AC: 02.06.2025 ITEM NO: 26.1

Deccan Education Society's

Kirti M. Doongursee College of Arts, Science and Commerce (AUTONOMOUS)

Affiliated to

UNIVERSITY OF MUMBAI

Syllabus for
Program: Bachelors of Science
Course: F.Y.BSc.(NEP 2020)
Subject: ZOOLOGY

Choice Based Credit System (CBCS)
with effect from
Academic Year 2024-2025

PROGRAM OUTCOMES

PO	Description
A student completing Bachelor's Degree in **Science** Program will be able to	
PO1	**Disciplinary Knowledge:** Demonstrate comprehensive knowledge of the disciplines that form a part of a graduate Programme. Execute strong theoretical and practical understanding generated from the specific graduate Programme in the area of work.
PO2	**Critical Thinking and Problem solving:** Exhibit the skills of analysis, inference, interpretation and problem-solving by observing the situation closely and design the solutions.
PO3	**Social competence:** Display the understanding, behavioral skills needed for successful social adaptation, work in groups, exhibits thoughts and ideas effectively in writing and orally.
PO4	**Research-related skills and Scientific temper:** Develop the working knowledge and applications of instrumentation and laboratory techniques. Able to apply skills to design and conduct independent experiments, interpret, establish hypothesis and inquisitiveness towards research.
PO5	**Trans-disciplinary knowledge:** Integrate different disciplines to uplift the domains of cognitive abilities and transcend beyond discipline-specific approaches to address a common problem.
PO6	**Personal and professional competence:** Performing dependently and collaboratively as a part of team to meet defined objectives and carry out work across interdisciplinary fields. Execute interpersonal relationships, self-motivation and adaptability skills and commit to professional ethics.
PO7	**Effective Citizenship and Ethics:** Demonstrate empathetic social concern and equity centered national development, and ability to act with an informed awareness of moral and ethical issues and commit to professional ethics and responsibility.
PO8	**Environment and Sustainability:** Understand the impact of the scientific solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.

Semester	Course Code	Course Title	Vertical	Credit
I	24ZOOMJ111	Non Chordates I & Basics of Ecology	Major	2
	24ZOOMJP11	Practical based on Non chordates I and Basics of Ecology	Practical	2
	24ZOOOE131	Biodiversity conservation and sustainable development	OE1	2
	24ZOOOE132	Nutrition - deficiency and Lifestyle diseases	OE2	2
	24ZOOVC141	Aquarium Fish Keeping	VSC	2
	24ZOOSE151	Introduction to Marine Biodiversity	SEC	2
II	24ZOOMJ211	Non chordates II and Life Processes	Major	2
	24ZOOMJP21	Practical based on Non Chordates II & Life Processes	Practical	2
	24ZOOOE231	Vector borne disease & its management	OE1	2
	24ZOOOE232	Global climate issues & International summits, agreements	OE2	2
	24ZOOVC241	Value added products from sea	VSC	2

	24ZOOSE251	Marine Entrepreneurship	SEC	2

Course Code	**MAJOR SEM – I**	**Credits**	**Lectures/Week**
24ZOOMJ111	**Paper I- Non Chordates I and Basics of Ecology**	**2**	**2**

Course Outcomes:

After successful completion of this course, students would be able to

CO1: Recall the characteristics of non chordates upto Nemathelminths and various ecological concepts , terminologies and theories.

CO2: Explain the selected features of Protista to Pseudocoelomates along with their evolution and understanding ecological aspects , factors affecting ecosystem.

CO3: Apply knowledge of the diversity of non-chordates to classify and identify different organisms within these phyla. Using ecological understandings to solve the various environmental challenges.

CO4: Compare and contrast the morphological and ecological characteristics of different non-chordate groups, highlighting their evolutionary adaptations. Analysing the effect of anthropological activities on various taxa in different food chains and food webs.

Unit	**Topics**	**No of Lectures**
I	**Non Chordates I** **General characteristics and classification** 1.1. Levels of organization 1.2. Kingdom Protista, 1.3. Phylum Porifera, Cnidaria,Ctenophora 1.4. Platyhelminthes, Nemathelminthes **Selected features of Protista to Peudocoelomate**	**15**

	1.5. Locomotion and Reproduction in Protista, 1.6. Canal system in sponges, 1.7. Polymorphism in Coelenterates , Concept of Corals and coral reefs, 1.8. Phylum -Platyhelminthe, Nemathelminthes- Parasitic adaptations	
II	**Basics of Ecology** 2.1 Concept of Ecosystems ,Ecosystem - Definition and components 2.2 Biogeochemical cycles (Water, Oxygen, Nitrogen, Sulphur) 2.3 Fresh water ecosystem – Lentic and Lotic 2.4 Types of ecosystem - Forest Ecosystem, Grass land Ecosystem, Dessert Ecosystem, Marine Ecosystem 2.5 Animal interactions (commensalism, mutualism, predation, antibiosis, parasitism) 2.6 Niche concept 2.7 Human census (India) – Concept, mechanism and significance 2.8 Population Ecology Vs Community Ecology	**15**

