Scheme of Programme: Bachelor of Science
Subject: Zoology
Semester 1

Course Code	Course Title	Course ID	L (Hrs)	T (Hrs)	P (Hrs)	L Credits	T Credits	P Credits	Total Credits	MARKS TI	MARKS TE	MARKS PI	MARKS PE	MARKS Total
Core Course(s)														
CC-A1	Diversity of Non-Chordates-I	240/ZOO/CC101	3	-	2	3	-	1	4	25	50	5	20	100
CC-A2	Molecular Biology	240/ZOO/CC102	3	-	2	3	-	1	4	25	50	5	20	100
CC-A3	Diversity of NonChordates-II	240/ZOO/CC103	3	-	2	3	-	1	4	25	50	5	20	100
Minor/ Vocational Course(s)														
MIC-1	One from Pool								2					50
Multidisciplinary Course(s)														
MDC-1	One from Pool								3					75
Ability Enhancement Course(s)														
AEC-1	One from Pool								2					50
Skill Enhancement Course(s)														
SEC-1	One from Pool								3					75
Value-added Course(s)														
VAC-1	One from Pool								2					50
Total Credits									**24**					**600**

Semester 2

Course Code	Course Title	Course ID	L	T	P	L	T	P	Credits	MA RKS				
			(Hrs)			Credits				TI	TE	PI	PE	Total
Core Course(s)														
CC-A4	Diversity of Chordates-I		3	-	2	3	-	1	4	25	50	5	20	100
CC-A5	Diversity of Chordates-II		3	-	2	3	-	1	4	25	50	5	20	100
CC-A6	Aquaculture		3	-	2	3	-	1	4	25	50	5	20	100
Minor/ Vocational Course(s)														
MIC-2	One from Pool								2					50
Multidisciplinary Course(s)														
MDC-2	One from Pool								3					75
Ability Enhancement Course(s)														
AEC-2	One from Pool								2					50
Skill Enhancement Course(s)														
SEC-2	One from Pool								3					75
Value-added Course(s)														
VAC-2	One from Pool								**2**					**50**
Total Credits									**24**					**600**

Semester 3

Course Code	Course Title	Course ID	L	T	P	L	T	P	Credits	MA RKS				
			(Hrs)			Credits				TI	TE	PI	PE	Total
Core Course(s)														
CC-A7	Cell Biology and Animal Genetics		3	-	2	3	-	1	4	25	50	5	20	100
CC-A8	Pest Management		3	-	2	3	-	1	4	25	50	5	20	100
CC-A9	Biodiversity and Mammalian Physiology		2	-	2	2	-	1	3	15	35	5	20	75
Minor/ Vocational Course(s)														
MIC-3	One from Pool								4					100
Multidisciplinary Course(s)														
MDC-3	One from Pool								3					75
Ability Enhancement Course(s)														
AEC-3	One from Pool								2					50
Total Credits									**20**					**500**

Semester 4

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-A10	Biomolecules and Mammalian Physiology		3	-	2	3	-	1	4	25	50	5	20	100
CC-A11	Cytogenetics		3	-	2	3	-	1	4	25	50	5	20	100
CC-A12	Basics of Endrocrinology and Immunology		3	-	2	3	-	1	4	25	50	5	20	100
Minor/ Vocational Course(s)														
MIC/VOC -4	One from Pool								4					100
Ability Enhancement Course(s)														
AEC-4	One from Pool								2					50
Value-added Course(s)														
VAC-3	One from Pool								**2**					**50**
Total Credits									**20**					**500**

Semester 5

Course Code	Course Title	Course ID	L (Hrs)	T (Hrs)	P (Hrs)	L Credits	T Credits	P Credits	Credits	MARKS TI	MARKS TE	MARKS PI	MARKS PE	MARKS Total
Core Course(s)														
CC-A13	Ecology and Environment		3	-	2	3	-	1	4	25	50	5	20	100
CC-A14	Animal Taxonomy		3	-	2	3	-	1	4	25	50	5	20	100
CC-A15	Animal Behaviour and Chronobiology		3	-	2	3	-	1	4	25	50	5	20	100
Minor/ Vocational Course(s)														
MIC-5	One from Pool								4					100
Skill Enhancement Course(s)														
Internship									4					100
Total Credits									**20**					**500**

