

**Scheme of Programme: Bachelor of Science in Life Sciences****Subject:**

**Zoology**

**(Scheme UG A1: Undergraduate Programmes (Multidisciplinary))**

**Semester 1**

Course Code	Course Title	Course ID	L	T	P	L	T	P	Total Credits	MARKS				
			(Hrs)			Credits				TI	TE	PI	PE	Total
Core Course(s)														
CC-A1	Diversity of Non-Chordates	240/ZOO M/CC101	3	-	2	3	-	1	4	25	50	5	20	100

**Semester 2**

**Core Course(s)**

Course Code	Course Title	Course ID	L	T	P	L	T	P	Total Credits	MARKS				
			(Hrs)			Credits				TI	TE	PI	PE	Total
Core Course(s)														
CC-A2	Diversity of Chordates		3	-	2	3	-	1	4	25	50	5	20	100

**Semester 3**

Course Code	Course Title	Course ID	L	T	P	L	T	P	Total Credits	MARKS				
			(Hrs)			Credits				TI	TE	PI	PE	Total
			Core Course(s)											
CC-A3	Cell Biologyand Animal Genetics		3	-	2	3	-	1	4	25	50	5	20	100

## Semester 4

Course Code	Course Title	Course ID	L	T	P	L	T	P	Total Credits	MARKS				
			(Hrs)			Credits				TI	TE	PI	PE	Total
Core Course(s)														
CC-A4	Biomolecules and Mammalian Physiology		3	-	2	3	-	1	4	25	50	5	20	100

Internship is to be done during summer break after 4<sup>th</sup> Semester, Marks will be added in 5<sup>th</sup> Semester.

## 5

Course Code	Course Title	Course ID	L	T	P	L	T	P	Credits	MARKS				
			(Hrs)			Credits				TI	TE	PI	PE	Total
Core Course(s)														
CC-A5	Ecology and Environment		3	-	2	3	-	1	4	25	50	5	20	100

## Semester 6

Course Code	Course Title	Course ID	L	T	P	L	T	P	Total Credits	MARKS				
			(Hrs)			Credits				TI	TE	PI	PE	Total
Core Course(s)														
CC-A6	Developmental Biology and Evolution		3	-	2	3	-	1	4	25	50	5	20	100

Semester 7; 8 (Honours) and Semester 8 (Honours with Research): Detailed Scheme will be prepared in due course of time.

Nature of Work	CourseCredits	Contact hours per week	Contact hoursper semester (15 weeks)
Lecture	01	01	15
Tutorial per paper	01	01	15
Practical, Seminar, Internship,field practice/project, or community engagement, etc.	01	02	30

Note: Tutorial batch size (UG programme: 20-25, PG Programme: 12-15)

The distribution of credits among the lectures/tutorial/practicum will be as follows:

Courses	Total Credits	L (Credits)	T (Credits)	P (Credits)	MARKS			
					TI	TE	PI	PE
	4	3 (3 hrs)	1	-	30	70	-	-
	3	2 (2 hrs)	1	-	25	50	-	-
	2	1	1	-	15	35	-	-
	4	3 (3 hrs)	-	1 (2 hrs)	25	50	5	20
	4 (Where pract. is dominant)	2 (2 hrs)	-	2 (4 hrs)	15	35	15	35

	3	2 (2 hrs)	-	1 (2 hrs)	15	35	5	20
	2	1	-	1 (2 hrs)	5	20	5	20
	2	-	-	2 (4 hrs)	-	-	15	35
	3	-	-	3 (6 hrs)	-	-	25	50
	4	-	-	4 (8 hrs)	-	-	30	70
AEC/VAC	2	2 (2 hrs)			15	35	-	-
	3	2 (2 hrs)		1 (2 hrs)	15	35	5	20
	2	1		1 (2 hrs)	5	20	5	20
DSEC	4	3 (3 hrs)		1 (2 hrs)	25	50	5	20
Minor/VOC	4	2 (2 hrs)		2 (4 hrs)	15	35	15	35
Internship	4	--	--	4 (8 hrs)			30	70

L= Lecture; T= Tutorial, P= Practicum; Ti= Theory Internal Assessment; TE= Theory End Semester Examination; PI= Practicum Internal;PE= Practicum End Semester examination

