

John Wilson Education Society's

# Wilson College (Autonomous)

Chowpatty, Mumbai 400007

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*Affiliated to the*

**UNIVERSITY OF MUMBAI**

**Syllabus for S.Y.B.Sc., Zoology**

**Program: B.Sc.**

**Program Code: WSZOO**

**Choice Based Credit System (CBCS) with effect from  
Academic year 2024–2025**

**(Under NEP 2020)**

**PROGRAM OUTLINE 2023-2024**

YEAR	SEM	COURSE CODE	COURSE TITLE	CREDITS
S.Y	III	WSZOOMJ231	Unicellular, Multicellular Acoelomate life and Molecular Biology	2
		WSZOOMJ232	Developmental Biology and Ecology	2
		WSZOOMJ233	Semester 3 Practical (Based on Major Discipline Specific Course)	2
		WSZOOMN231	Wonders of Animal world and Biodiversity Conservation	2
		WSZOOMN232	Semester 3 Practical (Based on Minor Discipline Specific Course)	2
		WSZOOOE231	Pollution and Human Diseases	2
		WSZOOSE231	Semester 3 Practical (Skill Enhancement Course) Laboratory Safety and Instrumentation	2
	IV	WSZOOMJ241	Chordate Life and Inheritance Biology	2
		WSZOOMJ242	Cell Biology and Endomembrane system	2
		WSZOOMJ243	Semester 4 Practical (Based on Major Discipline Specific Course)	2
		WSZOOMN241	Origin and Evolution, Parasitology	2
		WSZOOMN242	Semester 4 Practical (Based on Minor Discipline Specific Course)	2
		WSZOOOE241	Amazing Animals, National Parks and Sanctuaries of India	2
		WSZOOVS241	Field Sciences (Vocational Skill Course) (Semester Four)	2

Programme specific outcome of S.Y.B.Sc. Zoology NEP

PSO1: The learner will acquire knowledge about the important characters in various phylum's, the Transcription and Translation in Eukaryotes and Prokaryotes

PSO2: The learner will be acquainted about various stages in the development of embryos and also various concepts of ecosystem and population ecology.

PSO3: The learner will acquire knowledge about important aspects found in various phylums, various techniques used in ecological studies and molecular biology, difference in various stages of development observed in various animals.

PSO4: The learner will become familiar with important phenomena such as echolocation, bioluminescence, pearl formation, regeneration, mimicry, migration and parental care, biodiversity of India, agencies work for conservation of biodiversity and value of biodiversity.

PSO5: The learner will become accustomed to the various types of animal interaction, breeding and parental care in animals, types of feathers, beaks and claws, types of biodiversity in hotspot and observation of fauna in the field.

PSO6: The learner will become aware about various types of pollution, their source, effects, control and abatement measures, various human diseases, the causative factors, symptoms arising, treatment and prevention.

PSO7: The learner will know about principle and functioning of various instruments such as colorimeter, pH meter, microscope, conductivity meter, nephelometer, various safety symbols, use of central tendencies and plotting of various diagrams such as Pie, Bar and histogram.

PSO8: The learners will learn about various phenomenon in chordate organisms such as retrogressive metamorphosis, migration, neoteny, parental care, adaptive radiation, types of jaw, vertebrae, genes, types of chromosomes, polygenic inheritance, linkage and crossing over, sex determination by chromosomes, hormones and environment.

PSO9: The learners will become familiar with the structural and functional organization of cell with an emphasis on nucleus, plasma membrane and cytoskeleton, ultrastructure of cell organelles and their functions.

PSO10: The learner will become conversant about retrogressive metamorphosis, swim bladder, parental care, adaptive radiations, chromosome morphology, cell organelles structures, Polytene chromosomes, permeability of cells, barr bodies, polytene chromosomes, determine cell diameter, study of prokaryotic and eukaryotic cells.

PSO11: The learner will learn about the origin of life, theories of organic evolution, evidence in favour of organic evolution, evolutionary history of humans, parasitism, types of parasites, zoonosis, life cycle, pathogenicity, specificity, control measures and treatment of protozoan parasites.

PSO12: The learner will become accustomed to protozoan parasites, fossils, speciation types, homology and analogy, phylogeny of horse, evolutionary stage of man, Parasitic adaptation, ectoparasites, mounting of prokaryotic and eukaryotic cells, measure cell diameter and solve problems based on hardy - weinberg principles.

PSO13: The learner will know about butterflies, birds, mammals, animals discovered in the last decade, amazing animals, endangered, rare, vulnerable, extinct animals, ecotourism, biopiracy, National parks of India, sanctuaries of India and various projects launched in India.

PSO14: The learner will acquire knowledge about determination of population density, frequency, abundance by various methods, study of soil texture, air microflora, field instruments, GPS, animal sign and tracks, scats, pug marks and zoogeographical regions.

#### **PREAMBLE:**

With immense pleasure, we present herewith the S.Y.B.Sc., Zoology, NEP 2020 syllabus of Wilson College (autonomous). While designing the syllabi, we have taken into consideration that the learner must get thorough

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information and knowledge about the field of Zoology from classical to applied fields. During the course of syllabi design, rounds of meetings were conducted among the teachers to deliberate upon the units to be kept for the syllabi. Also, guidance from industry experts has been taken to put in more interesting and fruitful topics that will enhance their skills in the field.

The S.Y.B.Sc. syllabus is designed as a perfect blend of traditional and advanced knowledge of the field. The practicals are perfectly distributed into identification to improve the knowledge of the learners and also performing practicals to provide a hands-on experience to the learners. The Open Elective Course, Skill Enhancement Course and Vocational Skill Course are designed with concepts and topics that will really be helpful to the learners in industry or on field.

Looking into the prepared syllabus, I am sure that the learners will enjoy the syllabus of S.Y.B.Sc. NEP 2020 presented to them for their 3 and 4 semesters. I am sincerely thankful to the staff of the Zoology Department, industry experts, and our BoS members for their valuable contribution in the construction of this syllabus.

I hope you all enjoy the syllabus. Happy learning, and valuable suggestions and recommendations are most welcome.

Thank you all.

Dr. Sushant Mane

Head of the Zoology Department.