Semester 6

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-A16	Developmental Biology and Evolution		3	-	2	3	-	1	4	25	50	5	20	100
CC-A17	Biology of Insects		3	-	2	3	-	1	4	25	50	5	20	100
CC-A18	Parasitology		2	-	2	2	-	1	3	15	35	5	20	75
Minor/ Vocational Course(s)														
MIC-6	One from Pool								4					100
MIC-7	One from Pool								4					100
Skill Enhancement Course(s)														
SEC-3	One from Pool								3					75
Total Credits									**22**					**550**

The curriculum of semester 7 and 8 will be provided in due course of time.

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

Nature of Work	Course Credits	Contact hours per week	Contact hours per 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

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

COURSE ID: 240/ZOO/CC101

ZOOLOGY:
SEMESTER-I

CourseType	Course Code	Name of the Course	Credit	Contact Hours/ Week	Internal Assessment marks	End Term Marks	Max. Marks	Exam Duration
		Diversity of Non-Chordates-I	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)

Course Learning Outcomes (CLO)

1. Student will be able to describe unique characters and recognize life forms of phylum Protozoa
2. Student will be able to describe unique characters and recognize life forms of phylum Porifera
3. Student will be able to describe unique characters and recognize life forms of phylum Coelenterata
4. Student will be able to describe unique characters and recognize life forms of phylum Helminthes
5. Students will be capable of identifying the characters and classification of Non-Chordates

Instructions for Paper-Setter

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 order level Biodiversity and economic importance Type study of *Plasmodium* Parasitic protozoans: Life history, mode of infection and pathogenecity of *Trypanosoma* and *Leishmania*	12
II	Phylum Porifera: General characters and classification up to order level Biodiversity and Economic importance Type Study of *Sycon* Canal system in sponges Spicules in Sponges	11
III	Phylum – Coelentrata: General characters and classification up to order level Biodiversity and Economic importance Type Study of *Obelia* Corals and coral reefs Polymorphism in Siphonophores	11

IV	Phylum –Helminthes: General characters and classification up to order level, Biodiversity and Economic importance Type study of Liver Fluke, *Fasciola hepatica* Helminths Parasites: Brief account of Life history, mode of infection and pathogenecity of *Schistosoma*, *Ancyclostoma*, *Trichinella*, *Wuchereria* and *Oxyuris*	**11**

V Practical	Classificationuptoorderswithecologicalnoteandeconomicimportance ofthefollowinganimals: 1. Protozoa: Lamination of cultures of *Amoeba*, *Euglena* and *Paramecium;* permanent prepared slides: *Amoeba,Euglena, Trypanosoma, Noctiluca, Eimeria, Paramecium* (binary fission and conjugation), *Giardia*, *Entamoeba*, *Opalina, Vorticella,Balantidium,Nyctotherus*,radiolarianandformaniferanooze. 2. Parazoa(Porifera):*Sycon,Grantia,Euplectella,Hyalonema,Spongilla,Euspongia.* Permanentpreparedslides: L.S. and T.S. *Sycon*; gemmules, spicules and sponging fibres of Sycon, canal system of sponges 3. Coelenterata: *Porpita, Valella, Physalia, Aurelia, Rhizostoma, Metridium, Millipora, Alcyonium,Tubipora,Zoanthus, Madrepora, Favia, Fungia*, and *Astrea.* Permanent prepared slides: *Hydra* (W.M.), *Hydra* with buds,*Obelia* (colony and medusa), *Sertularia, Plumularia, Tubularia, Bougainvillea*, *Pennaria* (W.M.), *Aurelia* (sense organs and stagesoflifehistory). Permanentpreparedslides: T.S. *Hydra* (Testis and Ovary region) 4. Playhelminthes:*Dugesia,Fasciola,Taenia,Echinocoecus.*Permanentpreparedslides:*Miracidium,Sporocyst,Redia,Cercaria,Scolex*and*ProglotttidsofTaenia* (matureandgravid). T.S. *Fasciola* (Different regions) 5. Aschelminthes:*Ascaris*(maleandfemale),*Ancylostoma,Meloidogyne* Permanentpreparedslides : T.S. *Ascaris* (male and female), *Trichinella*	**30**

