Sustainable Utilization of Biodiversity Resources	**10 Hrs**
II	**Management of habitats** • Setting back succession; Grazing logging; Mechanical treatment; Advancing the successional process; Cover construction; • Preservation of general genetic diversity; Restoration of degraded habitats. **Estimation of wildlife and its habitat-** • Species Census methods; Species sampling method (Quadrat, Line Transect, Belt Transect, Pit fall, Mark-Recapture technique, Radio-telemetry etc.); • Ethics in Field Studics. Methods of recording field observations; Essential Field kit and its usage; Data analysis • Population estimation Population density, Natality, Mortality, fertility schedules and sex ratio computation; Faecal analysis of ungulates and	**10 Hrs**

	carnivores: Faecal samples, slide preparation, Hair identification, Pug marks and census method • Common diseases of wild animals.	
III	**Biodiversity of Indian zoo** • continent, Bio-geographical region in India, India as a mega diversity nation; India's National Biodiversity Action Plan, • Biodiversity hotspot in India; Species conservation projects in India (Tiger, Rhino, Lion, Turtles, Crocodiles, Birds, Coral reefs).; Management challenges in Tiger reserve. • **Protected areas and Management planning of wild life in protected areas**. National parks & sanctuaries, Important features of protected areas in India; **Wild Life Protection –** • Indian Wildlife (Protection) Act, 1972, Concept of Schedule in Wildlife Protection; Indian Biodiversity Act 2002; • IUCN Red list of Threatened Species; The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	**10 Hrs**

Learning Resources:

- Caughley, G., and Sinclair, A.R.E. (1994). Wildlife Ecology and Management.Blackwell Science.
- Woodroffe R., Thirgood, S. and Rabinowitz, A. (2005). People and Wildlife, Conflictor Co-existence? Cambridge University
- Bookhout, T.A. (1996). Research and Management Techniques for Wildlife andHabitats, 5th edition. The Wildlife Society, Allen Press.
- Sutherland, W.J. (2000). The Conservation Handbook: Research, Management andPolicy. Blackwell Sciences.
- Hunter M.L., Gibbs, J.B. and Sterling, E.J. (2008). Problem-Solving in ConservationBiology and Wildlife Management: Exercises for Class, Field, and Laboratory.Blackwell Publishing.

ZOO/GE/OE/T/200 : Environment & Public Health

(It should be chosen compulsorily from the faculty other than that of Major)

Total Credits : 02 Total Contact Hours : 30 Hrs

Maximum Marks : 50

Learning Objectives of the Course:

- Environmental education is a process that allows individuals to explore environmental issues, engage in problem solving, and take action to improve the environment.
- As a result, individuals develop a deeper understanding of environmental issues and have the skills to make informed and responsible decisions

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

- Students will be able to understand environmental pollution, global warming, climate change and its effects.
- Students will be able to understand interrelationships between a multitudes of factors that can impact on a public health problem, including scientific, medical, environmental factors. Have understanding different types of diseases.

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	**Introduction** Sources of Environmental hazards, hazard identification and accounting, Fate of toxic and persistent substances in the environment, dose Response Evaluation, exposure Assessment. **Climate Change:** Greenhouse gases and global warming, Acid rain, Ozone layer destruction, Effect of climate change on public health	**10 Hrs**
II	**Waste Management Technologies :** Sources of waste, types and characteristics, Sewage disposal and its management, Solid waste disposal, Biomedical waste handling and disposal, Nuclear waste handling and disposal, Waste from thermal power plants, **Case histories on** Bhopal gas tragedy, Chernobyl disaster,	**10 Hrs**

	Seveso disaster and Three Mile Island accident and their aftermath.	
III	**Different types of Pollution:** Air Pollution- Sources and effects, Water Pollution- Sources and effects, Noise pollution Pollution- Sources and effects Pollution control. **Diseases Causes, symptoms and control of** Tuberculosis, Asthma, Cholera, Minamata disease, Typhoid	**10 Hrs**

Learning Resources:

- Cutter, S.L., Environmental Risk and Hazards, Prentice-Hall of India Pvt.Ltd., New Delhi, 1999.
- Kolluru Rao, Bartell Steven, Pitblado R and Stricoff —Risk Assessmentand Management Handbookǁ, McGraw Hill Inc., New York,1996.
- Kofi Asante Duah —Risk Assessment in Environmental managementǁ,John Wiley and sons, Singapore, 1998.
- Kasperson, J.X. and Kasperson, R.E. and Kasperson,R.E., GlobalEnvironmental Risks, V.N.University Press, New York, 2003.
- Joseph F Louvar and B Diane Louver Health and Environmental RiskAnalysis fundamentals with applications, Prentice Hall, New Jersey 1997.

ZOO/VSC/T/200 : Vermicomposting

Total Credits : 01 Total Contact Hours : 15

Maximum Marks :

Learning Objectives of the Course:

- Gain foundational knowledge about vermicomposting as a biological waste management process.
- To introduce the students about biology of some important species of earth worms used in vermiculture.