**Syllabus UG A1: Undergraduate Programmes (Multidisciplinary)**

COURSE ID 240/ZOOM/CC101

ZOOLOGY: SEMESTER-I								
CourseType	Cour se Cod e	Name of the Course	Credi t	Contact Hour s/ Week	Internal Assessme ntmarks	End Ter m Mar ks	Max . Mar ks	Exam Durati on
		Diversity of Non-Chordates	3	3	25	50	75	3 hrs.
		Practical	1	2	5	20	25	4 hrs.
Level of the course: 100-199								
Pre-requisite for the course (if any): Biology as a Subject at 4.0 Level (Class XII)								
<b>Course Learning Outcomes (CLO)</b> 1. Student will be able to describe unique characters and recognize life forms of phylum Protozoa and Porifera 2. Student will be able to describe unique characters and recognize life forms of phylum Coelenterata and Helminthes 3. Student will be able to describe unique characters and recognize life forms of phylum Annelida and Arthropoda 4. Student will be able to describe unique characters and recognize life forms of phylum Mollusca, Echinodermata and Hemichordates 5. Students will be capable of identifying the characters and classification of Non-Chordates								
<b>Instructions for Paper-Setter</b> 1. Nine questions will be set in all. All questions will carry equal marks. 2. Question No. 1, which will be short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more questions selecting one question from each unit.								
UNIT	TOPICS						CONTACT HOURS	
I	Phylum Protozoa: General characters and classification up to class level., Parasitic protozoans: Life history, mode of infection and pathogenicity of <i>Entamoeba</i> , <i>Trypanosoma</i> , <i>Leishmania</i> and <i>Giardia</i> , Life history of <i>Plasmodium</i> Phylum Porifera: General characters and classification up to class level; Biodiversity and Economic importance; Canal system in sponges, spicules in sponges						12	
II	Phylum – Coelenterata: General characters and classification up to class level. Corals and coral reefs, Polymorphism in Siphonophores Phylum – Platyhelminthes and Aschelminthes: General characters and classification up to class level, Life history of Liver Fluke ( <i>Fasciola hepatica</i> ), Life history of <i>Taenia solium</i> ,						11	
III	Phylum – Annelida: General characters and classification up to class level, Metamerism in Annelids Phylum – Arthropoda: General characters and classification up to class level, Mouth parts in insects						11	
IV	Phylum - Mollusca: General characters and classification up to class level, Torsion and detorsion in Gastropoda Phylum – Echinodermata: General characters and classification up to class level, Water-vascular system in Asteroidea. Phylum Hemichordata: General characters of Hemichordates with examples						11	