Learning Resources

1. Jordan, E.L and P.S. Verma. 2009. Invertebrate Zoology, S.Chand and Co. Ltd. New Delhi.
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.
3. Kotpal, R.L. 2021. Zoology Invertebrates. Rastogi Publications, Meerut.
4. Nair, N.C., N. Arumugam, N. Soundarapandian, T. Murugan and S. Leelavathy. 2010. A textbook of Invertebrates. Saras Publication, Nagercoil.
5. Rastogi V.B. 2021 . Invertebrate Zoology. Kedar Nath Ram Nath , Meerut
6. Lal S.S. (2019) Practical Zoology Invertebrates. Rastogi Publications, Meerut
7. Anderson D.T. (1999) Invertebrate Zoology, Oxford University Press
8. Edward E. Ruppert, Robert D. Barnes (1994)· Invertebrate Zoology ; Saunders College Pub.

COURSE ID 240/ZOO/CC102

ZOOLOGY:
SEMESTER-I

CourseType	Course Code	Name of the Course	Credit	Contact Hours/ Week	Internal Assessment marks	End Term Marks	Max. Marks	Exam Duration
		Molecular Biology	**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)

Course Learning Outcomes (CLO)

1. Students will gain an understanding of the essential characteristics of DNA. 2: Students will acquire comprehensive knowledge about RNA and its functions.
3: Students will acquire knowledge about proteins, including their structure and functions.
4: Students will develop a comprehensive understanding of the mechanisms and regulation of gene expression.

Instructions for Paper-Setter

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	Nucleic acids: Carriers of genetic information: Historical perspective; DNA as the carrier of genetic information(Griffith's, Hershey &Chase, Avery, McLeod & McCarty), Types of genetic material, denaturation and renaturation, Nucleosome. DNA replication, repair and recombination (Unit of replication, enzymes involved, replication origin and replicationfork, fidelity of replication, extrachromosomal replicons	**11**
II	RNA synthesis and processing (transcription factors and machinery, formation of initiation complex, transcriptionactivator and repressor, RNA polymerases, capping, elongation, and termination, RNA processing, RNA editing, splicing, and polyadenylation, structure and function of different types of RNA, RNA transport).	**11**
III	Protein synthesis and processing (Ribosome, formation of initiation complex, initiation factors and their regulation, elongation and elongation factors, termination, genetic code, aminoacylation of tRNA, tRNA-identity, aminoacyltRNA synthetase, and translational proof-reading, translational inhibitors, Post- translational modificationof proteins).	**12**
IV	Control of gene expression at transcription and translation level (regulating the expression of prokaryotic andeukaryotic genes, role of chromatin in gene expression and gene silencing).	**11**

V Practical	1. Preparation of LB medium and raising E.coli. 2. Isolation of genomic DNA from E.coli./onion roots 3. RNA estimation by orcinol method. 4. DNA estimation by diphenylamine reagent/ UV Spectrophotometry. 5. Photographs establishing nucleic acid as genetic material (Messelson and Stahl's, Avery et al, Griffith's, Hershey & Chase's and Fraenkel & Conrat's experiments) 6. Study of Barr body from buccal smear preparation.	**30**