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

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

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	**Introduction to vermiculture** • Vermiculture - definition, meaning, history, economic importance, value in maintenance of soil structure, role as four r's of recycling (reduce, reuse, recycle and restore). • Role in bio transformation of the residues generated by human activity and production of organic fertilizers. • The matter and humus cycle (product, qualities).ground population, transformation process in organic matter. • Useful species of Earthworms, local and exotic species of earthworms; complementary activities of auto-evaluation; key to identify the species of earthworms. Basic characteristics of earthworm suitable for vermicomposting.	**5 Hrs**
II	**Biology of Eisenia fetida** • Taxonomy Anatomy, physiology and reproduction of lumbricidae. • Vital cycle of Eisenia fetida: alimentation, fecundity, annual reproducer potential and limit factors (gases, diet, humidity, temperature, PH, light, and climatic factors). • Complementary activities of auto evaluation.	**5 Hrs**
III	**Vermicomposting** • Small scale earthworm farming for home gardens - earthworm compost for home gardens.Conventional commercial composting - earthworm composting larger scale (pit, brick and,heap systems, and Kadapa slab method). • Earthworm farming, extraction (harvest), vermicomposting harvest and processing. Vermiwash collection, composition and use. • Enemies of earthworms, sickness and worm's enemies; frequent problems - prevention and fixation. Complementary activities of auto evaluation. • Applications of vermiculture • Benefits of vermicompost, Use of vermicompost in agriculture.	**5 Hrs**

Learning Resources:

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

ZOO/VSC/T/201 : Sericulture

Total Credits : 01 Total Contact Hours : 15

Maximum Marks :50

Learning Objectives of the Course:

- It involves giving students a thorough knowledge about the Silk worm and sericulture, cultivation of food plants, maintenance of the farm, seed technology, silkworm rearing and silk reeling.
- Train the students in identifying the diseases and pests of the food plants. Students get to learn about the quality of various things like leaf, seed cocoon, commercial cocoon and fibre so that they can get maximum return when actually practiced.

Course Outcomes (COs) : After completion of the course, students will be able to - To understand: Morphology of silkworm and its anatomical features like silk gland and secretion of silk.

- Scientific way of silkworm rearing technology of young and late age silkworm for raising assured cocoon must have an idea of characteristics of microbial organisms that causes diseases to silkworm.
- Control and prevention of pests and diseases.

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	**Introduction of Sericulture-** • Definition, history and present status; Life Cycle of Silk worm • Types of silkworms, Non-mulberry Sericulture and Mulberry Silk worms- Eri, muga and Tasar Silkworms, Structure of silk gland and secretion of silk. • Rearing of Silkworms: - Early age and Late age rearing, Rearing house and rearing appliances Disinfectants: Formalin, bleaching powder, Description of types of montages,	**5Hrs**
II	**Pests and Diseases Pests of silkworm**: • Uzi fly, dermestid beetles and vertebrates Pathogenesis of silkworm diseases: Protozoan, viral, fungal and bacterial • Control and prevention of pests and diseases • Introduction to mulberry, Varieties of mulberry and maintenance of mulberry garden, Diseases of mulberry.	**5 Hrs**
III	• Post cocoon processing – Stifling and reeling, **Prospects of Sericulture in India:** • Sericulture industry in different states, potential in mulberry and non-mulberry sericulture. • Economic importance of silk. • Visit to various sericulture centres and submission of Project report.	**5Hrs**

Learning Resources:

- Manual on Sericulture; Food and Agriculture Organisation, Rome 1976
- Handbook of Practical Sericulture: S.R. Ullal and M.N. Narasimhanna CSB,Bangalore
- Silkworm Rearing and Disease of Silkworm, 1956, Ptd. By Director of Ptg., Stn. &Pub. Govt. Press, Bangalore
- Appropriate Sericultural Techniques; Ed. M. S. Jolly, Director, CSR & TI, Mysore.
- Handbook of Silkworm Rearing: Agriculture and Technical Manual-1, Fuzi Pub. Co.Ltd., Tokyo, Japan1972.
- Manual of Silkworm Egg Production; M. N. Narasimhanna, CSB, Bangalore 1988.

- Silkworm Rearing; Wupang—Chun and Chen Da-Chung, Pub. By FAO, Rome 1988.
- A Guide for Bivoltine Sericulture; K. Sengupta, Director, CSR & TI, Mysore 1989.
- Improved Method of Rearing Young age silkworm; S. Krishnaswamy, reprinted CSB,Bangalore, 1986.

ZOO/VSC/P/226 : Vermicomposting (Practical) Total Credits : 01 Total Contact Hours : 30 Maximum Marks : 50		
Module No.	**Topics / actual contents of the syllabus**	**Contact Hours**
I	1. Preparation of vermicompost bed, Vermicompost collection, earthworm separation, Air drying of vermicompost, sieving and storing. 2.Vermiwash collection and processing 3. Study of vermicompost equipments, devices, vermiwash. 4. Preparation of vermibeds and maintenance.	**10 Hrs**
II	5. Harvesting and packaging of vermicompost. 6.Study of external features of Eisenia fetida / Pheretima posthuma 7.Key to identify different types of earthworm	**10 Hrs**
III	8. Visit to vermicomposting farm, Field visit for collection of earthworm and their identification.	**10 Hrs**

ZOO/VSC/P/227 : Sericulture (Practical)

