

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. ____
Subject: _ZOOLOGY__

Choice Based Credit System (CBCS)
with effect from
Academic Year 2023-2024

PROGRAM OUTCOMES

PO	Description
A student completing Bachelor's Degree in Science Program will be able to	
PO1	<p>Disciplinary Knowledge:</p> <p>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.</p>
PO2	<p>Critical Thinking and Problem solving:</p> <p>Exhibit the skills of analysis, inference, interpretation and problem-solving by observing the situation closely and design the solutions.</p>
PO3	<p>Social competence:</p> <p>Display the understanding, behavioral skills needed for successful social adaptation, work in groups, exhibits thoughts and ideas effectively in writing and orally.</p>
PO4	<p>Research-related skills and Scientific temper:</p> <p>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.</p>
PO5	<p>Trans-disciplinary knowledge:</p> <p>Integrate different disciplines to uplift the domains of cognitive abilities and transcend beyond discipline-specific approaches to address a common problem.</p>
PO6	<p>Personal and professional competence:</p> <p>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.</p>
PO7	<p>Effective Citizenship and Ethics:</p> <p>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.</p>
PO8	<p>Environment and Sustainability:</p> <p>Understand the impact of the scientific solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.</p>

Semester	Course Code	Course Title	Vertical	Credit
I	K23USZOOMJ111	Diversity and Evolution of Nonchordata (Protista To Pseudocoelomates)	Major	2
	K23USZOOMJ112	Perspectives in Ecology	Major	2
	K23USZOOMJP11	Animal diversity and techniques in population ecology	Practical	2
	K23USZOOVC141	Value added products from sea	VSC	2
	K23USZOOSC151	Aquarium Fish Keeping	SEC	2
II	K23USZOOMJ211	Diversity and Evolution of Non-chordata (Coelomates to Non-chordates)	Major	2
	K23USZOOMJ212	Physiology : Life Sustaining Systems	Major	2
	K23USZOOMJP21	Animal diversity and life systems	Practical	2
	K23USZOOMR221	Wildlife conservation and Management	Minor	2
	K23USZOOVC241	Pearl Oyster Culture	VSC	2
	K23USZOOSC251	Apiculture	SEC	2

Course Code	MAJOR SEM – I	Credits	Lectures/Week
K23USZOOM J111	Paper I- Diversity and Evolution of Non-chordata(Protista To Pseudocoelomates)	2	2

Course Outcomes:

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

- Recall the characteristics of Protista, Porifera, Cnidaria, Platyhelminthes, Nematoda, and Annelida.
- Explain the evolutionary relationships between Protista and Pseudocoelomates, and how these groups fit within the animal kingdom.
- Apply knowledge of the diversity of non-chordates to classify and identify different organisms within these phyla.
- Compare and contrast the morphological and ecological characteristics of different non-chordate groups, highlighting their evolutionary adaptations.

Unit	Topics	No of Lectures
I	General characteristics and classification up to classes <ol style="list-style-type: none"> 1) Levels of organization 2) Kingdom Protista, 3) Phylum Porifera, Cnidaria, Ctenophora 4) Platyhelminthes, Nematelminthes 	15
II	Evolution of Protista to Peudocoelomate <ol style="list-style-type: none"> 1) Locomotion and Reproduction in Protista, 2) Evolution of Parazoa and Metazoa, 3) Canal system in sponges, ; 4) Metagenesis in Obelia; Polymorphism in Cnidaria; Corals and coral reefs, 5) Phylum Ctenophora- evolutionary significance, 	15

	6) Phylum -Platyhelminthe, Nematelminthes- Parasitic adaptations	
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Textbooks:

- Invertebrates -R.L.Kotpal
- Barnes, R. S. K.; Calow, P.; Olive, P. J. W.; Golding, D. W.; Spicer, J. I. (2002) The Invertebrates: a Synthesis, Blackwell Publishing.
- Hickman, C.; Roberts, L.S.; Keen, S.L.; Larson, A. and Eisenhour, D. (2018) Animal Diversity, McGraw-Hill.
- Holland, P. (2011) The Animal Kingdom: A Very Short Introduction, Oxford University Press.
- Kardong, K.V. (2006) Vertebrates: Comparative Anatomy, Function, Evolution (4th edition), McGraw- Hill.
- Barrington, E.J.W. (1979) Invertebrate Structure and Functions. II Edition. E.L.B.S. and Nelson.
- Boradale, L.A. and Potts, E.A. (1961) Invertebrates: A Manual for the use of Students. Asia Publishing Home.
- Bushbaum, R. (1964) Animals without Backbones. University of Chicago Press.
- Invertebrate Zoology-Jordan and Verma