<b>PROGRAM(s): S.Y.B.Sc. (NEP)</b>		<b>SEMESTER: Three</b>			
<b>Course: Major Discipline Specific Course 1</b>		<b>Course Code: WSZOOMJ231</b>			
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>			
<b>Lectures (Hours per week)</b>	<b>Practical (Hours per week)</b>	<b>Tutorial (Hours per week)</b>	<b>Credit</b>	<b>Continuous Internal Assessment (CIA) (Marks- 40)</b>	<b>Semester End Examination (Marks- 60)</b>
2	-	NA	2	40 Marks	60 Marks
<b>Learning Objectives:</b>					
<ul style="list-style-type: none"> <li>• To make the learners acquire knowledge about the important characters in various phylum's.</li> <li>• To make the learner know about the Transcription and Translation in Eukaryotes and Prokaryotes.</li> </ul>					
<b>Course Outcomes:</b>					
<ul style="list-style-type: none"> <li>• The learner will be able to describe various concepts like canal systems, theories of coral reef formation, parasitic adaptations etc.</li> <li>• The learner will be able to explain the torsion in mollusca and water vascular system in echinoderm and its larvae.</li> <li>• The learner will be able to distinguish between translation, transcription in Prokaryotes and Eukaryotes.</li> <li>• The learner will be able to discuss biosynthesis of DNA, aminoacylation, activation and recognition of tRNA.</li> </ul>					

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DETAILED SYLLABUS**

<b>Course Code WSZOOMJ2 31</b>	<b>Sub unit</b>	<b>Course/Title (Major Discipline Specific Course 1)</b>	<b>2 Credits</b>
	<b>Unit 1</b>	<b>Unicellular, Multicellular Acoelomate life</b>	<b>1 Credit</b>
	1.1	Protozoa : Skeleton and Reproduction	
	1.2	Porifera : Canal Systems, Spicules and Reproduction	
	1.3	Coelenterata: Polymorphism, Types and theories of formation of coral reefs.	
	1.4	Helminthes: Parasitic adaptations in Helminthes	
	1.5	Annelida : Reproduction	
	1.6	Arthropoda: Crustacean Larvae and Metamorphosis in insects.	
	1.7	Mollusca: Shell and Torsion	
	1.8	Echinodermata: Water Vascular System and Larvae.	
	<b>Unit 2</b>	<b>Molecular Biology</b>	<b>1 Credit</b>
	2.1	Biosynthesis of DNA- Semiconservative method	
	2.2	Transcription in Prokaryotes: Initiation, Elongation, Termination of m- RNA, E. Coli RNA polymerase.	
	2.3	Transcription in Eukaryotes: Initiation, Elongation and Termination of m- RNA. RNA polymerase of Eukaryotes.	
	2.4	Difference in Transcription in Prokaryotes and Eukaryotes.	
	2.5	Translation: a) Genetic Code: Properties, Features and ‘Wobble hypothesis.’ b) Structure and Chemical Composition of Prokaryotic and Eukaryotic Ribosome.	
	2.6	Aminoacylation of t-RNA, Activation of t- RNA. Recognition of t- RNA	
	2.7	Translation in Prokaryotes, Initiation of Protein Synthesis, Chain Elongation and Chain Termination.	
	2.8	Translation in Eukaryotes	

<b>PROGRAM(s): S.Y.B.Sc. (NEP)</b>		<b>SEMESTER: Three</b>			
<b>Course: Major Discipline Specific Course 2</b>		<b>Course Code: WSZOOMJ232</b>			
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>			
<b>Lectures (Hours per week)</b>	<b>Practical (Hours per week)</b>	<b>Tutorial (Hours per week)</b>	<b>Credit</b>	<b>Continuous Internal Assessment (CIA) (Marks- 40)</b>	<b>Semester End Examination (Marks- 60)</b>
<b>2</b>	<b>-</b>	<b>NA</b>	<b>2</b>	<b>40 Marks</b>	<b>60 Marks</b>
<b>Learning Objectives:</b>					
<ul style="list-style-type: none"> <li>● To make learners acquire knowledge about various stages in the development of embryos.</li> <li>● To make the learners know about the various concepts of ecosystem and population ecology.</li> </ul>					
<b>Course Outcomes:</b>					
<ul style="list-style-type: none"> <li>● The learner will be able to explain about the process of fertilization, cleavage, blastulation and gastrulation.</li> <li>● The learner will be able to predict the fate of germinal layers and coelom formation.</li> <li>● The learner will be able to distinguish between major and minor, natural and artificial ecosystems.</li> <li>● The learner will be able to state the concepts of population and community ecology.</li> </ul>					

Course Code WSZOOMJ2 32	Sub unit	Course/Title (Major Discipline Specific Course 2)	2 Credits
	<b>Unit 1</b>	<b>Developmental Biology</b>	<b>1 Credit</b>
	1.1	Fertilization and Parthenogenesis	
	1.2	Eggs and Cleavage A] Types of Eggs B] Types of Cleavage	
	1.3	Types of Blastula: Amphibia, Bird and Mammal	
	1.4	Gastrulation	
	1.5	Morphogenetic Movement: - Epiboly, Emboly and Invagination, Involution and Infiltration.	
	1.6	Fate of three Germinal Layers	
	1.7	Coelom formation	
	1.8	Comparative structure of sperm in different animals.	
	<b>Unit 2</b>	<b>Ecology</b>	<b>1 Credit</b>
	2.1	Ecosystem: Concept of Ecosystem, Major and Minor ecosystems, Natural and Artificial Ecosystems	
	2.2	Abiotic Factors: A] Edaphic: Components of Soil and Soil Profile B] Climatic: Light, Temperature and Precipitation C] Topographic	
	2.3	Major Natural Ecosystems: A] Marine B] Fresh Water C] Terrestrial: Forest, Grassland and desert Biomes	
	2.4	Population Ecology: A] Concept of Dynamic Nature B] Factors influencing Population dynamics: Natality, Mortality, Survivorship Curves, Migration, Density, Age structure, growth curves and Sex ratio.	
	2.5	Community Ecology: Concept of Ecological Niche and Ecological Succession	
	2.6	Shelford's Law Of Tolerance, Liebig's law of the minimum.	



<b>PROGRAM(s): S.Y.B.Sc. (NEP)</b>		<b>SEMESTER: Three</b>			
<b>Course: Major Discipline Specific Course Practical</b>		<b>Course Code: WSZOOMJ233</b>			
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>			
<b>Lectures (Hours per week)</b>	<b>Practical (Hours per week)</b>	<b>Tutorial (Hours per week)</b>	<b>Credit</b>	<b>Continuous Internal Assessment (CIA) (Marks- 20)</b>	<b>Semester End Examination (Marks- 30)</b>
-	4	-	2	20 Marks	30 Marks
<b>Learning Objectives:</b>					
<ul style="list-style-type: none"> <li>● To make the learners acquire knowledge about important aspects found in various phylums.</li> <li>● To make the learners know about the various techniques used in ecological studies and molecular biology.</li> <li>● To make the learner aware about the difference in various stages of development observed in various animals.</li> </ul>					
<b>Course Outcomes:</b>					
<ul style="list-style-type: none"> <li>● The learner will be able to recognize various important characters such as polymorphism, larvae, shells, different eggs, etc., in different organisms from various phylums.</li> <li>● The learner will be able to estimate salinity and Phosphate - Phosphorus in water and Texture and moisture in soil..</li> <li>● The learner will be able to analyze the problems in Molecular Biology.</li> </ul>					