Total Credits : 01 Total Contact Hours : 30

Maximum Marks : 50

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	1. Requirements for sericulture Rearing appliances used in rearing and seed preparation mulberry silkworms (Drawings/sketches)(can be procured from District Sericulture Office) 2. Identification of the morphological features of egg, larva, pupa, cocoon and moths of different non- mulberry silkworms 3. Study of life cycle of Silkworm Bombyx mori: 4 Anatomy of Silkworm Cocoon characters of popular uni-, bi- and multivoltine races. 5 Study of silk gland : Location of silk gland and its structure, (Live if reared in college/Preserved specimen) 6 Study of eggs after getting DFL and Chawky rearing(DFL can be procured from District Sericulture office and live demonstration of Chawky rearing can be done in the lab)	**10 Hrs**
II	7 Study of process harvesting and storage of Cocoon.(Live demonstration/ photograph). 8 Study and selection of planting of variety of Mulberry plant and establishment of Mulberry garden(Mulberry varieties and Mulberry garden can be planted in college garden) 9 Identification and study of Sericulture products : Cotton and Silk Yarn different types, Silk Yarn, Noil Yarn cotton, wool and synthetic fiber (nylon/polyester)Identification of Tasar, Eri and Muga raw silk. 10. Reeling sector visit and demonstration.	**10 Hrs**
III	**Study of Silkworm disease** 11. Identification of different diseased silkworms based on external symptoms (Grasserie, Flacherie, Muscardine and Pebrine) 12 Identification of permanent slide of bacteria, spores of Pebrine, polyhedral of NPV, spores of Muscardine /mycelial mat. 13Methods of applications of silkworm bed disinfectants for management of silkworm diseases. 14Study of pests, predators and diseases of mulberry silk worm.(Photographs, Preserved specimens)	**10Hrs**

BSc Second Year: 4th Semester

Template of Course / Paper Contents:

(Respective BoS is expected to use following template for syllabus of each course / paper)

ZOO/DSC/T/250 : Genetics

Total Credits : 02 Total Contact Hours : 30 Hrs

Maximum Marks : 50

Learning Objectives of the Course:

- This course covers genetics, the science of heredity from its basic principles to the mostrecent advances in the field.
- Imparts basic knowledge of classical (transmission) and molecular genetics.

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

- Comprehensive, detailed understanding of the chemical basis of heredity.
- Comprehensive and detailed understanding of genetic methodology and how quantification of heritable traits in families and populations provides insight into cellular and molecular mechanisms.

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	**Mendelian Genetics :** • Mendel's laws of inheritance and its Extension • Principles of inheritance, • Incomplete dominance and co-dominance, • Multiple alleles, Lethal alleles, • Epistasis, • Pleiotropy, • Sex-linked, sex-influenced and sex-limited characters inheritance. • Linkage, Crossing Over and Chromosomal Mapping Linkage and crossing over, Cytological basis of crossing over, • Molecular mechanisms of crossing over including models of recombination, Somatic cell hybridization.	10 Hrs
II	**Mutations** : • Mutations and Sex Determination • Types of gene mutations (Classification), • Types of chromosomal aberrations (Classification, figures and with one suitable example of each), • Molecular basis of mutations in relation to UV light and chemical mutagens; • Detection of mutations: CLB method, attached X method. • Chromosomal mechanisms of sex determination in Drosophila and Man **Extra-chromosomal Inheritance :** • Extra-chromosomal Inheritance and Polygenic Inheritance Criteria for extra-chromosomal inheritance,	10 Hrs

	• Antibiotic resistance in Chlamydomonas, • Polygenic inheritance with suitable examples;	
III	**Recombination :** • Recombination in Bacteria and Viruses and • Transposable Genetic Elements • Conjugation, Transformation, Transduction, • Complementation test in Bacteriophage • Transposons in bacteria, • Ac-Ds elements in maize and P elements in Drosophila, • Transposons in humans.	**10 Hrs**

Learning Resources:

- Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). Principles of Genetics. VIII Edition.
- Wiley India Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V Edition.
- John Wiley and Sons Inc Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). Concepts of Genetics. X Edition.
- Benjamin Cummings Russell, P. J. (2009). Genetics- A Molecular Approach. III Edition.
- Benjamin Cummings Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. Introduction to Genetic Analysis. IX Edition.
- W. H. Freeman and Co Fletcher H. and Hickey I. (2015). Genetics. IV Edition.
- GS, Taylor and Francis Group, New York and London
- M.J., Snustad, D.P. Principles of Genetics. VIII Edition. Gardner, E.J., Simmons ,(2008).
- W.S., Cummings, M.R., Spencer, C.A. Concepts of Genetics. X Edition. John Wiley and Sons Inc Klug(2012).
- Genetics- A Molecular Approach. III Edition. Benjamin Cummings Russell, P J..(2009).
- Genes VIII. Benjamin Lewin, Oxford Univ press.(2004)
- Cell biology and Genetics - P.S. Verma and V.K.Agarwal, S. Chand publication
- Genetics - Manju yadav Ist Edition 2003, Discovery publishing House

ZOO/DSC/T/251 : Animal Physiology -II

Total Credits : 02 Total Contact Hours : 30 Hrs

Maximum Marks : 50

Learning Objectives of the Course:

- To enable the students, know about all the physiological processes controlling the human body, functions of hormones and their mechanism of action.
- To explain the role of nerve cells (neuron) in the transmission of nerve impulses.
- To analyse the role of some of the endocrine glands in regulating our growth and behaviour.