Course Code	MAJOR SEM – I	Credits	Lectures/Week
K23USZOOM J112	Paper II Perspectives in Ecology	2	2

Course Outcomes:

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

- Recall and identify key ecological concepts, theories, and terminology.
- Summarize the processes of energy flow and nutrient cycling in ecosystems and describe the factors that influence population dynamics, community structure, and ecosystem stability.
- Use ecological models to predict the impacts of environmental changes on populations, communities, and ecosystems and apply ecological knowledge to propose solutions to environmental challenges, such as habitat restoration or sustainable resource management.
- Analyze ecological data sets or case studies to identify patterns, trends, and underlying mechanisms.

Unit	Topics	No of Lectures
I	<p>Ecosystem</p> <p>1.1: Concept of Ecosystems</p> <p>Ecosystem - Definition and components</p> <p>1.2: Biogeochemical cycles (Water, Oxygen, Nitrogen, Sulphur)</p> <p>1.3: Fresh water ecosystem – Lentic and Lotic</p> <p>Forest Ecosystem, Grass land Ecosystem, Dessert Ecosystem</p> <p>1.4: Energy Flow in Ecosystem (Food chain and food web)</p>	15

	<p>1.5: Ecological pyramids - energy, biomass and number.</p> <p>1.6: Animal interactions (commensalism, mutualism, predation, antibiosis, parasitism)</p>	
II	<p>Population Ecology</p> <p>2.1: Population dynamics</p> <p>2.2: Population density</p> <p>2.3: Natality</p> <p>2.4 : Mortality</p> <p>2.5: Fecundity</p> <p>2.6: Age structure</p> <p>2.7: Sex ratio</p> <p>2.8: Survivorship curves</p> <p>2.9: Population dispersal and distribution patterns</p> <p>2.10 Niche concept</p> <p>2.11: Population growth regulation</p> <p>2.12: Population growth pattern</p> <p>Sigmoid</p> <p>J Shaped</p> <p>2.13 : Human census (India) – Concept, mechanism and significance</p>	15
<p>Textbooks and references:-</p> <ul style="list-style-type: none"> ● Introduction to Ecology and Wildlife - University Text Book of Zoology, F.Y.B.Sc. Semester II Course 3. University Press. ● Fundamentals of Ecology - Eugene P. Odum and Grey W. Barrett, Brook Cole/ Cengage learning 		

- Fundamentals of Ecology - M. C. Dash , Tata McGraw Hill company Ltd, New Delhi
- Ecology - Mohan P. Arora , Himalaya Publishing House
- Field Biology and Ecology -- Alen H. Benton and William E. Werner ,Tata McGraw Hill ltd, New Delhi
- Ecology and Environment - Sharma P. D , Rastogi Publication, Mumbai
Ecology : Principles and Applications - Chapman J.L , Cambridge University trust
- Ecology - Subramaniam and Others, Narosa Publishing House
- Wildlife laws and its impact on tribes - Mona Purohit, Deep and deep Publication
- Biology - Eldra Solomon, Linda R. Berg and Diana W. Martin, Thomson/ Brooks/ Cole
- Economic Zoology, Biostats and Animal Behaviour - Shukla, Mathur, Upadhyay, Prasad. Rastogi Publications.

Course Code	SEM I -Animal diversity and techniques in population ecology	Credits	Lectures/Week
K23USZO OMJP 11	Practical 1 (Paper 1 + Paper 2)	2	4
<p>Course Outcomes</p> <p>After successful completion of this course, students would be able to</p> <ul style="list-style-type: none"> • Memorize important terminology related to animal diversity and population ecology, such as population size, density, and growth rate. • 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. • Use appropriate statistical methods to analyze population data and interpret the results. • Evaluate the impacts of environmental factors, such as habitat fragmentation or climate change, on animal populations. 			
Paper 1			
1	Study of <i>Paramecium</i> W.M., Binary fission and Conjugation in <i>Paramecium</i>		
2	Life stages of <i>Plasmodium vivax</i> , <i>Trypanosma gambiense</i> and <i>Entamoeba histolytica</i> (Slides/Micro-photographs)		
3	Examination of pond water for protists		
4	Study of <i>Sycon</i> (including T.S. and L.S.), <i>Hyalonema</i> , and <i>Euplectella</i>		
5	Temporary mounts of spicules, gemmules and spongin fibres		