<b>Practical Course Code WSZOOMJ2 33</b>	<b>Sr. no.</b>	<b>Semester 3 Practical (Based on Major Discipline Specific Course)</b>	<b>Credits: - 2</b>
	1	Mounting of foraminiferan shells from sand	
	2	Observation of Binary fission and Conjugation in Paramecium	
	3	Observation of V. S. of Grantia and L. S. of Leucosolenia	
	4	Observation of Polymorphism : Obelia Colony and medusa, Physalia, Vellela, Porpita	
	5	Observation of Corals: Fungia, Madrepora, Meandrina [Brain Coral], Tubipora and Sea Fan.	
	7	Observation of Heteronereis and Trochophore Larva	
	8	Study of Crustacean Larvae : Nauplius, Cypris, Zoea, Megalopa, Alima, Mysis and Phyllosoma	
	9	Juvenile and adult Lepisma, Life History of House fly, Mosquito, Beetle and Butterfly.	
	10	Study of shells in Mollusca : Chiton, Dentalium, Trochus, Placuna, Solen, Sepia, Nautilus, Sinistral and Dextral Shells	
	11	Study of Echinoderm larvae : Bipinnaria, Ophiopleuteus, Echinopleuteus, Auricularia, Doliolaria	
	12	Estimation of Salinity in water by argentometric method.	
	13	Estimation of Phosphate phosphorous in water	
	14	Determination of Texture of soil	
	15	Determination of Moisture content of soil	
	16	Problems based on Molecular Biology	
	18	Study of Isolecithal, Mesolecithal, Telolecithal eggs	
	19	Study of blastula of Amphioxus, Frog, Mammal	
	20	Study of Gastrula of Amphioxus, Frog, Mammal	
	21	Study of flash patterns in fireflies.	
	22	Interpretation of spectrograms of echolocating animals.	
	23	Qualitative estimation of DNA by Diphenylamine method.	
	24	Qualitative estimation of RNA by Orcinol method.	

<b>PROGRAM(s): S.Y.B.Sc. (NEP)</b>		<b>SEMESTER: Three</b>			
<b>Course: Minor Discipline Specific Course</b>		<b>Course Code: WSZOOMN231</b>			
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>			
<b>Lectures (Hours per week)</b>	<b>Practical (Hours per week)</b>	<b>Tutorial (Hours per week)</b>	<b>Credit</b>	<b>Continuous Internal Assessment (CIA) (Marks- 40)</b>	<b>Semester End Examination (Marks- 60)</b>
2	-	NA	2	40 Marks	60 Marks
<b>Learning Objectives:</b>					
<ul style="list-style-type: none"> <li>To make the learner acquire knowledge about important phenomena such as echolocation, bioluminescence, pearl formation, regeneration, mimicry, migration and parental care.</li> <li>To make the learner know about the biodiversity of India, agencies work for conservation of biodiversity and value of biodiversity.</li> </ul>					
<b>Course Outcomes:</b>					
<ul style="list-style-type: none"> <li>The learner will be able to describe various phenomena such as echolocation, bioluminescence, pearl formation and regeneration.</li> <li>The learner will be able to quote the importance of mimicry, migration and parental care in animals.</li> <li>The learner will be able to point out the importance of different types of biodiversity and hotspots.</li> <li>The learner will be able to explain the work done by various national and international organizations for conservation of biodiversity.</li> </ul>					

Course Code WSZOOMN2 31	Sub unit	Course/Title (Minor Discipline Specific Course)	2 Credits
	<b>Unit 1</b>	<b>Wonders of Animal World</b>	<b>1 Credit</b>
	1.1	Echolocation in Microchiropteran Bats and Cetaceans - Dolphins and Whales	
	1.2	Mechanism of Pearl formation in Mollusca	
	1.3	Bioluminescence in Animals: (Mechanism and use for the animal): 1.3.1 Noctiluca 1.3.2 Glow worm 1.3.3 Firefly 1.3.4 Angler Fish	
	1.4	Mimicry in Butterflies and its significance 1.5.1 Batesian mimicry: Great Eggfly and Common Crow, Common Palmfly and Plain Tiger. 1.5.2 Mullerian mimicry: Striped Tiger and Tamil Lacewing, Common Crow, Double Branded Crow and King Crow	
	1.5	Mechanism of Coral formation and types of Coral reefs	
	1.6	Migratory behaviour in birds: Definition, types, physiological preparation, factors inducing bird migration and navigation during migration	
	1.7	Adaptive features of desert animals: Reptiles (Phrynosoma) and Mammals (Camel)	
	1.8	Breeding and Parental care 1.9.1: Pisces - Ovo-viviparous (Black Molly/Guppy), Mouth brooders (Tilapia), Brood pouches (Sea horse) 1.9.2: Amphibia - Mouth brooders (Darwin's Frog), Egg carriers (Midwife Toad) 1.9.3: Mammals - Egg-laying (Duck-billed Platypus), Marsupials (Kangaroo)	
	1.9	Avian Brood Parasitism (Cuckoo)	
		<b>Unit 2</b>	<b>Biodiversity and conservation</b>
	2.1	Introduction to Biodiversity - Definition	

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2.2	Levels of Biodiversity - Introduction to Genetic, Species and Ecosystem Biodiversity.
2.3	Introduction of Biodiversity Hotspots- (Western Ghats and IndoBurma Border).
2.4	Values of biodiversity - Direct and Indirect use value
2.5	Threats to Biodiversity - Habitat loss and Man-Wildlife conflict.
2.6	<p>Biodiversity conservation and management</p> <p>2.6.1: Conservation strategies: in situ, ex-situ, National parks, Sanctuaries and Biosphere reserves.</p> <p>2.6.2: Introduction to International efforts: Convention on Biological Diversity (CBD), International Union for Conservation of Nature and Natural Resources (IUCN), United Nations Environment Program - World Conservation Monitoring Centre (UNEP- WCMC)</p> <p>2.6.3: National Biodiversity Action Plan, 2002</p> <p>2.6.4: Introduction to Indian Wildlife (Protection) Act, 1972 and Convention for International Trade of endangered species</p>

<b>PROGRAM(s): S.Y.B.Sc. (NEP)</b>		<b>SEMESTER: Three</b>			
<b>Course: Minor Discipline Specific Course Practical</b>		<b>Course Code: WSZOOMN232</b>			
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>			
<b>Lectures (Hours per week)</b>	<b>Practical (Hours per week)</b>	<b>Tutorial (Hours per week)</b>	<b>Credit</b>	<b>Continuous Internal Assessment (CIA) (Marks- 20)</b>	<b>Semester End Examination (Marks- 30)</b>
-	4	-	2	20 Marks	30 Marks
<b>Learning Objectives:</b>					
<ul style="list-style-type: none"> <li>• To make the learner know about the various types of animal interaction, breeding and parental care in animals, types of feathers, beaks and claws.</li> <li>• To make the learner acquire important information such as types of biodiversity in hotspot and observation of fauna in the field.</li> </ul>					
<b>Course Outcomes:</b>					
<ul style="list-style-type: none"> <li>• The learner will be able to identify various foraminiferan shells, corals, birds, feathers, adaptive radiations and mimicry.</li> <li>• The learner will be able to describe the flash patterns, symbiosis, camouflage, cannibalism, animal architecture and bioluminescence.</li> <li>• The learner will be able to draw spectrograms of echolocating animals.</li> </ul>					