References:-

1. Invertebrates -R.L.Kotpal
2. Barnes, R. S. K.; Calow, P.; Olive, P. J. W.; Golding, D. W.; Spicer, J. I. (2002) The Invertebrates: a Synthesis, Blackwell Publishing.
3. Hickman, C.; Roberts, L.S.; Keen, S.L.; Larson, A. and Eisenhour, D. (2018) Animal Diversity, McGraw-Hill.
4. Holland, P. (2011) The Animal Kingdom: A Very Short Introduction, Oxford University Press.
5. Kardong, K.V. (2006) Vertebrates: Comparative Anatomy, Function, Evolution (4th edition), McGraw- Hill.
6. Barrington, E.J.W. (1979) Invertebrate Structure and Functions. II Edition. E.L.B.S. and Nelson.
7. Boradale, L.A. and Potts, E.A. (1961) Invertebrates: A Manual for the use of Students. Asia Publishing Home.

8. Bushbaum, R. (1964) Animals without Backbones. University of Chicago Press.

9. Invertebrate Zoology-Jordan and Verma

10. Introduction to Ecology and Wildlife - University Text Book of Zoology, F.Y.B.Sc. Semester II Course 3. University Press.

11. Fundamentals of Ecology - Eugene P. Odum and Grey W. Barrett, Brook Cole/ Cengage learning

12. Fundamentals of Ecology - M. C. Dash , Tata McGraw Hill company Ltd, New Delhi

13. Ecology - Mohan P. Arora , Himalaya Publishing House

14. Field Biology and Ecology -- Alen H. Benton and William E. Werner ,Tata McGraw Hill ltd, New Delhi

15. Ecology and Environment - Sharma P. D , Rastogi Publication, Mumbai Ecology : Principles and Applications - Chapman J.L , Cambridge University trust

16. Ecology - Subramaniam and Others, Narosa Publishing House

17. Wildlife laws and its impact on tribes - Mona Purohit, Deep and deep Publication

18. Biology - Eldra Solomon, Linda R. Berg and Diana W. Martin, Thomson/ Brooks/ Cole

19. Economic Zoology, Biostats and Animal Behaviour - Shukla, Mathur, Upadhyay, Prasad. Rastogi Publications.

Course Code	Practical based Non chordates I and Basics of Ecology	Credits	Lectures/Week
24ZOOMJP11	Practical 1 (Unit 1 + Unit 2)	2	4

Course Outcomes

After successful completion of this course, students would be able to

CO1:Memorize important terminology related to animal diversity and population ecology, such as population size, density, and growth rate.

CO2: Explain the diversity of animal forms, adaptations, and life cycles, including the differences between major animal phyla and understand the basic principles and theories of population ecology, such as population dynamics, factors influencing population growth, and patterns of dispersion.

CO3:Use appropriate statistical methods to analyze population data and interpret the results.

CO4:Evaluate the impacts of environmental factors, such as habitat fragmentation or climate change, on animal populations.

Practical No.	Practicals	Total Hours
1	Study of *Paramecium* W.M., Binary fission and Conjugation in Paramecium	60
2	Life stages of *Plasmodium vivax, Trypanosma gambiense and Entamoeba histolytica* (Slides/Micro-photographs)	
3	Examination of pond water for protists	
4	Study of *Sycon* (including T.S. and L.S.), *Hyalonema,* and *Euplectella*	
5	Study of *Obelia, Physalia, Millepora, Aurelia, Ephyra* larva, *Tubipora, Corallium, Alcyonium, Gorgonia, Metridium* (including T.S. and L.S.)	
6	Study of adult Schistosoma haematobium, *Taenia solium* and their life stages (Slides/microphotographs)	
7	Study of adult *Ascaris lumbricoides, Wuchereria bancrofti* and their life stages (Slides/micro-photographs)	
8	Interpretation of the given graphs/ tables and comment on pattern of population nature	

	i. Survivorship curve ii. Fecundity tables iii. Age structure iv. Sex ratio	
9	a) Calculation of Natality, Mortality, Population density from given data b) Estimation of population density by capture recapture method	
10	Interpretation of Growth curves (Sigmoid and J shaped)	
11	Estimation of hardness from given water sample (tap water v/s well water)	
12	Estimation of Free carbon dioxide (Free CO2) from two different samples- aerated drinks(diluted) v/s tap water	
13	Identification and interpretation of aquatic and terrestrial (Grassland) food chains and food webs	
14	Construction of food chain/food web using given information/data.	
15	a) Identification and interpretation of ecological pyramids of energy, biomass and number b) Construction of different types of pyramid from given data.	
16	Visit any ecosystem/ institutional visit/ museum visit and submit the report.	