6	Study of <i>Obelia</i> , <i>Physalia</i> , <i>Millepora</i> , <i>Aurelia</i> , <i>Ephyra</i> larva, <i>Tubipora</i> , <i>Corallium</i> , <i>Alcyonium</i> , <i>Gorgonia</i> , <i>Metridium</i> (including T.S. and L.S.)
7	Phylum Ctenophora -. Any one specimen/slide
8	Study of adult <i>Schistosoma haematobium</i> , <i>Taenia solium</i> and their life stages (Slides/microphotographs)
9	Study of adult <i>Ascaris lumbricoides</i> , <i>Wuchereria bancrofti</i> and their life stages (Slides/micro-photographs)
Paper 2	
10	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
11	a) Calculation of Natality, Mortality, Population density from given data b) Estimation of population density by capture recapture method
12	Interpretation of Growth curves (Sigmoid and J shaped)
13	Estimation of hardness from given water sample (tap water v/s well water) .

14	Estimation of Free carbon dioxide (Free CO ₂) from two different samples- aerated drinks(diluted) v/s tap water
15	Identification and interpretation of aquatic and terrestrial (Grassland) food chains and food webs
16	Construction of food chain/food web using given information/data.
17	a) Identification and interpretation of ecological pyramids of energy, biomass and number b) Construction of different types of pyramid from given data.

Textbooks and references:-

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

SUGGESTED READINGS

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

Course Code	VOCATIONAL SKILL COURSE SEM – I	Credits	Lectures/Week
K23USZOOV C141	Value added products from sea	2	2
<p>Course Outcomes:</p> <p>After successful completion of this course, students would be able to</p> <ul style="list-style-type: none"> ● Memorize the key steps involved in the processing and production of value-added products from the sea. ● Explain the principles and techniques used in the production of value-added products, including extraction, purification, and preservation methods. ● Apply quality control measures to ensure the safety, nutritional value, and sensory characteristics of value-added marine products. ● 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. 			
Unit	Topics	No of Lectures	
I	<p>Value added Products (With packaging)</p> <p>1.1 Dry, salted and smoked products</p> <p>1.2 Fish / Prawn Pickle</p> <p>1.3 Fish Chakli and Wafers</p> <p>1.4 Artificial products / Crabs streaks</p> <p>1.5 RTE products</p> <p>1.6 Fish Kabab</p> <p>1.7 Fish cuttlet</p> <p>1.8 Fish Amoti</p> <p>1.9 Fish Rumani</p> <p>1.10 Fish fillets</p>	15	

II	<p>Fish, Shell fish and Seaweed Products and By-products</p> <p>2.1 By-products</p> <p>2.1.1 Fish meal</p> <p>2.1.2 Fish oil</p> <p>2.1.3 Fish protein concentrate</p> <p>2.1.4 Functional fish protein concentrates</p> <p>2.1.5 Isinglass</p> <p>2.1.6 Shark leather</p> <p>2.1.7 Fish glue</p> <p>2.1.8 Fish gelatin</p> <p>2.1.9 Pearl essence</p> <p>2.1.10 Shark fin soup</p> <p>2.2 Fermented fish products</p> <p>2.2.1 Fish-Shrimp sauces and pastes</p> <p>2.2.2 Philippine Bagoong</p> <p>2.2.3 Malaysian Budu</p> <p>2.2.4 Fish silage</p> <p>2.2.5 Fish Protein Hydrolysate</p> <p>2.3 Products from marine invertebrates shell waste</p> <p>2.3.1 Chitin</p> <p>2.3.2 Chitosan</p> <p>2.3.3 Glucosamine hydrochloride</p> <p>2.3.4 Astaxanthine</p> <p>2.3.5 Calcium Supplements from shell</p> <p>2.4 Seaweed products</p> <p>2.4.1 Alginates</p> <p>2.4.2 Agar agar</p> <p>2.4.3 Agarose</p> <p>2.4.4 Carageenan</p>	15

Textbooks and references:-

- Adcock D, Bradfield R, Halborg A & Ross C. 1995. Marketing Principles and Practice. Pitman
- Publ.
- Ahvenainen, R. (Ed.) Novel Food Packaging Techniques, CRC Press, 2003.
- Amarchand D & Varadharajan B. 1979. An Introduction to Marketing. Vikas Publ.
- Athalye, A.S. (1992), Plastics in Packaging, Tata McGraw –Hill Publishing Co., New Delhi.