<b>Practical</b> <b>Course Code</b> <b>WSZOOMN2</b> <b>32</b>	<b>Sr. no.</b>	<b>Semester 3 Practical</b> <b>(Based on Minor Discipline Specific Course)</b>	<b>Credits: -</b> <b>2</b>
	1	Mounting of foraminiferan shells from sand.	
	2	Study of types of Corals - Meandrina, Tubipora, Acropora, Fungia, Montipora, Pocillopora, Heliopora, Gorgonia.	
	3	Study of the following; a. Symbiosis (Termite and Trychonympha, hermit crab and sea anemone) b. Camouflage (leaf insect, chameleon) c. Cannibalistic mate-eating animals (Spider and Praying Mantis) d. Animal architects: Termites, Harvester ant and Baya weaver bird e. Bioluminescent organisms - Railroad worm, click beetle, deep sea dragonfish, ctenophore	
	4	Breeding and parental care - a. Pisces (3 spined stickleback fish, skates) b. Amphibia (Rhacophorus, Caecilian) c. Reptilia (Crocodile, Turtle) d. Mammalia (Dugong, Mongoose) e. Aves (Hornbill, Pigeon)	
	5	Study of Adaptive radiation in Reptiles - Turtle, Tortoise, Phrynosoma, Draco	
	6	a. Study of Types of feathers (contour, filoplume, down), b. beaks (Nectar feeding, Insect catching, Fruit eating, Scavenging, Filter feeding), c. claws (perching, wading, swimming, hopping) in birds.	
	7	Identification of birds - Coppersmith Barbet, Bulbul, Rose ringed Parakeet, Magpie Robin, Common Tailor Bird, Purple Sunbird.	
	8	Study of flash patterns in fireflies.	
	9	Interpretation of spectrograms of echolocating animals.	

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10	Study of mimicry in Indian butterflies.	
11	Study of fauna in the Biodiversity Hotspots - Western Ghats and Indo - Burma Border.	
12	Estimation of Salinity in water by argentometric method.	
13	Estimation of Phosphate phosphorous in water	
14	Determination of Texture of soil	
15	Determination of Moisture content of soil	
16	Study of Biodiversity by constructing a food web.	



<b>PROGRAM(s): S.Y.B.Sc. (NEP)</b>		<b>SEMESTER: Three</b>			
<b>Course: Open Elective Course</b>		<b>Course Code: WSZOOOE231</b>			
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>			
<b>Lectures (Hours per week)</b>	<b>Practical (Hours per week)</b>	<b>Tutorial (Hours per week)</b>	<b>Credit</b>	<b>Continuous Internal Assessment (CIA) (Marks- 40)</b>	<b>Semester End Examination (Marks- 60)</b>
2	-	NA	2	40 Marks	60 Marks
<b>Learning Objectives:</b>					
<ul style="list-style-type: none"> <li>● To make the learners know about various types of pollution, their source, effects, control and abatement measures.</li> <li>● To make the learners know about various human diseases, the causative factors, symptoms arising, treatment and prevention.</li> </ul>					
<b>Course Outcomes:</b>					
<ul style="list-style-type: none"> <li>● The learner will be able to state the various types of pollution.</li> <li>● The learner will be able to explain about the sources, effects, control and abatement measures of various types of pollution.</li> <li>● The learner will be able to identify symptoms of common human diseases such as typhoid, ringworm, dengue, rabies etc.</li> <li>● The learner will be able to tell the treatment and preventive measures for various common human diseases such as typhoid, ringworm, dengue, rabies etc.</li> </ul>					

Course Code WSZOOOE2 31	Sub unit	Course/Title (Open Elective Course) (Semester Three)	2 Credits
	<b>Unit 1</b>	<b>Pollution Control</b>	<b>1 Credit</b>
	1.1	Types and sources of air pollutants	
	1.2	Effects of air pollution on organisms, its control and abatement measures	
	1.3	Types and sources of water pollutants	
	1.4	Effects of water pollution on organisms, its control and abatement measures	
	1.5	Types and sources of soil pollutants	
	1.6	Effects of soil pollution on organisms, its control and abatement measures	
	1.7	Different sources of Noise pollution	
	1.8	Effects of Noise pollution on organisms, its control and abatement measures	
	1.9	Pollution by Nuclear substances	
	1.10	Types and sources of solid waste pollution	
	1.11	Effects of solid waste pollution, its control and abatement measures	
	<b>Unit 2</b>	<b>Human diseases and treatment</b>	
	2.1	Tuberculosis - life cycle, symptoms, treatment and prevention	
	2.2	Typhoid - Causes, symptoms, treatment and prevention	
	2.3	Ringworm - Causes, symptoms, treatment and prevention	
	2.4	Ascariasis - Causes, symptoms, treatment and prevention	
	2.5	AIDS - Causes, symptoms, treatment and prevention	
	2.6	Dengue - Causes, symptoms, treatment and prevention	
	2.7	Rabies - Causes, symptoms, treatment and prevention	

<b>PROGRAM(s): S.Y.B.Sc. (NEP)</b>		<b>SEMESTER: Three</b>			
<b>Course: Skill Enhancement Course</b>		<b>Course Code: WSZOOSE231</b>			
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>			
<b>Lectures (Hours per week)</b>	<b>Practical (Hours per week)</b>	<b>Tutorial (Hours per week)</b>	<b>Credit</b>	<b>Continuous Internal Assessment (CIA) (Marks- 20)</b>	<b>Semester End Examination (Marks- 60)</b>
-	4	-	2	-	<b>60 Marks</b>
<b>Learning Objectives:</b>					
<ul style="list-style-type: none"> <li>● To make the learners know about principle and functioning of various instruments such as colorimeter, pH meter, microscope, conductivity meter and nephelometer.</li> <li>● To make the learner know about various safety symbols, use of central tendencies and plotting of various diagrams such as Pie, Bar and histogram.</li> </ul>					
<b>Course Outcomes:</b>					
<ul style="list-style-type: none"> <li>● The learner will be able to state the principle of various instruments such as colorimeter, pH meter, microscope, conductivity meter and nephelometer.</li> <li>● The learner will be able to show the functioning of various instruments such as colorimeter, pH meter, microscope, conductivity meter and nephelometer.</li> <li>● The learner will be able to identify various lab safety symbols.</li> <li>● The learner will be able to solve problems of central tendencies and draw diagrams such as Pie, Bar and histogram.</li> </ul>					