References :-

Note: Classification to be followed from "Barnes, R.D. (1982). Invertebrate Zoology, V Edition,"

1. Barnes, R.D. (1982). Invertebrate Zoology, V Edition. Holt Saunders International Edition.

2. Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). The Invertebrates: A New Synthesis, III Edition, Blackwell Science

3. Barrington, E.J.W. (1979). Invertebrate Structure and Functions. II Edition, E.L.B.S. and Nelson

4. Boradale, L.A. and Potts, E.A. (1961). Invertebrates: A Manual for the use of Students. Asia Publishing Home

5. R.L Kotpal-A textbook on Invertebrate Zoology Jordan and Verma -Invertebrate Zoology

Course Code	Open Elective SEM –1 Paper -1	Credits	Lectures/Week
24ZOOOE131	**Biodiversity Conservation and Sustainable development**	**2**	**2**

Course Outcomes:

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

CO1:Outline various terms, goals, concepts and theories with respect to biodiversity conservation and sustainable development

CO2:Develop understanding for the environment and importance of bio diversity and Learn about the judicious utilisation of natural resources

CO3:Use the concept of green technology and the eco-friendly practices and other prospects of environment protection and reduce the biodiversity loss.

CO4:Evaluate various anthropogenic activities and regulatory provisions in the context of environment and sustainable development .

Unit	Topics	No of Lectures
I	**Biodiversity Conservation** 1.1: Introduction to Biodiversity : Definition, Concepts, Scope and Significance . 1.2: Levels of Biodiversity - Introduction to Genetic, Species and Ecosystem Biodiversity. 1.3: Introduction of Biodiversity Hotspots - (Western Ghats and Indo-Burma Border) 1.4: Values of biodiversity - Direct and Indirect use value 1.5: Threats to Biodiversity - Habitat loss and Man-Wildlife conflict 1.6: Biodiversity conservation and management 1.6.1: Conservation strategies: insitu, ex-situ, National parks, Sanctuaries and Biosphere reserves. 1.6.2: Introduction to International efforts: Convention on Biological Diversity (CBD), International Union for Conservation of Nature and Natural Resources (IUCN), United Nations	**15**

	Environment Program -World Conservation Monitoring Centre (UNEP-WCMC) 1.6.3:-Invasive alien /exotic species	
II	**Sustainable development** 2.1 Sustainable Development; Brundlandt Report. 2.2 Biosafety of GMOs and LMOs. 2.3 Environmental movements. Public awareness of Environment problems. 2.4 Role of Government, NGO's, Ecological footprint, International treaties and conventions. organizations, International efforts (Vienna Convention, Montreal Protocol, UNFCCC, Kyoto Protocol, Copenhagen Summit, etc.; IPCC; Environmental laws and acts. 2.5 National Environmental Policy. NBPGR, BSI, ZSI, WWF, IUCN, Convention on Biological diversity; Ramsar Convention, other conservation efforts.	**15**

References:-

1. Joseph, B. (2008) Environmental studies, Tata McGraw Hill.

2. Miller, G.T. (2002). Sustaining the earth, an integrated approach. (5th edition) Books/Cole, Thompson Learning, Inc.

3. Chapman, J.L. and Reiss, M.J. (1999). Ecology: Principles and applications (2nd edition) Cambridge University Press.

4. Ghosh, S.K. and Singh, R. (2003). Social forestry and Forest Management. Global Vision Pub.

Course Code	Open Elective SEM – 1 Paper -2	Credits	Lectures/Week
24ZOOOE132	**Nutrition - deficiency and Lifestyle diseases**	2	2

Course Outcomes:

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

CO1:Highlight terms, concepts with respect to nutrition, dietary requirements and deficiency disorders .

CO2:Understand the role of food and nutrients in health and disease and knowing culturally competent nutrition requirements for diverse individuals.

CO3:Applying the knowledge to maintain holistic health and wellbeing .

CO4Analyze the effect of addictions and unhealthy lifestyle on mental and physical wellbeing.

Unit	Topics **Nutrition - deficiency and Lifestyle diseases**	No of Lectures
I	**Nutrition** 1.1 Basic concept of Food: Components and nutrients –Macronutrient- Carbohydrates, Lipids, Proteins-,Micro nutrients – Vitamins and Minerals. (Biological functions) 1.2 Concept of balanced diet, nutrient requirements and dietary pattern for different groups viz., adults, pregnant and nursing mothers, infants, school children, adolescents and elderly people. 1.3 Definition and concept of health (WHO), Physical and Mental health 1.4 Food hygiene: Potable water- sources and methods of purification at domestic level.	15
II	**Nutrient deficiency and Lifestyle diseases** 2.1 Common nutritional deficiency diseases- Protein Malnutrition (e.g., Kwashiorkor and Marasmus), 2.2 Vitamin A deficiency, Iron deficiency and Iodine deficiency disorders, Vitamin D deficiency disorder their symptoms, treatment, prevention	15

	2.3 Life style dependent diseases- hypertension, diabetes mellitus, and obesity their causes and prevention. 2.4 Social health problems- smoking, alcoholism, narcotics.	