- Bakker, M. (1986) The Wiley Encyclopedia of Packaging Technology, John Willey & Sons.
- Inc; New York.
- Balachandran KK. 2001. Post-Harvest Technology of Fish and Fish Products. Daya Publ.
- Chaston I. 1983. Marketing in Fisheries and Aquaculture. Fishing News Books.
- Coles, R., McDowell, D. and Kirwan, M.J. (Eds.) Food Packaging Technology, CRC Press, 2003.
- Dayanandan, R. - Entrepreneurship Development and Small Business Enterprises.
- 10. Dennis A, Brandfield R, Al Halhorg & Ross C. 2004. Marketing Principles and Practice.
- Pitman Publ. Ian C. 1984. Marketing in Fisheries and Aquaculture. Fishing News Books.
- Food Packaging Technology Handbook. NIIR Board, National Institute of Industrial Research, 2003.
- Gopakumar K. (Ed.). 2002. Text Book of Fish Processing Technology. ICAR.
- Govindan, T.K. Fish Processing Technology, Oxford-IBH, 1985.
- Hall GM. (Ed.). 1992. Fish Processing Technology. Blackie.
- Han, J.H. (Ed.) Innovations in Food Packaging, Elsevier Academic Press, 2005.
- Wheaton FW & Lawson TB. 1985. Processing Aquatic Food Products. John Wiley & Sons.
- Windsor M & Barlow. 1981. Introduction to Fishery Byproducts. Fishing News
- (Books).<http://ecoursesonline.iasri.res.in/mod/page/view.php?id=4458>
- Balachandran K.K. Post Harvest Technology of Fish and Fishery Products
- Brody J. Fishery Byproduct Technology

Course Code	SKILL ENHANCEMENT COURSE SEM - I	Credits	Lectures/Week
K23USZOOS C151	Aquarium Fish Keeping	2	2

Course Outcomes:

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

- 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.
- Learners should understand the importance of maintaining optimal water quality in an aquarium.
- 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.
- Learners should have a grasp of the dietary requirements of different fish species, breeding techniques and disease prevention

Unit	Topics	No of Lectures
I	<p>Setting up of an aquarium</p> <p>1.1 Identification of popular Ornamental fishes: Siamese fighting fish, Gold fish , Rosy barb, Black molly, Guppy, Koi carp, Arowana and Angel fish.</p> <p>1.2 Construction of fish tank: Size and shape of fish tank, bottom settings, stocking of fish, planting with aquarium plants,</p> <p>1.3 Accessories of fish Tank - aerators, types of filters, thermoregulators, lighting nets.</p>	15

II	<p>Maintenance of aquarium</p> <p>2.1 Transport of fishes: Oxygen packing</p> <p>2.2 Food and feeding: Culture of live food organisms- Micro worms, vinegar eel, tubifex.</p> <p>2.3 Artificial feed - Pellet feed formulation.</p> <p>2.4 Breeding methods:</p> <p>Siamese fighting fish, Gold fish, Black molly, Guppy and sword tail.</p> <p>2.5 Common diseases and treatment of ornamental fishes: Nutritional diseases, White spot diseases, Fungal diseases, Bacterial diseases, Dropsy diseases and ecto-parasites.</p>	15
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Textbooks:

- Jameson J.D., and Santhanam R., Manual of Ornamental Fishes and Farming
- Technologies, Fisheries College and Research Institute, Tamilnadu Veterinary and
- Animal Sciences, Tuticorin, 1996
- Felix S., Sundaraj V., and Thilakar S., Manual of Tropical Fish Diseases Diagnosis,
- Tamilnadu Veterinary and Animal Sciences University, Chennai, 1999.
- Ramanathan N., and Francis T., Manual of Breeding and Larval Rearing of Cultivable
- Fishes, Tamilnadu Veterinary and Animal Sciences University, Chennai, 1996.
- Santhanam,R. Sukumaran,N. and Natarajan,P Oxford and IBH Publishing Co
- pvt.NewDelhi 1990.