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

- Know mechanism of body functions and the basic knowledge of chemistry of biomolecules.
- Students can enlist various sensory receptors in human body and describe the structure and functioning of the sense organs–eye, ear, nose, tongue and skin.
- Students can identify properties of hormones and mention their nature and manner of functioning.
- Know the effects of over functioning (hyperactivity) and hypoactivity (under functioning) of pituitary and thyroid.

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	**Muscle Physiology :** Ultra structure of skeletal muscle, Structure of Sarcomere Muscle contraction –Walk along theory of muscle contraction **Reproductive System :** Histology of testis Physiology of male reproduction and hormone associated with it. Semen and its composition, Histology of ovary Physiology of female reproduction : Menstrual cycle and role of Hormones in female reproduction Methods of contraception in male and female.	**10 Hrs**
II	**Endocrine System :** Position, structure of endocrine glands and functions of its hormones – Anterior and Posterior Pituitary, Thyroid gland Parathyroid gland Pancreas Adrenal gland Mechanism of action of protein and steroid hormones Regulation of hormone secretion- Feedback mechanism of Thyroid hormones	**10 Hrs**
III	**Disease physiology** Diabetes: causes and symptoms and remedial measures	**10 Hrs**

	Obesity: causes , symptoms and remedial measures Anemia : causes and symptoms and remedial measures Heart ailments : Atherosclerosis,Coronary heart disease(CHD) : Causes, symptoms and remedial measures. Alzheimer's disease : Causes, symptoms and remedial measures. Parkinson disease : Causes, symptoms and remedial measures. Hyperthyroidism and Hypothyroidism : Causes, symptoms and remedial measures. Polycystic ovarian disease (PCOD): Causes, symptoms and remedial measures.	

Learning Resources:

- Guyton, A.C. & Hall, J.E. (2006). Textbook of Medical Physiology. XI Edition. Hercourt Asia PTE Ltd. /W.B. Saunders Company.
- Tortora, G.J. & Grabowski, S. (2006). Principles of Anatomy & Physiology. XI Edition John Wiley & sons
- Victor P. Eroschenko. (2008). diFiore's Atlas of Histology with Functional correlations. XII Edition. Lippincott W. & Wilkins.

ZOO/DSC/P/276 : Genetics (Practical) Total Credits : 02 Total Contact Hours : 60 Hrs Maximum Marks : 50		
Module No.	**Topics / actual contents of the syllabus**	**Contact Hours**
I	1. To study the Mendelian laws and gene interactions. 2. Problems sets on Mendelian and non Mendelian inheritance, including monohybrid, dihybrid, and trihybrid crosses, incomplete dominance, co-dominance, epistasis, and gene interactions. (Major and Minor Problems) Chi-square analyses using seeds/beads/Drosophila.	20 Hrs
II	3. Experiment in multiple alleles, co dominance and epistatic interaction. 4. Linkage maps based on data from conjugation, transformation and transduction in bacteria. 5. Linkage maps based on data from Drosophila crosses. 6. Blood group determination (ABO and Rh system) and genetic basis of inheritance .	20 Hrs
III	7. Study of Electrocardiogram. 8. Human karyotyping and identification of chromosomal abnormalities (Down syndrome, Klinefelter syndrome, Turner syndrome) 9. Study of human karyotype (normal and abnormal). Identification of genetic disorders using case studies and clinical karyotyping 10. Pedigree analysis of some human inherited traits. 11. Study of phenotypic variations in *Drosophila* (e.g., eye color, wing shape) Practical record.	20 Hrs

ZOO/DSC/P/277 : Animal Physiology –II (Practical) Total Credits : 02 Total Contact Hours : 60 Hrs Maximum Marks : 50		
Module No.	Topics / actual contents of the syllabus	Contact Hours
I	1. Recording of simple muscle twitch with electrical stimulation (or Virtual). 2. Demonstration of the unconditioned reflex action (Deep tendon reflex such as knee jerk reflex) or 3. (Virtual).	20 Hrs
II	4 Microscopic examination of the stages of gametogenesis 5 Study of endocrine glands in histological permanent slides- Mammalian Pituitary, Pancreas, Testis, Ovary, Adrenal, Thyroid and Parathyroid 6 To detect blood sugar level by using Glucometer. 7 Enumeration of Red Blood Cells (RBCs) and White Blood Cells (WBCs) using haemocytometer.	20 Hrs
III	8 Study of Electrocardiogram. 9 Sperm observation , counting 10. Disease related practicals –case study, survey, and visit to path. Lab. Blood Bank, for study and submission of report Practical record.	20 Hrs

ZOO/Mn/T/250 : Economic Zoology

(This course will be for the students from other discipline of the same faculty, Students are expected to choose the minor from other discipline of the same faculty)

Total Credits : 02 Total Contact Hours : 30 Hrs

Maximum Marks : 50

Learning Objectives

- It deals with the application of zoological knowledge for the benefit of mankind by understanding the economy, health and welfare of humans.
- It includes culturing organisms for mass production for human use and to control or eradicate harmful ones.
- It will bring to fore the multidisciplinary nature of Economic Zoology as it includes sericulture, apiculture, aquaculture, pisciculture and poultry culture.

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

- Develop an understanding of the beneficial higher and lower organisms in terms of economic prospective.
- Develop a critical understanding of the contribution of organisms to the welfare of society.