Learning Resources

- Lodish, H., Berk, A., Zipursky, S.L., Matsudaria, P., Baltimoe, D. and Darnell, J. 2021. Molecular Cell Biology, W.H. Freeman and Co., New York., USA. 9th edition.
- Karp, G. Iwasa, J. Marshall W. 2019. Cell and Molecular Biology. Concepts and Experiments. John Wiley and Sons. New York. 9th edition.
- Krebs, J.E. Goldstein E.S. Kilpatrick S.T. 2017. Lewin's Genes XII. Jones and Bartlett Publishers, Inc. 12th edition.
- Watson, J.D. 2017. Molecular Biology of the gene. Pearson Education India. 7^{th} edition.
- Cooper, G.M.and Hausman, R.E. 2013.The Cell: A Molecular Approach. Sinauer Associates, Sunderland, Massachusetts U.S.A. 6th edition.
- Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G.P. 2008. TheWorldof the Cell. Pearson Benjamin Cummings Publishing, San Francisco. 7th edition.
- Alberts, B. Johnson A.Lewis, J. Raff, M. Roberts K. & Walter P. 2007. Molecular Biology of Cell. W.W. Norton & Company. 5th edition.
- DeRobertis, E.D.P. and DeRobertis, E.M.F. 2006.Cell and Molecular Biology. Lippincott Williams and Wilkins, New York. 8th edition.
- Sen, S. Kar, D.K. Johri, B.M. 2005. Cytology and Genetics. Alpha Science International Ltd.

ZOOLOGY:
SEMESTER-I

CourseType	Course Code	Name of the Course	Credit	Contact Hours/ Week	Internal Assessment marks	End Term Marks	Max. Marks	Exam Duration
		Diversity of Non-Chordates-II	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)

Course Learning Outcomes (CLO)

1. Student will be able to describe unique characters and recognize life forms of phylum Annelida
2. Student will be able to describe unique characters and recognize life forms of phylum Arthropoda
3. Student will be able to describe unique characters and recognize life forms of phylum Molluscs
4. Student will be able to describe unique characters and recognize life forms of phylum Echinodermata and Hemichordates
5. Students will be capable of identifying the characters and classification of Non-Chordates

Instructions for Paper-Setter

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 - Annelida:** General characters and classification up to order level Biodiversity and economic importance of Annelida Type study - *Pheretima* (Earthworm) Metamerism in Annelida Trochophore larva:. Affinities, evolutionary significance	12
II	**Phylum - Arthropoda:** General characters and classification up to order level Biodiversity and economic importance of insects Type study – *Periplaneta*	11
III	**Phylum - Mollusca:** General characters and classification up to order level Biodiversity and economic importance Type study - *Pila* Torsion and detorsion in gastropoda Respiration and foot	11
IV	**Phylum - Echinodermata:** General characters and classification up to order level Biodiversity and economic importance Type Study -*Asteries* (Sea Star) Echinoderm larvae	11