1. Mudambi, S.R. and Rajagopal, M.V. (2007). Fundamentals of Foods, Nutrition and
Diet Therapy; Fifth Ed;; New Age International Publishers
2. Srilakshmi, B. (2002). Nutrition Science; New Age International (P) Ltd.
3. Srilakshmi, B. (2007). Food Science; Fourth Ed; New Age International (P) Ltd.
4. Swaminathan, M. (1986). Handbook of Foods and Nutrition; Fifth Ed; BAPPCO.
5. Bamji, M.S.; Rao, N.P. and Reddy, V. (2009). Text Book of Human Nutrition; Oxford & IBH Publishing Co. Pvt Ltd.
6. Wardlaw, G.M. and Hampl, J.S. (2007). Perspectives in Nutrition; Seventh Ed;
McGraw Hill.
7. Lakra, P. and Singh M.D. (2008). Textbook of Nutrition and Health; First Ed; Academic Excellence.
8. Manay, M.S. and Shadaksharaswamy, M. (1998). Food-Facts and Principles; New Age International (P) Ltd.
9. Gibney, M.J. et al. (2004). Public Health Nutrition; Blackwell Publishing.

Course Code	**VOCATIONAL SKILL COURSE SEM – I**	**Credits**	**Lectures per week**
24ZOOVC141	**Aquarium Fish Keeping**	**2**	**4**

Course Outcomes:

After successful completion of this course, students would be able to

CO1:To identify and understand the characteristics of different fish species commonly kept in aquariums. This includes knowledge of their natural habitats, behavior, diet, and compatibility with other species.

CO2:Learners should understand the importance of maintaining optimal water quality in an aquarium.

CO3:Learners should be capable of setting up and maintaining an aquarium. This includes knowledge of tank selection, filtration systems, lighting, heating, and appropriate decorations. They should understand the nitrogen cycle and the role of beneficial bacteria in maintaining water quality.

CO4:Learners should have a grasp of the dietary requirements of different fish species and disease prevention

Practical No.	Practicals	Total Hours
1	Introduction to ornamental fishery.	**60**
2	To study accessories required to setup of fish tank.	
3	Setting up of fish tank.	
4	Setting up of Basic Fresh water aquarium. Fish feed, aeration, cleaning, light etc.	
5	Maintenance of aquarium with regards to fish feed, aeration, cleaning, light etc .	
6	To study common diseases and treatment of ornamental fish.	

References: -

1. Jameson J.D., and Santhanam R., Manual of Ornamental Fishes and Farming
2. Technologies, Fisheries College and Research Institute, Tamilnadu Veterinary and
3. Animal Sciences, Tuticorin, 1996
4. Felix S., Sundaraj V., and Thilakar S., Manual of Tropical Fish Diseases Diagnosis,
5. Tamilnadu Veterinary and Animal Sciences University, Chennai, 1999.
6. Ramanthan N., and Francis T., Manual of Breeding and Larval Rearing of Cultivable
7. Fishes, Tamilnadu Veterinary and Animal Sciences University, Chennai, 1996.
8. Santhanam,R. Sukumaran,N. and Natarajan,P Oxford and IBH Publishing Co pvt.NewDelhi 1990.
9. Pitman Publ. Ian C. 1984. Marketing in Fisheries and Aquaculture. Fishing News Books.

Course Code	SKILL ENHANCEMENT COURSE SEM – I	Credits	Lectures per week
24ZOOSE151	Introduction to Marine Biodiversity	2	4

Course Outcomes:

After successful completion of this course, students would be able to

CO1:Recall and identify key marine ecological concepts and terminologies.

CO2:To understand classification of ecological subdivision of marine environment and various types of beaches along with it fauna

CO3:Applying knowledge to check the quality of commercially important marine organism.

CO4:To analyze the salinity of marine water by refractometer

Practical No	Practicals	Total hours
1	Introduction to Marine Biodiversity.	60
2	To study various types of Beaches Rocky, Sandy, Muddy shores with regards to Fauna.	
3	To study Foraminiferons shells.	
4	To study Ecological adaptations of intertidal zone organisms.	
5	Ecological subdivision of marine ecosystem based on land water mass (neretic , benthic, pelagic) and based on light penetration (euphotic , dysphotic , aphotic).	
6	Determination of salinity by refractometer.	
7	Determination of pH of marine water by pH paper and Universal indicator.	
8	To study phytoplankton and Zooplanktons.	
9	Mountings of Zooplanktons.	
10	To study commercially important marine fishes wrt anatomical features (cartilaginous / boney) , morphological features , freshness , costing , Shark ,Bombay duck, Mackerel, Oil sardine, pomfret, Kolia dissumerie, Kingfish .	

11	To study commercially important edible non Piscean resource organism. (Prawns, lobster, Crabs, Oysters, Clamps, Mussels, Sepia.)	
12	Visit to fish landing center/ fish market and submit the report.	