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	**Aquaculture** Definition, scope, and significance of Aquaculture Prawn culture- shrimp farming, seed production, nutrition, and health management **Pisciculture** Basic concept on mono and composite fish culture (Carp culture); Fish diseases caused by Ichthyophthirius multifilis, Trichodinia sp. and Ichthyobodo sp., symptoms and control; Setting and Maintenance of aquarium. **Pearl culture**.- Introduction to pearl culture. Global and national status of pearl culture, History of pearl culture ,Significance of pearl culture.	10 Hrs
II	**Sericulture** Different species and economic importance of silkworm, Mulberry and Non-mulberry Sericulture (Eri, Muga, Tussar), Sericulture techniques. **Apiculture** Different species of Honeybee, types of beehives - Newton and Lang troth, Bee Keeping equipment, Methods of extraction of honey (Indigenous and Modern) and its processing, Products of apiculture industry (Honey, Bees Wax, Propolis, Royal jelly, Pollen etc.) and their uses.	10 Hrs
III	**Poultry culture**: Introduction, Importance of poultry farming in agriculture and economy. Types of poultry (broilers, layers, dual-purpose) Classification of poultry species (chickens, turkeys, ducks, geese, etc.),	10 Hrs

	Types of poultry houses (open-sided, closed, cage systems), Equipment used in poultry farming (feeders, drinkers, egg trays, etc.) Biosecurity measures and disease prevention, Poultry Nutrition and Feeding, Processing and Marketing of Eggs and Meat, Common poultry diseases and their prevention, Poultry waste management, Government policies and subsidies for poultry farming.	

Learning Resources:

- Shukla, G.S. and Upadhyay, V.B.: Economic Zoology, 4e, 2002, Rastogi.
- D. B. Tembhare. (2017) Modern Entomology. Published by Himalaya Publishing House (ISO 9001: 2008 Certified).
- Dawes, J. A. (1984). The Freshwater Aquarium, Roberts Royee Ltd. London.
- S.S. Khanna and H.R. Singh. A Textbook of Fish Biology & Fisheries Published by Narendra Publishing House.3rdEdition. (ISBN13: 9789384337124).
- Dokuhon, Z.S. (1998). Illustrated Textbook on Sericulture. Oxford & IBH Publishing Co., Pvt. Ltd. Calcutta.
- Text Book of Poultry Science, P V Sreenivasaiah, Write and Print Publications, ISBN No. 9788192970592,
- Poultry Science Practices, Nilothpal Ghosh, CBS Publication & Distributions, 2015
- Text Book of Poultry Science, P V Sreenivasaiah, Write and Print Publications, ISBN No. 9788192970592,
- Principles of Poultry Science, 1996, CAB Publishers, ISBN 9780851991221
- 9A Text Book of Animal Husbandry, C. C. Banerjee, Oxford and IBH, Publish Co, ISBN: 9788120412606

ZOO/Mn/T/251 : Agricultural Entomology

(This course will be for the students from other discipline of the same faculty, Students are expected to choose the minor from other discipline of the same faculty)

Total Credits : 02 Total Contact Hours : 30 Hrs

Maximum Marks : 50

Learning Objectives of the Course:

To impart knowledge on major pests of horticultural and plantation crops regarding the extent and nature of loss, seasonal history and their integrated management. To familiarize the students about nature of damage and seasonal incidence of insect pests that cause loss to major field crops and their effective management by different methods

To train the students with theory and practice of biological control, mass production techniques and field evaluation of various biological control agents like parasitoids, predators and various entomopathogenic & microorganisms.

To familiarize the students with management of insect-pests with respect to behavioural control (attractants, pheromones and repellants); and insecticidal control (different groups of insecticides their field properties) and their application techniques.

Course Outcomes (COs) : After completion of the course, students will be able to - After completion of the course students will be acquainted with various insect-pests of horticultural crops their damage symptoms . Students will able to identify the common natural enemies of crop pests. They acquire the knowledge of mass production of egg, common predators, microbes and their laboratory hosts.

The students will be aquainted with the different means of insect-pest management in agricultural crops. They will also learn about the different application techniques of insecticides, their dosages, different types of chemical imposition appliances etc. under field condition.

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	1)**Introduction History of entomology** in India, evolution of insects as a most successful group in the animal kingdom, classification of insects up to the orders mention important families, morphology of insects-Head, thorax, abdomen, wings, genitalia, appendages, types of mouth parts and its structures, sampling methods for insect population 2) **Insect pest and pest out break** Definition of pest, categories of pests, parameters of insect population levels, causes of insect outbreak, accidental introduction of pests from foreign countries, resurgence, and pest resurgence, methods of collection and sampling of insect populations.	**10 Hrs**
II	3) **Major crops pests in India** Distribution, damage, bionomics and management of various insect pests- Wheat Pests-Aphids, Jowar pests, Cotton pests-leaf hopper, cotton aphids; thrips, whitefly, mealy bug; Mango pests- stemborer, Pest of sugar cane-Pyrilla perpusiella	**10 Hrs**
III	4) **Biological and Chemical control of pests** History, principles and scope of biological control and Chemical control ; important groups of parasitoids, predators and pathogens;	**10 Hrs**

	principles of classical biological control- Successful biological control projects, analysis, trends and future possibilities of biological control. 5) **Integrated pest management (IPM)** Definition and concept, Principles of pest management and history, Ecological methods of pest management-physical, mechanical and cultural,	

TextBooks: Name Authors (as appear on the book), "Title of text Book", Vol…, Edition, Name of Publisher, Year of Publications

ReferenceBooks:

1. Ananthakrishnan, T. N. (Ed.). (1992). Emerging Trends in Biological Control of Phytophagous Insects. Oxford & IBH publishing Co. Pvt. Ltd., New Delhi.