<b>Practical Course Code WSZOOSE23 1</b>	<b>Sr. no.</b>	<b>Semester 3 Practical (Skill Enhancement Course) Laboratory Safety and Instrumentation techniques</b>	<b>Credits: - 2</b>
	1	Identification & Interpretation of safety symbols (toxic, corrosive, explosive, flammable, skin irritant, oxidising, compressed gases, aspiration hazards and Biohazardous infectious material.)	
	2	Study of Central tendencies (Calculation and using Spreadsheet)	
	3	Plotting of Bar diagram, histogram and pie diagram	
	4	Study of parts of microscopes and their functions	
	5	Technique of focussing a permanent slide under 10x and 45x (objectives) of microscope.	
	6	Study of principle and functioning of Colorimeter	
	7	Dilution of given sample and estimation of OD by using colorimeter.	
	8	Calculation of concentration from the given OD using formula	
	9	Study of principle and functioning of pH meter	
	10	Calibration of pH meter and determination of different pH using pH meter.	
	11	Study of principle and functioning of conductivity meter	
	12	Calibration of conductivity meter and determination of different conductance using conductivity meter.	
	13	Study of principle and functioning of Nephelometer	
	14	Calibration of Nephelometer and determination of turbidity of given water sample.	

**MODALITY OF ASSESSMENT.****A. Internal Assessment- 40%- 40 Marks per paper**

Sr. No.	Evaluation Type	Marks
1	Written Objective Examination	20
2	Assignment/ Case study/ field visit report/ presentation/ project	20
	<b>Total</b>	<b>40</b>

**B. External Examination- 60%- 60 Marks per paper****Semester End Theory Examination:**

1. Duration - These examinations shall be of **two hours** duration.
2. Theory question paper pattern:
  - a. There shall be 6 questions each of 10 marks one on each unit.
  - b. All questions shall be compulsory with internal choice within the questions.

**Paper Pattern:**

Question	Options	Marks	Questions Based on
1	100 %	10	Unit 1
2	100 %	10	
3	100 %	10	
4	100 %	10	Unit 2
5	100 %	10	
6	100 %	10	
	<b>TOTAL</b>	<b>60</b>	

**Practical Examination Pattern:****A. Internal Examination: 40%- 20 Marks**

Particulars	Paper I
Journal	05
Experimental tasks	10
Participation	05

<b>Total</b>	<b>20</b>
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<b>Particulars</b>	<b>Paper I</b>
<b>Laboratory work</b>	<b>10</b>
<b>Viva + Spots + Report</b>	<b>20</b>
<b>Total</b>	<b>30</b>

**B. External Examination: 60%- 40 Marks Semester End Practical Examination:**

### **PRACTICAL BOOK/JOURNAL**

The students are required to perform 75% of the Practical mentioned in the syllabus for the journal to be duly certified.

The students are required to present a duly certified journal for appearing at the practical examination, failing which they will not be allowed to appear for the examination.

<b>PROGRAM(s): S.Y.B.Sc. (NEP)</b>		<b>SEMESTER: Four</b>			
<b>Course: Major Discipline Specific Course 1</b>		<b>Course Code: WSZOOMJ241</b>			
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>			
<b>Lectures (Hours per week)</b>	<b>Practical (Hours per week)</b>	<b>Tutorial (Hours per week)</b>	<b>Credit</b>	<b>Continuous Internal Assessment (CIA) (Marks- 40)</b>	<b>Semester End Examination (Marks- 60)</b>
2	-	NA	2	40 Marks	60 Marks

**Learning Objectives:**

- To make the learners know about various phenomenon in chordate organisms such as retrogressive metamorphosis, migration, neoteny, parental care, adaptive radiation, types of jaw and vertebrae.
- To make the learners know about gene, types of chromosomes, polygenic inheritance, linkage and crossing over, sex determination by chromosomes, hormones and environment.

**Course Outcomes:**

- The learner will be able to discuss various phenomenon in chordate organisms such as retrogressive metamorphosis, migration, neoteny, parental care, adaptive radiation.
- The learner will be able to identify types of jaws and vertebrae in chordate organisms.
- The learner will be able to identify types of chromosomes and types of crossing over.
- The learner will be able to relate the sex determination in chordate organisms by chromosomes, hormones and environment.

## DETAILED SYLLABUS

Course Code WSZOOMJ2 41	Sub unit	Course/Title (Major Discipline Specific Course 1)	2 Credits
	<b>Unit 1</b>	<b>Chordate Life</b>	<b>1 Credit</b>
	1.1	Retrogressive metamorphosis in Ascidians	
	1.2	Types of Jaws suspension in vertebrates	
	1.3	Types of vertebrae based on the shape of the centra.	
	1.4	Swim Bladder, Breeding and Parental Care in fishes	
	1.5	Neoteny and Parental care in Amphibians	
	1.6	Adaptive radiations in reptiles	
	1.7	Migration in Birds	
	1.8	Adaptive radiation in birds	
	1.9	Egg laying mammals and marsupials	
	1.10	Aquatic Mammals	
	<b>Unit 2</b>	<b>Inheritance Biology</b>	<b>1 Credit</b>
	2.1	Classical and Modern concept of Gene (Cistron, Muton, Recon).	
	2.2	Types of chromosome- heterochromatin, euchromatin, Giant chromosomes- Polytene and Lampbrush.	
	2.3	Polygenic inheritance with reference to skin color and eye colour in humans.	
	2.4	Linkage and crossing over, Types of crossing over, Cytological basis of crossing over.	
	2.5	Sex Determination Chromosomal Mechanisms: XX-XO, XX-XY, ZZ-ZW	
	2.6	Sex determination in Honey bees- Haplodiploidy Sex determination in Drosophila-Genic balance theory,	
	2.7	Hormonal influence on sex determination-Freemartin and Sex reversal.	
	2.8	Role of environmental factors in sex determination - Bonelia and Crocodile	
2.9	Barr bodies and Lyon hypothesis		



<b>PROGRAM(s): S.Y.B.Sc. (NEP)</b>		<b>SEMESTER: Four</b>			
<b>Course: Major Discipline Specific Course 2</b>		<b>Course Code: WSZOOMJ242</b>			
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>			
<b>Lectures (Hours per week)</b>	<b>Practical (Hours per week)</b>	<b>Tutorial (Hours per week)</b>	<b>Credit</b>	<b>Continuous Internal Assessment (CIA) (Marks- 40)</b>	<b>Semester End Examination (Marks- 60)</b>
<b>2</b>	<b>-</b>	<b>NA</b>	<b>2</b>	<b>40 Marks</b>	<b>60 Marks</b>

**Learning Objectives:**

- To make the learner know about the structural and functional organization of cell with an emphasis on nucleus, plasma membrane and cytoskeleton.
- To make the learner know the ultrastructure of cell organelles and their functions.