Course Code	MAJOR SEM – II	Credits	Lectures/Week
K23USZOOM J211	Paper I Diversity and Evolution of Non-chordata (Coelomates to Non-chordates)	2	2
<p>Course Outcomes:</p> <p>After successful completion of this course, students would be able to</p> <ul style="list-style-type: none"> ● Recall the names and characteristics of different groups of coelomate nonchordates. ● Describe the morphological adaptations exhibited by coelomate nonchordates. ● Apply knowledge of coelomate nonchordate adaptations to predict their behavior and responses in different environments. ● Evaluate the impact of coelomate nonchordates on ecosystem dynamics and nutrient cycling. 			
Unit	Topics	No of Lectures	
I	<p>General characteristics and classification up to classes</p> <p>1.1 Phylum Annelida</p> <p>1.2 Phylum Arthropoda</p> <p>1.3 Phylum Onychophora</p> <p>1.4 Phylum Mollusca</p> <p>1.5 Phylum Echinodermata</p>	15	
II	<p>Evolution of Coelomates upto Echinodermata</p> <p>2.1 Evolution of Coelom, Metamerism in Annelida.</p> <p>2.2 Moulting in insects, Metamorphosis in Insects; Social life in insects (bees and termites)</p>	15	

	<p>2.3 Evolutionary significance of Onychophora</p> <p>2.4 Torsion and detorsion in Gastropoda</p> <p>2.5 Evolutionary significance of trochophore larva, <i>nauplius</i> larva</p> <p>2.6 Water-vascular system in Asteroidea</p> <p>2.7 Evolutionary significance (Affinities with Chordates) of Echinodermata</p>	
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Textbooks and references:-

- Invertebrates -R.L.Kotpal
- Barnes, R. S. K.; Calow, P.; Olive, P. J. W.; Golding, D. W.; Spicer, J. I. (2002) The Invertebrates: a Synthesis, Blackwell Publishing.
- Hickman, C.; Roberts, L.S.; Keen, S.L.; Larson, A. and Eisenhour, D. (2018) Animal Diversity, McGraw-Hill.
- Holland, P. (2011) The Animal Kingdom: A Very Short Introduction, Oxford University Press.
- Kardong, K.V. (2006) Vertebrates: Comparative Anatomy, Function, Evolution (4th edition), McGraw- Hill.
- Barrington, E.J.W. (1979) Invertebrate Structure and Functions. II Edition. E.L.B.S. and Nelson.
- Boradale, L.A. and Potts, E.A. (1961) Invertebrates: A Manual for the use of Students. Asia Publishing Home.
- Bushbaum, R. (1964) Animals without Backbones. University of Chicago Press.
- Invertebrate Zoology-Jordan and Verma

Course Code	MAJOR SEM – II	Credits	Lectures/Week
K23USZOOM J212	Paper II Physiology : Life Sustaining Systems.	2	2

Course Outcomes:

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

- Memorize key anatomical structures and their roles within the body systems.
- Describe the basic mechanisms and processes involved in the functioning of each life-sustaining system.
- Apply knowledge of the physiological systems to interpret and analyze specific clinical scenarios or case studies.
- Compare and contrast the functioning of different organ systems and their adaptations across different species or in response to different physiological challenges.

Unit	Topics	No of Lectures
I	<p>Human Digestive system and Respiratory System</p> <p>1.1 : Food Constitution (Carbohydrates, Proteins, Fats)</p> <p>1.2 : Digestive System Human Digestive System Process of Digestion in Humans.</p> <p>1.3 : Respiration Human Respirator System</p>	15

	Process of Respiration in Humans.	
II	<p>Human Excretory, Nervous and Reproductive systems</p> <p>2.1 : Excretory System Excretory System of Human Process of Urine Formation</p> <p>2.2 : Nervous Co-ordination :-Structure and Types of Neurons Nerve Impulse Conduction of Nerve Impulse</p> <p>2.3 : Reproductive Systems:-Structure of Human Testis and Ovary Graffian Follicles Menstrual Cycle</p>	15

Textbooks and references:-

- Berne Robert M. [et al.] 1998. Physiology. 4th ed. St. Louis : Mosby, c1998. QT4 .P499 1998
- Emslie-Smith Donald... [et al.] 1988. Textbook of physiology. 11th ed. Edinburgh ; New York : Churchill Livingstone, 1988. QT104 .B39 1988
- Guyton, Arthur C. 1984. Physiology of the human body. 6th ed. Philadelphia : Saunders College Pub., c1984. QT104 .G86 1984
- Guyton, Arthur C. 1987. Human physiology and mechanisms of disease. 4th ed. Philadelphia : Saunders, 1987. QT104 .G85 1987
- Hoar, William S 1983. General and comparative physiology. 3rd ed. Englewood Cliffs, N.J. : Prentice-Hall, c1983. QT4 .H63 1983
- Hober R. et al. 1945 Physical chemistry of cells and tissues. :1st ed Blakiston Co., Philadelphia QU4.H6 1945