2. Ananthakrishnan, T. N. (1984). Biology of Gall Insects. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

3. Apple, J. L. and Smith, R. R. (1976). Integrated Pest Management. Plenum Press, New York. 3. Atwal, A. S. (1986). Agricultural Pests of India and South East Asia. Kalyani Publishers, Ludhiana. 4. Banerjee, B. (1988). An introduction to Agricultural Acarology - Biology and control of mite pests in the tropics. S.K. Dutta Associated Publishing Co., 8798/7, Shidipura, Karolbagh, New Delhi.

5. Bucherl, W. and Buckley, E. (Eds). (1971).Venomous Animals and Their Venoms. Academic Press New York, London.

6. Claussen, C. P. (1962). Entomophagous Insects. Haner Publishing Co.,

7. David, B. V. and Ananthakrishnan, T. N. (2004). General and Applied Entomology Second Edition. Tata McGraw Hill Publishing Company Limited, New Delhi.

8. Debach, Paul (1964). Biological Control of Insect Pests and Weeds. Chapman & Hall.

9. Dent, D. (1991). Insect Pest Management, CAB International, UK.

10. Evans, G. O. (1992). Principles of Acarology, CAB International, U.K.

11. Kilgore. W. W. and Doutt, R. L. (1967). Pest Control. Academic Press, London

12. Krantz, G. W. (1978). A manual of Acarology, D.S.U. Book Stores, Corvallis, Oregon.

13. Nair. M. R. G. K. (1975, 1996). Insect & Mites of Crops in India. ICAR, New Delhi

14. Pedigo, L. P. (1996). Entomology & Pest Management Practice. Hall India Pvt. Ltd., New Delhi.

15. Ramakrishna Ayyer, R. V. (1963). A Handbook of Economic Entomology of South India. Govt. of Madras publication.

ZOO/GE/OE/T/250 : Food Nutrition & Health

(It should be chosen compulsorily from the faculty other than that of Major)

Total Credits : 02 Total Contact Hours : 30 Hrs

Maximum Marks : 50

Learning Objectives of the Course:

- The prime focus is to provide the students with a basic understanding of the relationship between food, nutrition and health.
- It is important to understand this link and change eating habits in accordance to one`s age, pregnancy, lactation and physical activity. Mental health is also affected largely by our lifestyle.
- Apart from physical activity, the intake of the required vitamins, minerals and antioxidants also nourish the brain. Malnutrition is the main cause of impairment of growth in young children and infants and leads to diseases like Marasmus.
- Moreover, food hygiene including food and water-borne infections along with food spoilage has also been covered in this course.

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

- Have a better understanding of the association of food and nutrition in promoting healthy living.
- Think more holistically about the relationship between nutrition science, and social and health issues.
- Move on to do post-graduation studies and apply for jobs as food safety officers, food analysts, food inspectors, food safety commissioners or controllers for jobs in organizations like FSSAI. Specialize in various fields of nutrition

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	**Basic concept of food and nutrition** Food Components and food nutrients, Concept of a balanced diet, nutrient needs and dietary patterns for various groups- adults, infants, school children, adolescents and elderly. Food Pyramid, Nutritional anthropometry- BMI, waist-to-hip ratio, skinfold test and bioelectrical impedance; interpretation of these measurements. Nutritional Biochemistry Carbohydrates, Lipids, Proteins, their dietary source and role Vitamins- their dietary source and importance Minerals- their biological functions. Dietary Fibres - Definition, their dietary source and nutritional importance. Elementary idea of Probiotics, Prebiotics, and Organic Food.	**10 Hrs**
II	**Health and deficiency** Definition and concept of health, Major nutritional Deficiency diseases- (kwashiorkor and marasmus), Deficiency disorders, their causes, symptoms, treatment, prevention and government programmes, if any. Life style disease and social health problems Life style related diseases-	**10 Hrs**

	hypertension, diabetes mellitus, Atherosclerosis and obesity Their causes and prevention through dietary and lifestyle modifications,	
III	**Social health problems** smoking, alcoholism, drug dependence and Common ailments- cold, cough, and fevers, their causes and treatment. Food hygiene Food and Waterborne infections; Bacterial infection: Cholera, typhoid fever, dysentery; Brief account of food spoilage: Causes of food spoilage and their preventive measures.	**10 Hrs**

Learning Resources:

- Shashi Goyal& Pooja Gupta. Food, Nutrition and Health (ISBN: 9788121940924)
- Linda Tapsell. Food, Nutrition and Health. I Edition , Oxford(ISBN: 978- 0195518344)
- Avantina Sharma. Principles of Therapeutic Nutrition and Dietetics.. CBS Publishers and Distributors Pvt. Ltd.
- Elia M et al. (eds) Clinical Nutrition. Wiley-Blackwell, A John Wiley & Sons Ltd.
- Gibney MJ et al. (eds) (2009) Introduction to Human Nutrition. Wiley-Blackwell A John.