**Course Outcomes:**

- The learner will be able to explain the structural and functional organization of cell with an emphasis on nucleus, plasma membrane and cytoskeleton.
- The learner will be able to describe the composition of the transport mechanisms adopted by the cell and its organelles for its maintenance and composition of the cell.
- The learner will be able to discuss the intricacies of the endomembrane system.
- The learner will be able to tell the interrelationship between the endomembrane system and functioning of the cell.

Course Code WSZOOMJ242	Sub unit	Course/Title (Major Discipline Specific Course 2)	2 Credits
	<b>Unit 1</b>	<b>Cell Biology</b>	<b>1 Credit</b>
	1.1	Introduction to cell biology Definition and scope Cell theory Generalized prokaryotic, eukaryotic cell: size, shape and structure	
	1.2	Nucleus: - Size, shape, number and position Structure and functions of interphase nucleus, Ultrastructure of nuclear membrane and pore complex, Nucleolus: general organization, chemical composition & functions, Nuclear sap/ nuclear matrix, Nucleocytoplasmic interactions	
	1.3	Fluid Mosaic Model, Junctional complexes, Membrane receptors, Microvilli and Desmosomes.	
	1.4	Diffusion and Osmosis Transport: Passive and Active Endocytosis and Exocytosis	
	1.5	Microtubules: Composition and functions Microfilaments: Composition and functions	
	<b>Unit 2</b>	<b>Endomembrane System</b>	
	2.1	General morphology of endomembrane system, ultrastructure, types of ER and biogenesis of ER Functions of Rough Endoplasmic Reticulum(RER) and Smooth Endoplasmic Reticulum(SER)	
	2.2	Ultrastructure of Golgi complex, functions of Golgi complex (protein glycosylation, lipid and polysaccharide metabolism, protein sorting and secretion, Golgi Anti-Apoptotic Protein -GAAP)	
	2.3	Origin, occurrence, polymorphism and functions; Peroxisomes: Origin, morphology & functions	
	2.4	Ultrastructure, chemical composition, functions of mitochondria and bioenergetics (Chemical energy & ATP, Krebs cycle, respiratory chain and oxidative phosphorylation), Biogenesis.	
	2.5	Lysosomes: - Structure and Functions	
	2.6	Diseases associated with cell organelles	

<b>PROGRAM(s): S.Y.B.Sc. (NEP)</b>		<b>SEMESTER: Four</b>			
<b>Course: Major Discipline Specific Course Practical</b>		<b>Course Code: WSZOOMJ243</b>			
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>			
<b>Lectures (Hours per week)</b>	<b>Practical (Hours per week)</b>	<b>Tutorial (Hours per week)</b>	<b>Credit</b>	<b>Continuous Internal Assessment (CIA) (Marks- 20)</b>	<b>Semester End Examination (Marks- 30)</b>
-	4	-	2	20 Marks	30 Marks

**Learning Objectives:**

- To make the learner know about retrogressive metamorphosis, swim bladder, parental care, adaptive radiations, chromosome morphology, cell organelles structures and Polytene chromosomes.
- To make the learner know about permeability of cells, barr bodies, polytene chromosomes, determine cell diameter, study of prokaryotic and eukaryotic cells.

**Course Outcomes:**

- The learner will be able to explain about retrogressive metamorphosis, swim bladder, parental care and adaptive radiations in animals.
- The learner will be able to describe the chromosome morphology, cell organelles structures and Polytene chromosomes.
- The learner will be able to interpret the permeability of cells and cell diameter.
- The learner will be able to demonstrate the mounting of barr bodies, polytene chromosomes, prokaryotic and eukaryotic cells.

Practical Course Code WSZOOMJ 243	Sr. no.	Semester 4 Practical (Based on Major Discipline Specific Course)	Credits: - 2
	1	Study of Ascidian tadpole (retrogressive metamorphosis)	
	2	Study of swim bladder (in situ)	
	3	Parental Care and Breeding in Sea horse, Gouramy, Siamese fighter, Catfish, Tilapia, Caecilian, Midwife toad, Neoteny (axolotl larvae)	
	4	Adaptive radiation in reptiles : Turtle, Tortoise, Chameleon, Phrynosoma, Crocodile or Gharial	
	5	Study of Adaptive radiations in Mammals : Duck billed Platypus, Kangaroo, Bottlenose dolphin, Blue whale, Sea Cow [Dugong]	
	6	Study of permeability of cell through plasma membrane (osmosis in blood cells)	
	7	Study of ultra structure of Cell Organelles using electron micrograph Mitochondria, Endoplasmic reticulum, Golgi complex, Nucleus and Lysosomes	
	8	Study of Chromosome morphology using Onion root tip-squash preparation	
	9	Detection of blood groups and Rh factor.	
	10	Mounting of Barr bodies.	
	11	Study of polytene chromosome in chironomous larva	
	13	Study of Chromosome morphology	
	14	Measurement of cell diameter by oculometer (by using permanent slide)	
	15	Study of prokaryotic cells (bacteria) by Crystal violet staining technique	
	16	Study of eukaryotic cells (WBCs/Epithelial cell) from blood smear by Leishman's stain	

<b>PROGRAM(s): S.Y.B.Sc. (NEP)</b>		<b>SEMESTER: Four</b>			
<b>Course: Minor Discipline Specific Course</b>		<b>Course Code: WSZOOMN241</b>			
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>			
<b>Lectures (Hours per week)</b>	<b>Practical (Hours per week)</b>	<b>Tutorial (Hours per week)</b>	<b>Credit</b>	<b>Continuous Internal Assessment (CIA) (Marks- 40)</b>	<b>Semester End Examination (Marks- 60)</b>
2	-	NA	2	40 Marks	60 Marks
<p><b>Learning Objectives:</b></p> <ul style="list-style-type: none"> <li>• To make the learner know about the origin of life, theories of organic evolution, evidence in favour of organic evolution and evolutionary history of humans.</li> <li>• To make the learner about parasitism, types of parasites, zoonosis, life cycle, pathogenicity, specificity, control measures and treatment of protozoan parasites.</li> </ul>					
<p><b>Course Outcomes:</b></p> <ul style="list-style-type: none"> <li>• The learner will be able to explain the origin of life and various theories of organic evolution.</li> <li>• The learner will be able to describe evidence in favour of organic evolution and evolutionary history.</li> <li>• The learner will be able to identify different types of parasites and specificity.</li> <li>• The learner will be able to tell about zoonosis, life cycle, pathogenicity, control measures and treatment of protozoans.</li> </ul>					