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

Course Code	SEM 2 -Animal diversity and life systems	Credits	Lectures/Week
K23USZO OMJP 21	Practical 1 (Paper 1 + Paper 2)	2	4
<p>Course outcome After successful completion of this course, students would be able to</p> <ul style="list-style-type: none"> • Recall specific examples of animals within each major group or phylum. • Describe the physiological processes and functions common to animals, such as digestion, respiration, circulation, nervous system, etc. • Apply principles of animal physiology to analyze and interpret data from experiments or field studies. • Evaluate the adaptations of specific animal groups in response to environmental changes or evolutionary pressures. 			
Paper 1			
1	Study of <i>Aphrodite, Nereis, Heteronereis, Sabella, Serpula, Chaetopterus, Pheretima, Hirudinaria</i>		
2	T.S. through pharynx, gizzard, and typhlosolar intestine of earthworm.		
3	T.S. through crop of leech		
4	Study of <i>Limulus, Palamnaeus, Palaemon, Daphnia, Balanus, Sacculina, Cancer, Eupagurus, Scolopendra, Julus</i> , termite, louse, honeybee, silk moth, wasp		
5	Phylum Onychophora- Any one specimen/slide		

6	Study of <i>Chiton, Dentalium, Pila, Doris, Helix, Unio, Ostrea, Mytilus, Loligo, Sepia, Octopus</i> and <i>Nautilus</i>
7	Study of Echinoderm larvae
8	Study of <i>Pentaceros/Asterias, Ophiura, Clypeaster, Echinus, Echinocardium, Cucumaria</i> and <i>Antedon</i>
9	Water-vascular system in Asteroidea
Paper 2	
10	Qualitative estimation of Vitamin C by Iodometric method.
11	Study of microscopic structure of starch granules of different cereals (wheat, maize and jowar).
12	Estimation of maltose from brown/white bread.
13	Estimation of protein content of two egg varieties.
14	Study of Human Digestive system. L.S and T.S of Intestines.
15	Study of Human Excretory system - L.S and T.S of Kidney.
16	Study of Human male and female Reproductive system T. S of Testis T.S of Ovary Study of Menstrual Cycle

17	First Aid – Demonstration Practical Training for teachers and students to be conducted by the experts from Redcorss, Civil defence, Civic authorities by individual institute or cluster colleges in rotation
18	BMI analysis - Measurement of Height/ Weight and calculation of BMI using formula, preparation and submission of report. (10 students/ group-50 readings/group)
<p>Practical References</p> <p>Practical 1</p> <p>Note: Classification to be followed from “Barnes, R.D. (1982). <i>Invertebrate Zoology</i>, V Edition, Holt Saunders International Edition”</p> <p>SUGGESTED READINGS</p> <ul style="list-style-type: none"> ● Barnes, R.D. (1982). <i>Invertebrate Zoology</i>, V Edition. Holt Saunders International Edition ● Barnes, R.S.K., Calow, P., Olive, P. J. W., Golding, D.W. and Spicer, J.I. (2002). ● <i>Invertebrates: A New Synthesis</i>, III Edition, Blackwell Science ● Barrington, E.J.W. (1979). <i>Invertebrate Structure and Functions</i>. II Edition, E.L.B.S. Nelson ● Boradale, L.A. and Potts, E.A. (1961). <i>Invertebrates: A Manual for the use of Students</i>. Asia Publishing Home ● R.L Kotpal-A textbook of Vertebrate Zoology ● Jordan and Verma-Vertebrate Zoology <p>Practical Paper 2</p> <ul style="list-style-type: none"> ● Berne Robert M. [et al.] 1998. <i>Physiology</i>. 4th ed.P499 1998 ● Emslie-Smith Donald... [et al.] 1988. <i>Textbook of physiology</i>. 11th ed. Edinburgh ; New York : Churchill Livingstone, 1988. QT104 .B39 1988 	