	Aristotle's Lantern **Phylum – Hemichordata**: Type study: *Balanoglossus*	
V Practical	Classification up to orders with ecological note and economic importance of the following animals: 1. Annelida Specimens:Pheretima, Heteronereis, Polynoe, Aphrodite, Chaetopterus, Arenicola, Tubifex and Pontobdella. 2. Arthropoda Specimens: Peripatus, Palaemon (Prawn), Lobster, Cancer (crab), Sacculina, Eupagurus (hermit crab), Lepas, Balanus, Cyclops, Daphnia, Lepisma, Periplaneta (cockroach), Schistocerca (locust), Poecilocerus (ak-hopper), Gryllus (cricket), Mantis (praying mantis),Cicada, Forticula (earwig), Dragon fly, termite queen, bug, moth, beetle, Polistes (wasp), Apis (honey bee), Bombyx (silk moth), Cimex (begbug), Pediculus (body louse). Millipedes, Scolopendra (centipedes), Palamnaeus (scorpion), Aranea (spider), Limulus (king crab). 3. Mollusca Specimens: Mytilus, Ostrea, Cardium, Pholas, Solen (razor fish), Pecten, Holiotis, Patella, Aplysia, Doris, Limax, Loligo, Sepia, Octopus, Nautilus (complete and T.S.), Chiton and Dentalium. 4. Echinodermata Specimens: Asterias, Echinus, Cucumara, Ophiothrix, Antedon and Asterophyton. 5. Hemichordata Balanoglossus **(B) Study of the following permanent stained preparations:** 1. T.S. Pheretima (pharyngeal and typhlosolar regions), Setae, septal nephridia and spermathecae of Pheretima. 2. Trachea and mouthpmts of cockroach. 3. Statocyst of Palaemon. 4. Glochidium larva of Anodonta; radula and osphradium of Pila. 5. T.S. Star fish (arm) 6. T.S. Balanoglossus (through various regions). (C)Demonstration by C. D.: 1 . Mouth parts and trachea of Periplanata (cockroach), radula of Pila; pedicillarae of Asterias. 2. setae of earthworm, and mouth parts of Honey bee, House fly and cockroach. (D) Preparation of models of the different systems of the following animals: 1. Earthworm: Digestive, reproductive and nervous systems. 2. Grasshopper/ cockroach: Digestive, reproductive and nervous systems. 3. Pila: Pallial complex, digestive and nervous systems	**30**

Learning Resources

1. Jordan, E.L and P.S. Verma. 2009. Invertebrate Zoology, S.Chand and Co. Ltd. New Delhi.
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.
3. Kotpal, R.L. 2021. Zoology Invertebrates. Rastogi Publications, Meerut.
4. Nair, N.C., N. Arumugam, N. Soundarapandian, T. Murugan and S. Leelavathy. 2010. A textbook of Invertebrates. Saras Publication, Nagercoil.
5. Rastogi V.B. 2021 . Invertebrate Zoology. Kedar Nath Ram Nath , Meerut
6. Lal S.S. (2019) Practical Zoology Invertebrates. Rastogi Publications, Meerut
7. Anderson D.T. (1999) Invertebrate Zoology, Oxford University Press
8. Edward E. Ruppert, Robert D. Barnes (1994)· Invertebrate Zoology ; Saunders College Pub.

Semester 2
Subject: Zoology

ZOOLOGY: SEMESTER-2								
CourseType	**Course Code**	**Name of the Course**	**Credit**	**Contact Hours/ Week**	**Internal Assessment marks**	**End Term Marks**	**Max. Marks**	**Exam Duration**
		Diversity of Chordates-I	**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)

Course Learning Outcomes (CLO)

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 Cephalochordates
3. Student will be able to describe unique characters and recognize life functions of Cyclostomes
4. Student will be able to describe unique characters and recognize life functions of Pisces
5. Students will be capable of identifying the characters and classification of Chordates

Instructions for Paper-Setter

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	**Chordates:** Principles of classification; Origin and Evolutionary tree; Role of amnion in evolution; Salient features of chordates; Functional morphology of the types with examples emphasizing their biodiversity, economic importance and conservation measures where required.	**12**
II	General characters and classification of phyla upto orders with examples emphasizing their Biodiversity ,economic importance and conservation measures where required. **Protochordates:** Systematic position, distribution, ecology, morphology and affinities Urochordata: *Herdmania* – type study Cephalochordata; *Amphioxus* – type study	**11**
III	General characters and classification of phyla upto orders with examples emphasizing their biodiversity, economic importance and conservation measures where required. **Cyclostomes:** Classification and ecological significance Type study of *Petromyzon.*	**11**
IV	General characters and classification of all phyla upto orders with examples emphasizing their biodiversity, economic importance and conservation measures where required. **Pisces:** Scales & Fins, Parental care in fishes, fish migration. Types study of Labeo	**11**