References :

1. Marine ecology by Nair and Thumpy
2. Mase janun gheuya (Marathi) by Dr .Vinay Deshmukh and Dr Nandini Deshmukh
3. Elements of Marine ecology by R.V.Tait.
4. Fishes by Mary Chandi
5. Fish products and value addition by S. Balasundari , G Raghu
6. Santhanam,R. Sukumaran,N. and Natarajan,P Oxford and IBH Publishing Co. pvt.NewDelhi 1990.

Course Code	MAJOR SEM – II	Credits	Lectures/Week
24ZOOMJ211	Paper I Non Chordates II and Life Processes	2	2

Course Outcomes:

After successful completion of this course, students would be able to

CO1:Recall the names and characteristics of different groups of coelomate nonchordates and memorize key anatomical structures and their role in human body.

CO2:Understand the morphological adaptations exhibited by coelomate nonchordates and to know the basic mechanism and processes involved in functioning of human body.

CO3:Apply knowledge of the diversity of non-chordates to classify and identify different organisms within these phyla and applying knowledge of various normal physiological process against clinical conditions.

CO4:Compare and contrast the morphological and ecological characteristics of different non-chordate groups, highlighting their evolutionary adaptations and analysing the interactions between different life processes.

Unit	Topics	No of Lectures
I	**Non Chordates II and Life Processes** **General characteristics and classification** 1.1 Phylum Annelida , 1.2 Phylum Arthropoda , 1.3 Phylum Mollusca 1.4 Phylum Echinodermata , 1.5 **Phylum Hemichordata** **Selected features of Coelomates** 1.6 Metamerism in Annelida 1.7 Moulting in insects, Metamorphosis in Insects; Social life in insects (bees and termites) 1.8 Water-vascular system in Asteroidea 1.9 Torsion and detorsion in Gastropoda	15
II	**Life Processes** 2.1 Human Digestive System ,Process of Digestion in Humans. 2.2 Respiration , Human Respiratory System , Process of Respiration in Humans.	15

	2.3 Excretory System ,Excretory System of Human ,Process of Urine Formation 2.4 Nervous Co-ordination :-Structure and Types of NeuronsNerve Impulse ,Conduction of Nerve Impulse 2.5 Systems:-Structure of Human Testis and Ovary Graffian Follicles Menstrual Cycle	

References:-

1. Invertebrates -R.L.Kotpal
2. Barnes, R. S. K.; Calow, P.; Olive, P. J. W.; Golding, D. W.; Spicer, J. I. (2002) The Invertebrates: a Synthesis, Blackwell Publishing.
3. Hickman, C.; Roberts, L.S.; Keen, S.L.; Larson, A. and Eisenhour, D. (2018) Animal Diversity, McGraw-Hill.
4. Holland, P. (2011) The Animal Kingdom: A Very Short Introduction, Oxford University Press.
5. Kardong, K.V. (2006) Vertebrates: Comparative Anatomy, Function, Evolution (4th edition), McGraw- Hill.
6. Barrington, E.J.W. (1979) Invertebrate Structure and Functions. II Edition. E.L.B.S. and Nelson.
7. Boradale, L.A. and Potts, E.A. (1961) Invertebrates: A Manual for the use of Students. Asia Publishing Home.
8. Bushbaum, R. (1964) Animals without Backbones. University of Chicago Press.
9. Invertebrate Zoology-Jordan and Verma
10. Berne Robert M. [et al.] 1998. Physiology. 4th ed. St. Louis : Mosby, c1998. QT4 .P499 1998
11. Emslie-Smith Donald... [et al.] 1988. Textbook of physiology. 11th ed. Edinburgh ; New York : Churchill Livingstone, 1988. QT104 .B39 1988
12. Guyton, Arthur C. 1984. Physiology of the human body. 6th ed. Philadelphia : Saunders College Pub., c1984. QT104 .G86 1984
13. Guyton, Arthur C. 1987. Human physiology and mechanisms of disease. 4th ed. Philadelphia : Saunders, 1987. QT104 .G85 1987
14. Hoar, William S 1983. General and comparative physiology. 3rd ed. Englewood Cliffs, N.J. : Prentice-Hall, c1983. QT4 .H63 1983

15. Hober R. et al. 1945 Physical chemistry of cells and tissues. :1st ed Blakiston Co., Philadelphia QU4.H6 1945

16. Marieb E.N. 1995. Human Anatomy and Physiology 3rd ed. Benjamin/Cummings Menlo Park. QS4.M37 1995

Course Code	**SEM 2 Practical based on Non chordates II & Life Processes**	**Credits**	**Lectures/Week**
24ZOOMJP21	**Practical 1 (Unit 1 + Unit 2)**	**2**	**4**

Course outcome

After successful completion of this course, students would be able to

CO1:Recall specific examples of animals within each major group or phylum.

CO2:Describe the physiological processes and functions common to animals, such as digestion, respiration , nervous system, etc.

CO3:Apply principles of animal physiology to analyze and interpret data from experiments or field studies.

CO4:Evaluate the adaptations of specific animal groups in response to environmental changes or evolutionary pressures.