ZOO/GE/OE/T/250 ;Wildlife photography and Nature interpretation

(It should be chosen compulsorily from the faculty other than that of Major)

Total Credits : 02 Total Contact Hours : 30 Hrs

Maximum Marks : 50

Learning Objectives of the Course:

- To develop an understand of Wildlife and their habitat
- To critically evaluate the photographic processes for nature and wildlife, within the larger context of biodiversity documentation
- To understand conservation photography and challenges of wildlife photography
- To understand the importance of composition in wildlife photography

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

- Opt for wildlife photography as a career option
- Engage in digital photography and post processing
- Persue research for effective photographic documentation.

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	**Wild Life Protection –** • Indian Wildlife (Protection) Act, 1972,Concept of Schedule in Wildlife Protection; • Indian Biodiversity Act 2002; IUCN Red list of Threatened Species; Amendments in the IPA-2024. • Rivet popper hypothesis, • **Concepts in Wildlife :** keystone species, flagship species	**10 Hrs.**
II	**Wildlife Photography** – Basic Principles of photography, • Components of a Photographic camera. • Fundamentals of DSLR and Digital camera , • Types of camera lenses and accessories; • Understanding Exposure, Exposure Triangle, • Law of reciprocity, Sunny Rule 16, Depth of Field and Hyperfocal distance. • Ethics and Legalities.	**10 Hrs**
III	**Nature interpretation:** • Definition of Nature interpretation • Difference between environmental education and nature interpretation • Qualities of Nature interpretation • Purpose of Interpretation with example with object (Photograph) • Principle and essence of Nature interpretation	**10 Hrs**

Learning Resources: Wildlife Photography:

- "Sunlight and Shadows: An Indian Wildlife Photographer's Diary" by M.Y. Ghorpade
- "Moments from the Wild: The Best of Indian Wildlife Photography" by Anand Shinde et al."Wildlife of India" by Bikram Grewal
- "The Bera Bond" by Sundeep Bhutoria
- "Kaadum Camerayum" by N.A. Naseer
- "Hidden India: A Journey to Where the Wild Things Are" by Latika Nath and Shloka Nath **Nature Interpretation**: "This Fissured Land: An Ecological History of India" by Madhav Gadgil and Ramachandra Guha
- "Nature Conservation in the New Economy: People, Wildlife and the Law in India" edited by Ghazala Shahabuddin and K. Sivaramakrishnan
- "The Fall of a Sparrow" by Salim Ali The autobiography of India's renowned ornithologist offers insights into his life's work and the evolution of bird study and conservation in the country
- ."Cities and Canopies: Tree s in Indian Cities" by Harini Nagendra and Seema Mundoli This book explores the natural history of urban trees in India, highlighting their ecological and cultural significance in city landscapes.
- "The Vanishing: India's Wildlife Crisis" by Prerna Singh Bindra An unflinching look at the unacknowledged crisis facing India's wildlife, discussing the threats and conservation efforts needed to protect the country's natural heritage.
- https://bookauthority.org/books/best-wildlife-photography-books

ZOO/SEC/T/250 : Biological Techniques

Total Credits : 01 Total Contact Hours : 15 Hrs

Maximum Marks :50

Learning Objectives of the Course:

- This is the only laboratory course taught independently of lecture courses. It has full hands on approach to expose the students to modern techniques and methodologies
- Student should understand the various techniques used in biological sciences.
- To develop students competencies in biotechniques and its applications in a technology-rich, interactive environment.
- Understand the mechanics of common laboratory assays and how they can be applies to research.
- Aims to make students learn about modern instruments for various analytical work

Learning Outcome: After successfully completing this course, the students will be able to

- Understand the purpose of the technique, its proper use and possible modifications/ improvement.
- Learn the theoretical basis of technique, its principle of working and its correct application.
- Learn the maintenance laboratory equipments / tools, safety hazards and precautions.
- Understand the technique of cell and tissue culture. Learn the preparation of solution of given percentage and molarity.
- Understand the process of preparation of buffer. Learn the techniques of separation of amino acids, proteins and nucleic acids.

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	**Principles and uses of analytical instruments –** Balances, pH meter, Calorimeter, **Microscopy :** Microscopy: Introduction to Microscopy. Definitions-Resolving Power, Limit of Resolution and Magnification, Numerical Aperture **Types of microscopes** bright field, dark-field, phase contrast. Basic principles of Light Microscopy Electron Microscopy **Microtomy:** Tissue preparation, fixation, block, preparation, sectioning staining, dehydration and mounting. **Principle and Applications of** Paper chromatography,	**10 Hrs**
II	**Tools and techniques in Biochemistry and Physiology – .** Extraction of Tissue Glycogen, Proteins, Lipids and Nucleic Acids. Subcellular Fractionation by Differential Centrifugation. **Principle and applications of Electrophoresis:** Separation of Biomolecules by Agarose gel electrophoresis	**10 Hrs**
III	**Computer aided techniques for** data presentation, data analyses, statistical techniques,	**10 Hrs**

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

Learning Resources:

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

ZOO/ SEC /T/251 : Fish hatchery Management

Total Credits : 01 Total Contact Hours : 15 Hrs.