<p style="text-align: center;"><b>V Practical</b></p>	<p>Classification up to orders with ecological note and economic importance of the following animals:</p> <ol style="list-style-type: none"> <li>1. Protozoa: Lamination of cultures of <i>Amoeba</i>, <i>Euglena</i> and <i>Paramecium</i>; permanent prepared slides: <i>Amoeba</i>, <i>Euglena</i>, <i>Trypanosoma</i>, <i>Noctiluca</i>, <i>Eimeria</i>, <i>Paramecium</i> (binary fission and conjugation), <i>Opalina</i>, <i>Vorticella</i>, <i>Balantidium</i>, <i>Nyctotherus</i>, radiolarian and foraminiferan ooze.</li> <li>2. Parazoa (Porifera): <i>Sycon</i>, <i>Grantia</i>, <i>Euplectella</i>, <i>Hyalonema</i>, <i>Spongilla</i>, <i>Euspongia</i></li> <li>3. Coelenterata: <i>Porpita</i>, <i>Valella</i>, <i>Physalia</i>, <i>Aurelia</i>, <i>Rhizostoma</i>, <i>Metridium</i>, <i>Millipora</i>, <i>Alcyonium</i>, <i>Tubipora</i>, <i>Zoanthus</i>, <i>Madrepora</i>, <i>Favia</i>, <i>Fungia</i>, and <i>Astrea</i>. Permanent prepared slides: <i>Hydra</i> (W.M.), <i>Hydra</i> with buds, <i>Obelia</i> (colony and medusa), <i>Sertularia</i>, <i>Plumularia</i>, <i>Tubularia</i>, <i>Bougainvillea</i>, <i>Aurelia</i> (sense organs and stages of life history).</li> <li>4. Platyhelminthes: <i>Dugesia</i>, <i>Fasciola</i>, <i>Taenia</i>, <i>Echinocoecus</i>. Permanent prepared slides: <i>Miracidium</i>, <i>Sporocyst</i>, <i>Redia</i>, <i>Cercaria</i>, <i>Scolex</i> and <i>Proglottids</i> of <i>Taenia</i> (mature and gravid).</li> <li>5. Aschelminthes: <i>Ascaris</i> (male and female), <i>Trichinella</i>, <i>Ancylostoma</i>, <i>Meloidogyne</i></li> <li>6. Annelida: <i>Pheretima</i>, <i>Heteronereis</i>, <i>Polynoe</i>, <i>Aphrodite</i>, <i>Chaetopterus</i>, <i>Arenicola</i>, <i>Tubifex</i> and <i>Pontobdella</i></li> <li>7. Arthropoda: <i>Peripatus</i>, <i>Palaemon</i> (Prawn), <i>Lobster</i>, <i>Cancer</i> (crab), <i>Sacculina</i>, <i>Eupagurus</i> (hermit crab),</li> <li>8. <i>Lepas</i>, <i>Balanus</i>, <i>Cyclops</i>, <i>Daphnia</i>, <i>Lepisma</i>, <i>Periplaneta</i> (cockroach), <i>Schistocerca</i> (locust), <i>Poeciloceris</i></li> </ol>	<p style="text-align: center;"><b>30</b></p>
	<p>(ak-hopper), <i>Gryllus</i> (cricket), <i>Mantis</i> (praying mantis), <i>Cicada</i>, <i>Forficula</i> (earwig), Dragon fly, termite queen, bug, moth, beetle, <i>Polistes</i> (wasp), <i>Apis</i> (honey bee), <i>Bombyx</i> (silk moth), <i>Cimex</i> (bed bug), <i>Pediculus</i> (body louse), <i>Millipede</i>, <i>Scolopendra</i> (centipede), <i>Palamnaeus</i> (scorpion), <i>Aranea</i> (spider), <i>Limulus</i> (king crab)</p> <ol style="list-style-type: none"> <li>9. Mollusca: <i>Mytilus</i>, <i>Ostrea</i>, <i>Cardium</i>, <i>Pholas</i>, <i>Solen</i> (razor/Fish), <i>Pecten</i>, <i>Holiotis</i>, <i>Patella</i>, <i>Aplysia</i>, <i>Doris</i>, <i>Limax</i>, <i>Loligo</i>, <i>Sepia</i>, <i>Octopus</i>, <i>Nautilus</i> (complete and T.S.), <i>Chiton</i> and <i>Dentalium</i></li> <li>10. Echinodermata: <i>Asterias</i>, <i>Echinus</i>, <i>Cucumaia</i>, <i>Ophiothrix</i>, <i>Antedon</i> and <i>Asterophyton</i></li> <li>11. Hemichordata: <i>Balanoglossus</i></li> </ol> <p>Study of slides of Non-Chordates phyla; Staining of <i>Obelia</i> and <i>Sertularia</i></p>	
<p style="text-align: center;"><b>Learning Resources</b></p>		
<ol style="list-style-type: none"> <li>1. Jordan, E.L and P.S. Verma. 2009. Invertebrate Zoology, S.Chand and Co. Ltd. New Delhi.</li> <li>2. Ayyar, E.K and T. Ananthakrishnan. 1992. Manual of Zoology Vol.1 Invertebrates Part I and II, S.Viswanathan Printers and Publishers Pvt. Ltd.Madras.</li> <li>3. Kotpal, R.L. 2021. Zoology Invertebrates. Rastogi Publications, Meerut.</li> <li>4. Nair, N.C., N. Arumugam, N. Soundarapandian, T. Murugan and S. Leelavathy. 2010. A textbook of Invertebrates. Saras Publication, Nagercoil.</li> <li>5. Rastogi V.B. 2021 . Invertebrate Zoology. Kedar Nath Ram Nath , Meerut</li> <li>6. Lal S.S. (2019) Practical Zoology Invertebrates. Rastogi Publications, Meerut</li> <li>7. Anderson D.T. (1999) Invertebrate Zoology, Oxford University Press</li> <li>8. Edward E. Ruppert, Robert D. Barnes (1994). Invertebrate Zoology ; Saunders College Pub.</li> </ol>		