Practical No.	**Practicals**	**Total hours**
1	Study of *Aphrodite, Nereis, Heteronereis, Sabella, Serpula, Chaetopterus, Pheretima, Hirudinaria*	
2	Study of *Limulus*, *Palamnaeus, Palaemon, Daphnia, Balanus*, *Sacculina*, *Cancer*,*Eupagurus*, *Scolopendra*, *Julus*, termite, louse, honeybee, silk moth, wasp	
3	Study of *Chiton, Dentalium, Pila, Doris, Helix, Unio, Ostrea, Mytilus, Loligo, Sepia,Octopus* and *Nautilus*	
4	Study of Echinoderm larvae	
5	Study of *Asterias, Ophiura, Clypeaster, Echinus, Echinocardium, Cucumaria* and *Antedon*	
6	To study the activity of Salivary amylase	
7	Study of Human Digestive system. (L.S and T.S of Intestines)	

8	Study of Human Excretory system **-** L.S and T.S of Kidney.	**60**
9	BMI analysis - Measurement of Height/ Weight and calculation of BMI using formula, preparation and submission of report. (10 students/ group-50 readings/group)	
10	Study of Human male and female Reproductive system T. S of Testis T.S of Ovary Study of Menstrual Cycle	
11	**Study Structure and function of Human Brain .**	
12	Study normal and abnormal Constituent of Urine	
13.	Visit to National park and submit the report.	

References:-

1. Barnes, R.D. (1982). *Invertebrate Zoology*, V Edition. Holt Saunders InternationalEdition
2. Barnes, R.S.K., Calow, P., Olive, P. J. W., Golding, D.W. and Spicer, J.I. (2002).
3. *Invertebrates: A New Synthesis,* III Edition, Blackwell Science
4. Barrington, E.J.W. (1979). *Invertebrate Structure and Functions*. II Edition, E.L.B.S. Nelson
5. Boradale, L.A. and Potts, E.A. (1961). *Invertebrates: A Manual for the use of Students*. Asia Publishing Home
6. R.L Kotpal-A textbook of Vertebrate Zoology
7. Jordan and Verma-Vertebrate Zoology
8. Berne Robert M. [et al.] 1998. Physiology. 4th ed.P499 1998
9. Emslie-Smith Donald... [et al.] 1988. Textbook of physiology. 11th ed. Edinburgh ; New York : Churchill Livingstone, 1988. QT104 .B39 1988
10. Guyton, Arthur C. 1984. Physiology of the human body. 6th ed. Philadelphia : Saunders College Pub., c1984. QT104 .G86 1984
11. Guyton, Arthur C. 1987. Human physiology and mechanisms of disease. 4th ed. Philadelphia : Saunders, 1987. QT104 .G85 1987
12. Hoar, William S 1983. General and compaative physiology. 3rd ed. Englewood Cliffs, N.J. : Prentice-Hall, c1983. QT4 .H63 1983
13. Hober R. et al. 1945 Physical chemistry of cells and tissues. :1st ed Blakiston Co., Philadelphia QU4.H6 1945
14. Marieb E.N. 1995. Human Anatomy and Physiology 3rd ed. Benjamin/Cummings Menlo Park. QS4.M37 1995

*Note - The practicals may be conducted by using specimens authorised by the wildlife and such other regulating authorities though it is strongly recommended

that the same should be taught by using photographs/audio-visual aids/ simulations / models, etc. as recommended by the UGC and as envisaged in the regulations of the relevant monitoring bodies. No new specimens, however, shall be procured.

Course Code	OPEN ELECTIVE SEM 2– Paper -1	Credits	Lectures/Week
24ZOOOE231	Vector borne disease & its management	2	2

Course Outcomes:

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

CO1:Identify the causative agents and control measures of many commonly occurring vector born diseases.

CO2:Develop understanding about the types of vectors, their adaptations and diseases.

CO3:Devise strategies to manage the vectors population below threshold levels, public health importance.

CO4:Comprehend the consequences of these disease causing agents on population as whole.

Unit	Topics Vector borne disease & its management	No of Lectures
I	**Vector borne diseases** 1.1Vectors -Brief introduction, 1.2 Types – Digenic and monogenic vectors 1.3 General characteristics and adaptations of vectors such as mosquitoes, flies, fleas, lice, bed bug 1.4 Mosquito borne Diseases – Malaria, Dengue, Filariasis , chikungunya Flies borne disease – Diarrhoea and dysentery , typhoid	15

	Lice borne diseases – Typhus Bedbug borne diseases – Irritation and sleeplessness	
II	**Vector borne disease Management** 2.1Control of vector flies by screening, fly traps, electrocution, poison baits and outdoor residual sprays; 2.2Chemical control. Efficacy of synthetic pyrethroids, residual spray of insecticides, treated bed nets/curtains and fumigations 2.3 Biological control of mosquitoes by use of guppy. 2.4 Social awareness to reduce mosquito breeding grounds , maintaining hygiene and keeping surroundings clean	**15**