Maximum Marks :50

Learning Objectives of the Course:

- Enable students to understand the breeding techniques
- Enable students to understand fish seed trade and transport
- Enable students to understand fish hatcheries and management

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

- Understand different types of fish hatcheries and their operation.
- Gain the knowledge about isolation, preservation and collection of pituitary
- Understand behaviour of spawn in relation to hydro biological characters

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	**Introduction**: Factors affecting fish breeding fish breeding **Bundh breeding Techniques**: Types of bundhs (dry and wet bundhs), artificial breeding by stripping method. **Induced breeding by hypophysation**: Definition, hormones responsible for induced breeding, position of pituitary, removal of pituitary and preservation of pituitary for future use. Preparation of pituitary gland suspension for injection and dosages. Collection, rearing and selection of brooders Synthetic hormones used in induced breeding	05 Hrs
II	**Principle, structure and management of fish hatcheries:** a) Breeding hapa and Hatching hapa b) Glass jar hatchery c)Bin hatchery d)CIFE D-81 model (Dwivedi-80) model e) CIFE D-81 model (Dwivedi-81) model f) Chinese hatchery	05 Hrs
III	**Fish seed trade and transport** Fish seed identification Fish seed trade in India **Fish seed transportation system**: Open and close transportation system Causes of seed mortality in transportation Use of chemicals in live fish transportation Anaesthetic and antibiotics used in transportation Techniques in fish seed release	05 Hrs

Learning Resources:

- Jhingran, V.G. and Pullin, R.S.V.1985.Hatchery Manual for the Common, Chinese and Indian major carps, ICLARM, Philippines.
- Chattopadhyay, Nihar Ranjan. 2016.Induced Fish Breeding: A Practical Guide for Hatcheries, Academic Press Inc.,370pp.
- Khanna, S.S.1980.An Introduction to Fishes, Central Book Depot,486pp.
- Venkataramanujam, K. and Ramanathan, N.1994.Manual of Finfish Biology, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi,110pp.
- Robert et al., 1986.Fish Hatchery Management,United States Department of the Interior Fish and Wildlife Service,Washington,D.C.,517pp.
- Sakhare, V.B.2012.Inland Fisheries, Daya Publishing House, New Delhi,336pp.
- Gupta and Mohapatra., 2008.Textbook of Breeding and Hatchery Management of carps, Narendra Publishing Housr,Delhi,163pp.
- Piska, Ravishankar.1999.Fisheries and Aquaculture, Lahari Publications, Hyderabad.

ZOO/ SEC /P/276 : Biological Techniques (practical)

Total Credits : 01 Total Contact Hours : 30 Hrs

Maximum Marks : 50

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	1. Checking the efficiency of pipette using a weighing balance and known measurements of volume. Use and application of micropipettes to measure and dispense solutions. 2. Use and application of analytical weighing balance to weigh chemicals. 3 Preparation of stock solutions and standard solutions and use of serial dilution technique in preparation of dilute solutions. 4 Calculating molecular weight of a substance and preparation of molar solutions of different chemicals. 4. Preparation of percent solutions and calculations to determine final concentrations. 5 Adsorption chromatography to separate coloured mixtures.	**10Hrs**
II	6. Preparation of buffer and determination of pH. 7. Identification of amino acids in the mixture using paper chromatography. 8. Tissue fixation, paraffin block preparation, sectioning, staining, dehydration and mounting . 9. Preparation of permanent slides of microscopic organisms/ small insects.	**10 Hrs**
III	10. Handling and use of centrifuge, microscope, 11 colorimeter and electrophoresis 12. Demonstration of bright field, phase contrast, Practical record.	**10Hrs**

ZOO/ SEC /P/277 : Fish hatchery Management(Practical)

Total Credits : 01 Total Contact Hours : 30 Hrs

Maximum Marks :50

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	**Identification and classification of culturable fishes:** *Catla catla, Labeo rohita,* *Cirrhinus mrigala, Cyprinus carpio,* *Ctenopharyngodon idella, Hypophthalmichthyes molitrix,* *Clarias batrachus and Ophicephalus spp.* Sexual dimorphism in culturable fishes	**10 hrs**
II	Identification fry and fingerling stages of culturable fishes. Removal of fish pituitary, its preservation and preparation of extract.-Demonstration of Induced breeding technique	**10 hrs**
III	Estimation of fecundity by different methods (Von Bayer method, Gravimetric method and Volumetric method) Visit to nearby freshwater fish hatchery to know its principle, components and operation.	**10 hrs**

Dr. Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar
Semester Pattern Curriculum under (NEP 2020)Under Graduate Bachelor Degree Programme (B.Sc.)Faculty of Science and Technology Subject- Zoology
Question paper pattern (Theory)

FACULTY OF SCIENCE
B.Sc TERM END EXAMINATION
ZOOLOGY

Paper code- **Paper Name-**

Time: 1 Hour. **Maximum Marks: 30**

N.B . (i) Part 'A' is compulsory.
(ii) Attempt any four questions from Part 'B'.
(iii) Draw neat labeled diagrams wherever necessary.

PART A

Q. 1 Attempt the following. (MCQ/ Fill in the blanks/ Answer in sentence). **10 Marks**

1)

2)

3)

4)

5)

PART B (Full length questions) (Attempt Any **four**)

Q. 2 **05 Marks**

Q. 3 **05 Mark**

Q. 4 **05 Marks**

Q. 5 **05 Marks**

Q. 6 **a)** **03 Marks**

b) **02 Marks**

Q. 7 **a)** **03Marks**

b) **02Marks**

(Note ; in a given structure it should cover entire course curriculum both in part A and Part B)