V Practical	*1.* Classification upto orders, habit, habitats, external characters and economic importance (if any): Protochordata : *Molqula, Hetryllus, Pyrosoma, Doliolum, Olikopleura,* and *Amphioxus.* Cyclostomata : *Myxine, Petromyzon* and *Ammocoetus larva.* Chondrichthyes: *Zygaena, Pristis, Narcine* (electric ray), *Trygon, Rhinobatus, Raja* and *Chimaera.* Osteichthyes : *Acipenser, Lepidosteus, Muraena, Mystus, Catla, Hippocampus,Syngnathus, Exocoetus, Anabas, Diodon, Ostraczion, Tetradon, Echinus, Lophius, Solea* and *Polypterus.* Any of the Lung Fishes. **2.Preparation of models of the different systems of the following animals:** Herdmania: General anatomy *Labeo* (locally available fish): Digestive and reproductive systems: cranial nerves ***3.*Study of the skeleton of *Scoliodon, Labeo*** 4.**Study of the following prepared slides:** Tornaria larva, T.S. *Amphioxus* (through differentregionds). Oikopleura, different types of scales. 5. **Make permanent stained preparations of the following**: *Salpa,* Spicules, and Cycloid scales 1. Make permanent stained preparations of the following: *Salpa,* Spicules, and Pharynx of *Herdmania,Amphioxus*, Cycloid scales 2. Field Visit to Protected areas/National Park/Wildlife Sanctuary or Zoo. **6. Project Report:** 1. Migration in fishes 2. Ornamental fishes	**3 0**

Learning Resources

1. R.L.Kotpal. Modern Textbook of Zoology
2. E.L. Jordan and Verma. Chordate Zoology.
3. Barrington, E.J.W. The Biology of Hemichordata and Protochordata. Oliver and Boyd, Edinbourgh.
4. Walters, H.E. and Sayles, L.D. Biology of vertebrates. MacMillan & Co., New York.
5. Kent, C.G. Comparative anatomy of vertebrates.
6. S.S. Lal. Practical Zoology Vertebrate

ZOOLOGY:
SEMESTER-2

CourseType	Course Code	Name of the Course	Credit	Contact Hours/ Week	Internal Assessment marks	End Term Marks	Max. Marks	Exam Duration
		Diversity of Chordates-II	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)

Course Learning Outcomes (CLO)

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

Instructions for Paper-Setter

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	**Chordates:** **Amphibia:** Origin, Evolutionary tree. Type study of frog (*Rana tigrina*), Parental Care in Amphibia	12
II	**Reptilia:** Type study of Lizard (Hemidactylus), Origin, Evolutionary tree. Extinct reptiles; Poisonous and non-poisonous snakes; Poison apparatus in snakes.	11
III	**Aves:** Type study of Pigeon (*Columba livia*); Flight adaptation, Principles of aerodynamics in Bird flight, migration in birds.	11
IV	**Mammals:** Classification, type study of Rat; Adaptive radiations of mammals and dentition. **Note: Type study includes detailed study of various systems of the animal.**	11

V Practical	**1.** Classification up to orders, habit, habitats, external characters and economic importance (if any) of the following animals:- Amphibia : *Necturus, Proteus, Amphiuma, Salamandra, Amblystoma, Axolotie larva, Alytes, Bufo, Rana.* Reptilia : *Hemidactylus, Calotes, Draco, Varanus, Phrynosoma, Chamaeleon, Typhops, Python, Eryx, Ptyas, Bungarus, Naja, Hydrus, Viper, Crocodilus, Gavialis, Chelone* (Turtle) and *Testudo* (Tortoise). Aves : *Casuarius, Arden, Anas, Milvus, Pavo, Eudynamis, Tyto* and *Alcedo, Halcyon* Mammalia : *Ornithorphynchus, Echidna, Didelphis, Macropus, Loris, Macaque, Hystrix, Funambulus, Telix, Panthera, Canis, Herpestes, Capra, Pteropus* **2. Preparation of models of the different systems of the following animals:** *Hemidactylus* : Digestive, arterial, venous and urinogenital systems. Rat : Digestive, arterial, venous and urinogenital systems. **3. Study of the skeleton** of *Rana* (Frog), *Varanus*, Pigeon or Gallus and *Orcyctolagus*/rat **4. Study of the following prepared slides**: Histology of rat (compound tissues). **5. Study and collection of Quill, Contour, Filoplume and Down feathers** **6. Project Report:** 1. Survey of diversity 2. Parental care 3. Dentition in mammals 4. Migration in birds	**3 0**