References:-

1. Imms, A.D. (1977). A General Text Book of Entomology. Chapman & Hall, UK.
2. Chapman, R.F. (1998). The Insects: Structure and Function.IV Edition, Cambridge
   University Press, UK.
3. Mathews, G. (2011). Integrated Vector Management: Controlling Vectors of Malaria

   and other Insect Vector borne Diseass.Wiley-Blackwell. 107
4. Belding, D.L. (1942). Textbook of Clinical Parasitology. Appleton-Century Co., Inc.,

   New York.
5. Roy, D.N. and Brown, A.W.A. (2004). Entomology. Biotech Books, Delhi

Course Code	**OPEN ELECTIVE SEM 2– Paper 2**	**Credits**	**Lectures/Week**
24ZOOOE232		**2**	**2**

	Global Climate Issues & International summits, agreements		

Course Outcomes:

After completing this course, the student will be able to:

CO1:Recall the terms, concepts and theories of global environmental issues.

CO2:Understand the physical basis of green house gas effect on man and materials.

CO3:Implement the knowledge of climate change and its effect on reducing the emission of green house gases at individual level

CO4:Analyse the anthropogenic effects on global climate change.

Unit	**Topics** **Global Climate Issues & International summits, agreements**	**No of Lectures**
I	Unit I: Global Climate Issues- 1.1Global Environmental change issues. 1.2 Greenhouse gases and their sources; Greenhouse effect 1.3 Causes of depletion of ozone layer and consequences 1.4 Climate change: Effects of enhanced UV-B on plants,microbes, animals, human health and materials; global energy infrastructure and GHG emissions. 1.5 Acid rain, Eutrophication, El Niño and the Southern Oscillation -El Niño and its Effects	**15**
II	Unit II: International summits and agreements 1.1International efforts on climate change issues.	**15**

	1.2 Global efforts for mitigating ozone layer depletion. 1.3 Climate modeling and climate change feedbacks. 1.4 International Agreements: the United NationsFramework Convention on Climate Change, Kyoto Protocol, Paris Agreement. 1.5 Integrated Assessment, Decisions under uncertainty: Abate now, or delay? 1.6 Emissions budgets.	

References :-

1. Adger, N.; Brown, K. and Conway, D. (2012). Global Environmental Change: Understanding

the Human Dimensions. The National Academic Press.

2. Turekian, K.K. (1996). Global Environmental Change-Past, Present, and Future. PrenticeHall.

3. Matthew, R.A.; Barnett, J. and McDonald, B. (2009). Global Environmental Change and

Human Security. MIT Press., USA.

4. Hester, R.E. and Harrison, R.M. (2002). Global Environmental Change. Royal Society of Chemistry.

Course Code	VOCATIONAL SKILL COURSE SEM – II	Credits	Lectures/Week
24ZOOVC241	Value added products from sea	2	4

Course Outcomes:

After successful completion of this course, students would be able to

CO1:Memorize the key steps involved in the processing and production of value-added products from the sea.

CO2:Explain the principles and techniques used in the production of value-added products, including extraction, purification, and preservation methods.

CO3:Apply quality control measures to ensure the safety, nutritional value, and sensory characteristics of value-added marine products.

CO4:Analyze the composition and nutritional properties of different marine resources to determine their suitability for value addition. Evaluate the environmental and sustainability implications of extracting and processing marine resources for value-added products. Analyze consumer preferences and market trends to identify potential niche markets for value-added marine products.

Practical No	Practicals	Total hours
1	**Preparations of fish / Prawn pickle.**	60
2	**Making of fish cutlet.**	
3	Making of crab / sea food soup.	
4	Making of fish Papad / Fish Amoti	
5	Preparation of Jawla and larval prawn chutney.	
6	**Study of by products of fish. Fish oil, ising glass**	
7	**Products from marine invertebrate shell waste. Chitin, Chitosan, Calcium supplements.**	
8	**Survey of various commercially available fish / canned products.**	
9	**Institutional visit - CIFE/ Fishery survey of India/ NIO Mumbai.**	
10	**Survey of fish market/ Cold storage shops and report submission.**	