Course Code WSZOOMN241	Sub unit	Course/Title (Minor Discipline Specific Course)	2 Credits
	<b>Unit 1</b>	<b>Origin and Evolution</b>	<b>1 Credit</b>
	1.1	Introduction <ul style="list-style-type: none"> <li>● Origin of the Universe</li> <li>● Chemical evolution - Miller-Urey experiment,</li> <li>● Haldane and Oparin theory</li> <li>● Origin of life</li> <li>● Origin of eukaryotic cell</li> </ul>	
	1.2	Theories of organic evolution <ul style="list-style-type: none"> <li>● Theory of Lamarck</li> <li>● Theory of Darwin and Neo- Darwinism</li> <li>● Mutation Theory</li> <li>● Modern synthetic theory</li> <li>● Weismann's Germplasm theory</li> </ul>	
	1.3	Evidences in favour of organic evolution <ul style="list-style-type: none"> <li>● Evidences from geographical distribution, paleontology, anatomy, embryology, physiology and genetics</li> </ul>	
	1.4	Evolutionary history <ul style="list-style-type: none"> <li>● Evolutionary time scale; eras, periods and epochs,</li> <li>● Major events in the evolutionary time scale</li> <li>● Stages in primate evolution including Homo sapiens.</li> <li>● Evolution of horse</li> </ul>	
	<b>Unit 2</b>	<b>Parasitology</b>	<b>1 Credit</b>
	2.1	Definitions: Parasitism, Host, Parasite, Vector-biological and mechanical.	
	2.2	Types of parasites-Definitive, Intermediate, Ectoparasite, Endoparasite and their subtypes.	
	2.3	Definition, structural specificity, physiological specificity and ecological specificity.	
	2.4	Life cycle, pathogenicity, control measures and treatment of <i>Entamoeba histolytica</i> , <i>leishmaniasis</i> , <i>Plasmodium</i>	
	2.5	Zoonosis- Bird flu, Anthrax, Rabies and Toxoplasmosis.	

<b>PROGRAM(s): S.Y.B.Sc. (NEP)</b>		<b>SEMESTER: Four</b>			
<b>Course: Minor Discipline Specific Course Practical</b>		<b>Course Code: WSZOOMN242</b>			
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>			
<b>Lectures (Hours per week)</b>	<b>Practical (Hours per week)</b>	<b>Tutorial (Hours per week)</b>	<b>Credit</b>	<b>Continuous Internal Assessment (CIA) (Marks- 20)</b>	<b>Semester End Examination (Marks- 30)</b>
-	4	-	2	20 Marks	30 Marks

**Learning Objectives:**

- To make the learner know about protozoan parasites, fossils, speciation types, homology and analogy, phylogeny of horse, evolutionary stage of man, Parasitic adaptation and ectoparasites.
- To make the learner know about mounting of prokaryotic and eukaryotic cells, measure cell diameter and solve problems based on hardy - weinberg principles.

**Course Outcomes:**

- The learner will be able to identify protozoan parasites, fossils, speciation, homology, analogy, parasites, ectoparasites and parasitic adaptations.
- The learner will be able to explain the phylogeny of horse and evolution of man.
- The learner will be able to draw phylogenetic trees and solve problems based on hardy - weinberg principles.
- The learner will be able to demonstrate mounting of prokaryotic, eukaryotic cells and measure cell diameter using an oculometer.

Practical Course Code WSZOOMN 242	Sr. no.	Semester 4 Practical (Based on Minor Discipline Specific Course)	Credits: - 2
	1	Study of Protozoan parasites: Giardia, Entamoeba, Plasmodium, Trypanosoma, Leishmania.	
	2	Identification and study of fossils : - a. Arthropods: Trilobite, b. Mollusca: Ammonite, c. Aves: Archaeopteryx	
	3	Identification of a) Allopatric speciation (Cyprinodont species) b) Sympatric speciation (Hawthorn fly and Apple maggot fly) c) Parapatric speciation (Snail)	
	4	Study of homology and analogy from suitable specimens/ pictures.	
	5	Study of Phylogeny of horse with diagrams/ cut outs of limbs and teeth of horse ancestors b) Darwin's Finches with diagrams/ cut outs of beaks of different species.	
	6	Study of successive stages of evolution of man with special reference to cranial capacity, skull, gait, dentition.	
	7	Study of morphological similarities between Man and Ape (Girdles, Skull, long bones). (Australopethicus, Homo erectus, Homo neanderthals, Cromagnon and Homo sapiens)	
	8	Construction of an evolutionary phylogenetic tree from given data.	
	9	Problems based on hardy weinberg principle.	
	10	Study of Anthrax bacteria, Rabies virus, Bird Flu virus, Toxoplasma.	
	12	Parasitic adaptations: Scolex and mature proglottid of Tapeworm	
	13	Study of Ectoparasites: a) Leech b) Tick c) Mite	
	14	Measurement of cell diameter by oculometer (by using permanent slide)	
	15	Study of prokaryotic cells (bacteria) by Crystal violet staining technique	
	16	Study of eukaryotic cells (WBCs) from blood smear by Leishman's stain	



<b>PROGRAM(s): S.Y.B.Sc. (NEP)</b>		<b>SEMESTER: Four</b>			
<b>Course: Open Elective Course</b>		<b>Course Code: WSZOOOE241</b>			
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>			
<b>Lectures (Hours per week)</b>	<b>Practical (Hours per week)</b>	<b>Tutorial (Hours per week)</b>	<b>Credit</b>	<b>Continuous Internal Assessment (CIA) (Marks- 40)</b>	<b>Semester End Examination (Marks- 60)</b>
2	-	NA	2	40 Marks	60 Marks
<b>Learning Objectives:</b>					
<ul style="list-style-type: none"> <li>● To make the learner know about butterflies, birds, mammals, animals discovered in the last decade and amazing animals.</li> <li>● To make the learner know about endangered, rare, vulnerable, extinct animals, ecotourism, biopiracy, National parks of India, sanctuaries of India and various projects launched in India.</li> </ul>					
<b>Course Outcomes:</b>					
<ul style="list-style-type: none"> <li>● The learner will be able to identify different butterflies, birds and mammals of India.</li> <li>● The learner will be able to discuss animals discovered in the last decade and amazing animals.</li> <li>● The learner will be able to classify between endangered, rare, vulnerable and extinct animals.</li> <li>● The learner will be able to explain about ecotourism, biopiracy, different animal conservation projects and different national parks and sanctuaries of India.</li> </ul>					