Learning Resources

1. R.L.Kotpal. Modern Textbook of Zoology
2. E.L. Jordan and Verma. Chordate Zoology.
3. Barrington, E.J.W. The Biology of Hemichordata and Protochordata. Oliver and Boyd, Edinbourgh.
4. Walters, H.E. and Sayles, L.D. Biology of vertebrates. MacMillan & Co., New York.
5. Kent, C.G. Comparative anatomy of vertebrates.
6. S.S. Lal. Practical Zoology Vertebrate

ZOOLOGY:
SEMESTER-2

CourseType	Course Code	Name of the Course	Credit	Contact Hours/ Week	Internal Assessmentmarks	End Term Marks	Max. Marks	Exam Duration
	03	**Aquaculture**	**3**	**3**	**25**	**50**	**75**	**3 hrs.**
		Practical	**1**	**2**	**5**	**20**	**25**	**4 hrs.**

Level of the course: 200-299

Pre-requisite for the course (if any): Biology as a Subject at 4.0 Level (Class XII)

Course Learning Outcomes (CLO)

1. Students will understand about fresh water fishes of India
2. Students will capable to undertake about fishing crafts and gears
3. It will make the students understand about the seed production in fishes
4. Students will be able to explain the culture technology in fishery
5. Students will be able to identify fish specimens

Instructions for Paper-Setter

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 onequestion from each unit.

UNIT	TOPICS	CONTACT HOURS
I	Introduction to world fisheries: Production, utilization and demand, Major species cultured Fresh Water fishes of India: River system, reservoir, pond, tank fisheries; captive and culture fisheries, cold waterfisheries.	**12**
II	Fishing crafts and gears. Fin fishes, Crustaceans, Molluscs and their culture. Traits of important cultivable fish and shellfish and their culture methods – Indian major carps, exotic carps, airbreathing fishes, cold water fishes, freshwater prawns, mussels	**11**
III	Seed production: Natural seed resources – its assessment, collection, Hatchery production Nutrition: Sources of food (Natural, Artificial) and feed composition (Calorie and Chemical ingredients).	**11**
IV	Field Culture: Culture, Culture in Pond-running waters; recycled water culture, cage culture; poly culture. Culture technology: Induced breading in fishes, techniques and hormones; Fish Biotechnology (Transgenesis and Cryopreservation of gametes).	**11**

V Practical	*1.*Identification of *Catla catla, Labeo rohita, L. calbasu, Cirrhinus, mrigala, Puntius sarana, Channa punctatus, C. marulius, C. stariatus, Trichogaster fasciata, Mystus seenghala, M. cavasius, M. tengra, Callichrouspabola, C. bimaculatus, Wallago attu,* Prawns, Crabs, Lobsters, Clams, Mussels & Oysters. *2.* A study of the slides of fish parasites. *3.* A study of the different types of nets, e.g., cast net, gill net, drift net and drag net. *4.* A visit to lake/reservoir/fish breeding centre.	**30**

Learning Resources

1. Arumugam N. (2014). Aquaculture and Fisheries, Saras Publication
2. Bardach, JE, Ryther & McLarney, Wo (1972) Aquaculture, New York: Wiley-Interscience. 896pp.
3. Lagler, KF, Bardach, JE, Miller, RR & Passino, DRM (1977) Ichthyology, 21nd Edition, New York, Wiley, 506 pp.
4. Khanna S S, & Singh H R (2014). Textbook of Fish Biology and Fisheries 3rd edn. Narendra Publishing House