References:-

1. Adcock D, Bradfield R, Halborg A & Ross C. 1995. Marketing Principles and Practice. Pitman Publ.
2. Ahvenainen, R. (Ed.) Novel Food Packaging Techniques, CRC Press, 2003.
3. Amarchand D &Varadharajan B. 1979. An Introduction to Marketing. Vikas Publ.
4. Athalye, A.S. (1992), Plastics in Packaging, Tata McGraw –Hill Publishing Co., New Delhi.
5. Bakker, M. (1986) The Wiley Encyclopedia of Packaging Technology, John Willey & Sons.
6. Inc; New York.
7. Balachandran KK. 2001. Post-Harvest Technology of Fish and Fish Products. Daya Publ.
8. Balachandran K.K. Post Harvest Technology of Fish and Fishery Products
9. Brody J. Fishery Byproduct Technology Chaston I. 1983. Marketing in Fisheries and Aquaculture. Fishing News Books.
10. Coles, R., McDowell, D. and Kirwan, M.J. (Eds.) Food Packaging Technology, CRC Press,2003.
11. Dayanandan, R. - Entrepreneurship Development and Small Business Enterprises.
12. Dennis A, Brandfield R, Al Halhorg & Ross C. 2004. Marketing Principles and Practice.
13. Food Packaging Technology Handbook. NIIR Board, National Institute of Industrial Research, 2003.
14. Gopakumar K. (Ed.). 2002. Text Book of Fish Processing Technology. ICAR.
15. Govindan, T.K. Fish Processing Technology, Oxford-IBH, 1985.
16. Hall GM. (Ed.). 1992. Fish Processing Technology. Blackie.
17. Han, J.H. (Ed.) Innovations in Food Packaging, Elsevier Academic Press, 2005.
18. Wheaton FW & Lawson TB. 1985. Processing Aquatic Food Products. John Wiley & Sons.
19. Windsor M & Barlow. 1981. Introduction to Fishery Byproducts. Fishing News
20. (Books).http://ecoursesonline.iasri.res.in/mod/page/view.php?id=4458

Course Code	SKILL ENHANCEMENT COURSE SEM – II	Credits	Lectures/Week
24ZOOSE251	Marine Entrepreneurship	2	4

Course Outcomes:

CO1:After successful completion of this course, students would be able to

CO2:Memorize marine resource organism with entrepreneurship potential

CO3:Understanding different procedures to make commercially important products.

CO4:Applying knowledge to check the quality of commercially important marine organism.

CO5:Analyze consumer preferences and market trends to identify various marine products

Practical No	Practicals	Total hours
1	Introduction to economically important marine fish with regards to basic morphological and anatomical features , freshness, costing etc (Mackerel, Bombay duck, pomfrets, *Kolia dussumeri*, Black pomfrets, King fish.)	60
2	**Study of various economically important prawns, crabs and lobsters.**	
3	**Study of different types of edible Mollusca. Bivalve, Sepia, Octopus, Oysters, Mussels.**	
4	**Making of prawn / fish pickles.**	
5	**Making fish cutlet.**	
6	**Making of fish Papad/ Fish Amoti**	
7	**Shell jewellry designing.**	
8	**Home décor articles made from shells.**	
9	**Survey of fish market/ Cold storage shops and report submission.**	
10	**Institutional visit - CIFE/ Fishery survey of India/ NIO Mumbai.**	

References:-

1. Adcock D, Bradfield R, Halborg A & Ross C. 1995. Marketing Principles and Practice. Pitman Publ.
2. Ahvenainen, R. (Ed.) Novel Food Packaging Techniques, CRC Press, 2003.
3. Amarchand D &Varadharajan B. 1979. An Introduction to Marketing. Vikas Publ.

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6. Balachandran KK. 2001. Post-Harvest Technology of Fish and Fish Products. Daya Publ. Balachandran K.K. Post Harvest Technology of Fish and Fishery Products
7. Brody J. Fishery Byproduct Technology
8. Chaston I. 1983. Marketing in Fisheries and Aquaculture. Fishing News Books.
9. Coles, R., McDowell, D. and Kirwan, M.J. (Eds.) Food Packaging Technology, CRC Press,2003.
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12. Pitman Publ. Ian C. 1984. Marketing in Fisheries and Aquaculture. Fishing News Books.
13. Food Packaging Technology Handbook. NIIR Board, National Institute of Industrial Research, 2003.
14. Gopakumar K. (Ed.). 2002. Text Book of Fish Processing Technology. ICAR.
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16. Hall GM. (Ed.). 1992. Fish Processing Technology. Blackie.
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18. Wheaton FW & Lawson TB. 1985. Processing Aquatic Food Products. John Wiley & Sons.
19. Windsor M & Barlow. 1981. Introduction to Fishery Byproducts. Fishing News
20. http://ecoursesonline.iasri.res.in/mod/page/view.php?id=4458

Evaluation Scheme for First Year (UG) under NEP

(2 credits)

I. Internal Evaluation for Theory Courses – 20 Marks

1) Continuous Internal Assessment(CIA) Assignment - – 10 marks

2) Continuous Internal Assessment(CIA) ONLINE Unit Test – 10 marks

II. External Examination for Theory Courses – 30 Marks

Duration: 1 Hours

Theory question paper pattern: All questions are compulsory.

Question	Based on	Marks
Q.1	Unit I	15
Q.2	Unit II	15

- All questions shall be compulsory with internal choice within the questions.
- Each Question may be sub-divided into sub questions as a, b, c, d, etc. & the allocation of Marks depends on the weightage of the topic.

III. Practical Examination

- Each core subject carries 50 Marks.
- Duration: 2 Hours for each practical course.
- Minimum 80% practical from each core subjects are required to be completed.
- Certified Journal is compulsory for appearing at the time of Practical Exam

NOTE: To pass the examination, attendance is compulsory in both Internal & External (Theory + Practical) Examinations.