- Guyton, Arthur C. 1984. Physiology of the human body. 6th ed. Philadelphia : Saunders College Pub., c1984. QT104 .G86 1984
- Guyton, Arthur C. 1987. Human physiology and mechanisms of disease. 4th ed. Philadelphia : Saunders, 1987. QT104 .G85 1987
- Hoar, William S 1983. General and comparative physiology. 3rd ed. Englewood Cliffs, N.J. : Prentice-Hall, c1983. QT4 .H63 1983
- Hober R. et al. 1945 Physical chemistry of cells and tissues. :1st ed Blakiston Co., Philadelphia QU4.H6 1945
- 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	MINOR SEM – II	Credits	Lectures/Week
K23USZOOM R221	Wildlife conservation and Management	2	2
Course Outcomes:			
After successful completion of this course, students would be able to			
<ul style="list-style-type: none"> ● Develop an understanding of how animals interact with each other and their natural environment ● Develop the ability to use the fundamental principles of wildlife ecology to solve local, regional and national conservation and management issues ● Gain an appreciation for the modern scope of scientific inquiry in the field of wildlife conservation management ● Develop an ability to analyze, present and interpret wildlife conservation management information. 			
Unit	Topics	No of Lectures	
I	National parks and Sanctuaries of India 1.1: Concept of Endangered and Critically Endangered species using examples of Indian Wildlife with respect to National Parks and Wildlife Sanctuaries of India (Sanjay Gandhi National Park, Tadoba Tiger Reserve, Corbett National Park, Kaziranga National Park, Gir National Park, Silent Valley, Pirotan Island Marine Park, Keoladeo Ghana National Park, Bandipur Sanctuary) 1.2: Management strategies with special reference to Rhinoceros in India 1.3: Ecotourism 1.4: Biopiracy	15	
II	Wildlife Management	15	

	<p>2.1: Habit, Habitat, Territory and Niche of Wild Animals: Herbivores, carnivores, solitary, social (flock, pod, community), pack and herd, types of habitats and territories, niche concept</p> <p>2.2: Threats to Wildlife</p> <p>2.1.1: Poaching and hunting, deforestation, encroachment, competition (intra-specific and inter-specific), overgrazing and climate change, diseases (zoonosis and reverse zoonosis)</p> <p>2.1.2: Tourism and human animal conflict</p> <p>2.3: Wildlife Conservation</p> <p>2.3.1: Techniques and methods used for wildlife census: Aerial counts, camera trap, line transect census and track surveys, capture mark recapture method, wildlife radio telemetry</p> <p>2.3.2: Forest management, policies and Acts: Harvesting Trees, Thinning harvest, Clearcut Harvest, Shelterwood harvest, Seed tree harvest, Group selection harvest, Single-tree selection harvest, Prescribed burning, Reforestation</p> <p>Forest policy 1894, 1952, 1988; The Indian Forest Act, 1927; Forest (Conservation) Act, 1980, Wild life conservation Act amendment 2021</p>	
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Textbooks and References

- Wildlife laws and its impact on tribes - Mona Purohit, Deep and deep Publication
- Biology - Eldra Solomon, Linda R. Berg and Diana W. Martin, Thomson/ Brooks/ Cole
- Economic Zoology, Biostats and Animal Behaviour - Shukla, Mathur, Upadhyay, Prasad. Rastogi Publications
- International Pvt. Ltd. New Delhi 110016.
- Text book of environmental science; S. C. Santra.
- Wild life management; Rajesh Gopal.
- Wildlife Management and Conservation - Contemporary Principles and Practices; Paul R.
- Krausman and James W. Cain III.

- Wildlife Ecology, Conservation, and Management; John M. Fryxell, Anthony R. E. Sinclair
- 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, Conflict or Co-existence? Cambridge University.
- Bookhout, T.A. (1996) Research and Management Techniques for Wildlife and Habitats (5th edition) The Wildlife Society, Allen Press.
- Sutherland, W.J. (2000) The Conservation Handbook: Research, Management and Policy. Blackwell Sciences 95
- Hunter M.L., Gibbs, J.B. and Sterling, E.J. (2008) Problem solving in Conservation Biology and Wildlife Management: Exercises for Class, Field, and Laboratory. Blackwell Publishing.