**Syllabus UG A1: Undergraduate Programmes (Multidisciplinary)**

**ZOOLOGY: SEMESTER-2**

CourseTy	Cour se Code	Name of the Course	Cred it3	Conta ct Hour s/ Week	Internal Assessme ntmarks	End Ter m Mar ks	Max. Mar ks	Exam Durati on
peCC- A2 4 credit		Diversity	1	3	2 5	50	75 3	hrs.
		of		3	5	50	25 4	hrs.
		Chordat		2		20		
		es						
		Practical						
Level of the course: 100-199								
Pre-requisite for the course (if any): Biology as a Subject at 4.0 Level (Class XII)								
<b>Course Learning Outcomes (CLO)</b>								
1. Student will be able to describe unique characters and recognize life functions of Urochordates								
2. Student will be able to describe unique characters and recognize life functions of Pisces								
3. Student will be able to describe unique characters and recognize life functions of Amphibians & Reptiles								
4. Student will be able to describe unique characters and recognize life functions of Birds & Mammals								
5. Students will be capable of identifying the characters and classification of Chordates								
<b>Instructions for Paper-Setter</b>								
1. Nine questions will be set in all. All questions will carry equal marks.								
2. Question No. 1, which will be short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more questions selecting one question from each unit.								
<b>UNIT</b>	<b>TOPICS</b>	<b>CONTACT HOURS</b>						
I	<b>Chordates:</b> Salient features of chordates; Origin and classification of chordates up to class level. Functional morphology of the types with examples emphasizing their biodiversity, economic importance and conservation measures where required.	12						
	<b>Protochordates:</b> Urochordata: Classification and ecological significance; morphology and affinities Cephalochordata: Classification and ecological significance; morphology and affinities							
	<b>Cyclostomes:</b> Classification and ecological significance; morphology and affinities							
II	<b>Pisces:</b> General characters and classification of all phyla upto orders with examples emphasizing their biodiversity, economic importance and conservation measures where required. Scales & Fins, Parental care in fishes, fish migration.	11						
III	<b>Amphibia:</b> General characters and Classification upto class level; evolutionary tree; Parental Care and Neoteny in Amphibia	11						
	<b>Reptilia:</b> General characters and Classification upto classes; Extinct reptiles; poison apparatus in snakes, Difference between poisonous and non-poisonous snakes; Key for Identification of poisonous and non-poisonous snakes							
IV	<b>Aves:</b> General characters and Classifications upto classes. Flight/Aerial adaptation in birds, origin and types of Feathers; Migration in Birds; Archaeopteryx as missing link;							
	<b>Mammals:</b> General characters and classification up to classes; adaptive radiation in mammals; Dentition in mammals							

<p style="text-align: center;"><b>V Practical</b></p>	<p>1. Classification upto orders, habit, habitats, external characters and economic importance (if any):</p> <ul style="list-style-type: none"> <li>• Protochordata: <i>Molqula, Hetryllus, Pyrosoma, Doliolum, Olikopleura</i>, and <i>Amphioxus</i>.</li> <li>• Cyclostomata: <i>Myxine, Petromyzon</i> and <i>Ammocoetus</i> larva.</li> <li>• Chondrichthyes: <i>Zygaena, Pristis, Narcine</i> (electric ray), <i>Trygon, Rhinobatus, Raja</i> and <i>Chimaera</i>.</li> <li>• Osteichthyes: <i>Acipenser, Lepidosteus, Muraena, Mystus, Catla, Hippocampus, Syngnathus, Exocoetus, Anabas, Diodon, Ostracion, Tetradon, Echinus, Lophius, Solea</i> and <i>Polypterus</i>. Any of the Lung Fishes.</li> <li>• Amphibia: <i>Necturus, Proteus, Amphiuma, Salamandra, Ambystoma, Axolotl</i> larva, <i>Alytes, Bufo, Rana</i>.</li> <li>• Reptilia: <i>Hemidactylus, Calotes, Draco, Varanus, Phrynosoma, Chamaeleon, Typhlops, Python, Eryx, Ptyas, Bungarus, Naja, Hydrus, Viper, Crocodilus, Gavialis, Chelone</i> (Turtle) and <i>Testudo</i> (Tortoise).</li> <li>• Aves: <i>Casuarus, Arden, Anas, Milvus, Pavo, Eudynamis, Tyto, Alcedo, Halcyon</i></li> <li>• Mammalia: <i>Ornithorhynchus, Echidna, Didelphis, Macropus, Loris, Macaque, Hystrix, Funambulus, Felix, Panthera, Canis, Herpestes, Capra, Pteropus</i>.</li> </ul> <p>2. Study of the skeleton of <i>Scoliodon, Labeo, Rana</i> (Frog), <i>Varanus</i>, Pigeon or <i>Gallus</i> and <i>Orcyctolagus</i>/rat.</p> <p>3. Study of the following permanent slides: Tornaria larva, T.S. <i>Amphioxus</i> (through different regions). <i>Oikopleura</i>, Histology of rat (compound tissues), different types of scales.</p> <p>4. Make permanent stained preparations of the following: <i>Salpa</i>, Spicules, and Pharynx of <i>Herdmania, Amphioxus</i>, Cycloid scales</p> <p>5. Field Visit to Protected areas/National Park/Wildlife Sanctuary, Zoological museum or Zoo.</p>	<p style="text-align: center;"><b>30</b></p>
<p><b>Learning Resources</b></p>		
<ol style="list-style-type: none"> <li>1. R.L.Kotpal. Modern Textbook of Zoology</li> <li>2. E.L. Jordan and Verma. Chordate Zoology.</li> <li>3. Barrington, E.J.W. The Biology of Hemichordata and Protochordata. Oliver and Boyd, Edinburgh.</li> <li>4. Walters, H.E. and Sayles, L.D. Biology of vertebrates. MacMillan &amp; Co., New York.</li> <li>5. Kent, C.G. Comparative anatomy of vertebrates.</li> <li>6. S.S. Lal. Practical Zoology Vertebrate</li> </ol>		