Course Code WSZOOOE2 41	Sub unit	Course/Title  (Open Elective Course) (Semester Four)	2 Credits
	<b>Unit 1</b>	<b>Amazing Animals</b>	<b>1 Credit</b>
	1.1	Introduction and life timeline	
	1.2	Butterflies the flying jewels- Blue Mormon, Striped tiger c) Herpetofauna of India- Flying frog, Fan Throated lizard and Gharial	
	1.3	Feathered Bipeds: Kingfisher, Drongo	
	1.4	Mammals of India: Malabar giant squirrel	
	1.5	The world's most amazing animals (emphasis should be given only on amazing aspects) a) Octopus b) Spider c) Mudskipper d) Flying fish e) Pebble toad f) Strawberry poison frog g) Komodo dragon h) Lesser flamingo i) Great white pelican j) Spatule -tailed hummingbird k) Cheetah	
	1.6	Five most incredible animals discovered within the last decade a) The Purple (joker) crab, b) The African dwarf sawshark (stabbing shark), c) The Psychedelic (crime fighting) gecko, d) The Matilda viper e) The Myanmar snub-nosed monkey	
	1.7	Marvels of Animals a) Mantis shrimp: Fastest punch b) Homing in Pacific salmon c) Sperm whale: Mechanism of deep sea diving.	
	<b>Unit 2</b>	<b>National parks and Sanctuaries of India</b>	<b>1 Credit</b>
	2.1	Categorization of fauna into endangered, rare, vulnerable and extinct species. Study of Indian states animals and birds.	
	2.2	National Parks and Wildlife Sanctuaries of India (Sanjay Gandhi National Park, Tadoba Tiger Reserve, Corbett National Park, Kaziranga National Park, Gir National Park, Ranthambore National Park,, Pirotan Island Marine Park, Keoladeo Ghana National Park, Bandipur Sanctuary	
	2.3	Ecotourism and Biopiracy	
	2.4	Project Hangul, Project Elephant, Project Tiger.	
	2.5	Project Himalayan Musk Deer,	
	2.6	Project Snow Leopard, Project Sea Turtle.	

<b>PROGRAM(s): S.Y.B.Sc. (NEP)</b>		<b>SEMESTER: Four</b>			
<b>Course: Vocational Skill Course</b>		<b>Course Code: WSZOOVS241</b>			
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>			
<b>Lectures (Hours per week)</b>	<b>Practical (Hours per week)</b>	<b>Tutorial (Hours per week)</b>	<b>Credit</b>	<b>Continuous Internal Assessment (CIA) (Marks- 20)</b>	<b>Semester End Examination (Marks- 60)</b>
-	4	-	2	-	<b>60 Marks</b>
<b>Learning Objectives:</b>					
<ul style="list-style-type: none"> <li>● To make the learner acquire knowledge about determination of population density, frequency and abundance by various methods.</li> <li>● To make the learner know about study of soil texture, air microflora, field instruments, GPS, animal sign and tracks, scats, pug marks and zoogeographical regions.</li> </ul>					
<b>Course Outcomes:</b>					
<ul style="list-style-type: none"> <li>● The learner will be able to estimate the population density, frequency and abundance of species by various methods.</li> <li>● The learner will be able to estimate soil texture and air microflora.</li> <li>● The learner will be able to identify field instruments, animal signs, tracks, scats, pug marks and zoogeographical regions.</li> <li>● The learner will be able to apply the use of GPS.</li> </ul>					

Course Code WSZOOVS2 41	Sub unit	Course/Title Field Sciences (Vocational Skill Course) (Semester Four)	2 Credits
	1	To determine the minimum size of the quadrat by species area-curve method.	
	2	To determine the minimum number of quadrats required for reliable estimate of biomass in grasslands	
	3	Determination of population density, frequency and abundance in a natural/hypothetical community by quadrat method and calculation of Shannon Weiner diversity index.	
	4	Determination of population density, frequency and abundance in a natural/hypothetical community by line transect method and calculation of species diversity index.	
	5	Estimation of population density by capture recapture method	
	6	To study frequency of species and to compare the frequency distribution with Raunkiaer's standard frequency diagram.	
	7	To estimate Importance Value Index for species on the basis of relative frequency, relative density and relative dominance in protected and grazed grassland.	
	8	To measure the species through point-frame method	
	9	To determine the biomass of a particular area.	
	10	To study species diversity (richness and evenness), Index of dominance, Similarity index, Dissimilarity index and Species diversity index	
	11	Determination of Soil Texture using sedimentation method	
	12	Study of air microflora.	
	13	Study of Instruments: D.O. meter, Photometer(Lux meter), Refractometer, Secchi's disk, Sound meter,	
	14	Use of GPS in designing a working area for field study/ report making.	
	15	Identification of field equipment.	
	16	Identification of rings, tags, colour codes and colour markings on animals.	

	17	Identification and analysis of animal signs and tracks.	
	18	Analysis of scat with the help of a key.	
	19	Study of tracing of pug marks of wildlife.	
	20	Identification of various Zoogeographical regions on a map and animals in zoogeographical realms.	

**MODALITY OF ASSESSMENT.**

**C. Internal Assessment- 40%- 40 Marks per paper**

<b>Sr. No.</b>	<b>Evaluation Type</b>	<b>Marks</b>
1	<b>Written Objective Examination</b>	<b>20</b>
2	<b>Assignment/ Case study/ field visit report/ presentation/ project</b>	<b>20</b>
	<b>Total</b>	<b>40</b>

**D. External Examination- 60%- 60 Marks per paper**

**Semester End Theory Examination:**

1. Duration - These examinations shall be of **two hours** duration.
2. Theory question paper pattern:
  - a. There shall be 6 questions each of 10 marks one on each unit.
  - b. All questions shall be compulsory with internal choice within the questions.

**Paper Pattern:**

<b>Question</b>	<b>Options</b>	<b>Marks</b>	<b>Questions Based on</b>
<b>1</b>	<b>100 %</b>	<b>10</b>	Unit 1
<b>2</b>	<b>100 %</b>	<b>10</b>	
<b>3</b>	<b>100 %</b>	<b>10</b>	
<b>4</b>	<b>100 %</b>	<b>10</b>	Unit 2
<b>5</b>	<b>100 %</b>	<b>10</b>	
<b>6</b>	<b>100 %</b>	<b>10</b>	
	<b>TOTAL</b>	<b>60</b>	

**Practical Examination Pattern:**

**C. Internal Examination: 40%- 20 Marks**

Particulars	Paper I
Journal	05
Experimental tasks	10
Participation	05
<b>Total</b>	<b>20</b>

Particulars	Paper I
Laboratory work	10
Viva + Spots + Report	20
<b>Total</b>	<b>30</b>

**D. External Examination: 60%- 30 Marks Semester End Practical Examination:****PRACTICAL BOOK/JOURNAL**

The students are required to perform 75% of the Practical mentioned in the syllabus for the journal to be duly certified.

The students are required to present a duly certified journal for appearing at the practical examination, failing which they will not be allowed to appear for the examination.

**References**

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- Medical Parasitology - Arora.
- Textbook of Medical parasitology - C. K. Jayaram Paniker.
- Fundamental of genetics – J.L Jain and Sanjay Jain and Nitin Jain.S chand publication.6th edition.
- Principles and techniques of Biochemistry and Molecular Biology – Keith Wilson and John walker 7th edition.
- Lehninger Principles of Biochemistry – Nelson and Cox, McMillan Worth.
- Genetics – P.S Verma and V. K Agrawal. 9 th edition.
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- Chordate Zoology – Jordan and Verma, S. Chand Publication.
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- Zoology – S. A. Miller and J. B. Harley, Tata McGraw hill.
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**WILSON COLLEGE (AUTONOMOUS), SYLLABUS FOR ZOOLOGY**

- Cell biology and genetics – P. K Gupta.
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