Course Code	VOCATIONAL SKILL COURSE SEM – II	Credits	Lectures/Week
K23USZO OVC241	Pearl Oyster Culture	2	2

Course Outcomes:

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

- The learner will be familiarized with the organism's economic importance
- The learner will be able to understand the technicalities of the pearl oyster culture
- The learner would be able to establish the pearl oyster culture
- Learner will be able to tackle problems faced during the culturing and learner will be able to create business opportunities

Unit	Topics	No of Lectures
I	INTRODUCTION TO OYSTER AND ITS TYPES AND FEED Oyster in animal kingdom. Types of oysters Fresh water oysters. Mantle cavity and gonadal identification, : Formulation and preparation of artificial feeds for larval rearing, microparticulate diets, Nutritional requirements of oyster micro organism culture for pond management and mass culture techniques of important microalgae, rotifers, artemia, infusoria, cladocerans, copepods, oligochaetes, nematode and insects larvae.	15
II	IMPLANTATION TECHNIQUES Pearl oyster Surgery, Selection of Oyster, Half round Pearl culture. Nucleus implantation, Surgery and precautions. Beads insertion, Graft tissue preparation , Surgery and precautions Insertion of beads. Spherical Pearl implantation and Surgical Operation. Surgery and precautions. Beads in insertion in Oyster	15

	. Assignment: Introduction to Oyster surgery, Types of surgical instruments, Application of Surgical instruments.	
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Textbook and references:-

- Haws Maria (March2002) The basics of pearl farming : a Layman's manual: (U.S.A). CTSA publications.
- Alexander E .Farn (march1986) pearls :(U.S.A.).Butterworth Heinemann publications.
- Le Jia Li(2014)New technologies to promote freshwater pearl culture(China) Ocean Press publications.
- CMFRI MANUAL ON PEARL CULTURE TECHNIQUES
prints.cmfri.org.in/3208/1/Special_Publication_No_20.pdf

Course Code	SKILL ENHANCEMENT COURSE SEM – II	Credits	Lectures/Week
K23USZOOS C251	Apiculture	2	2
Course Outcomes:			
After successful completion of this course, students would be able to			
<ul style="list-style-type: none"> • Identify the different types of bees and their roles within a hive and recognize common equipment and tools used in beekeeping. Interpret the significance of environmental factors on bee health and behavior. • Apply knowledge of bee biology to identify and diagnose common bee diseases and pests. • Evaluate the impact of environmental factors on honey production and bee behavior. 			
Unit	Topics	No of Lectures	
I	Types of bees and Bee keeping 1.1 History of Bee keeping – Scope and importance – Classification of honey bee species 1.2 Basic concepts of morphology, mouth parts and sting of Honey bees – Social organization in honey bees: Colony life – Queen, drone, worker – Life cycle of the honey bee. 1.3 Bee hives – Traditional bee hives – Modern bee hive: Newton hive. Bee dances, Flora for apiculture – selection of bees for apiculture – tools and extraction of honey.	15	
II	Apiculture techniques and products 2.1 Modern appliances for Apiaries, Products: Honey, Bee wax, Bee venom, Pollen, Royal jelly, Propolis – Chemical composition, nutritional and medical value of honey.	15	

	2.2 Diseases of Honey bee – Symptoms and control measures - Bacterial: American foul brood, Stone brood and Nosemosis,– Bee enemies: Wax moth, Ants, Wasp ant	
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Textbooks and reference:-

1. Apiculture – Sunithira. C, 2016, DivyaJothi Publication, Kanyakumari, Tamil Nadu.
2. Fundamentals of Bee keeping – Sathe. T.V., 2006, Daya Publishing House Pvt. Ltd.,
New Delhi.

Additional references:-

- Honey Bee Pests, Predators and Diseases, 3rd Edition, Roger A. Morse, a. Kim Flottum, 1998, Wicwas Press.
- Bee Keeping in India, Ghosh. G.K., 1998, APH Publishing, New Delhi.
- 3.Honey – A Comprehensive Survey – International Bee Research Association for house –CNRC [England].
- Honey Bee Biology and Bee keeping, Dewey M. Caron, 2013, Wicwas Press, Kalamazoo.
- The Backyard Bee keeper, 3rd Edition, Kim Flottum, 2014, Quarry Books, Quayside Publishing Group, Beverly.

Evaluation Scheme for First Year (UG) under NEP (2 credits)

I. Internal Evaluation for Theory Courses – 20 Marks

1) Continuous Internal Assessment(CIA) Assignment - Tutorial/ Case Study/ Project / Presentations/ Group Discussion / Ind. Visit. – 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.