CHOICE BASED CREDIT SYSTEM - LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK

B.Sc Zoology

Those who have joined from the Academic year 2023-24 onwards

Programme:	**B.Sc. Zoology**
Programme Code:	23
Duration:	**3 years [UG]**
Programme Outcomes: (These are mere guidelines. Faculty can create POs based on their curriculum or adopt from UGC or University for their Programme)	**PO1: Disciplinary knowledge:** Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate Programme of study **PO2: Communication Skills:** Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share one's views and express herself/himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups. **PO3: Critical thinking:** Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefson the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theoriesby following scientific approach to knowledge development. **PO4: Problem solving:Capacity** to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's learning to real life situations. **PO5: Analytical reasoning**: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints. **PO6: Research-related skills**: A sense of inquiry and capability for asking relevant/appropriate questions, problem arising, synthesising and articulating; Ability to recognise cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; ability to plan, execute and report the results of an experiment or investigation **PO7: Cooperation/Team work:** Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team **PO8: Scientific reasoning**: Ability to analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective. **PO9: Reflective thinking**: Critical sensibility to lived experiences, with self awareness and reflexivity of both self and society. **PO10 Information/digital literacy:** Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data. **PO 11 Self-directed learning**: Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion.

	PO 12 Multicultural competence: Possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups. **PO 13: Moral and ethical awareness/reasoning**: Ability toembrace moral/ethical values in conducting one's life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work. Capable of demonstratingthe ability to identify ethical issues related to one‟s work, avoid unethical behaviour such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights; appreciating environmental and sustainability issues; and adoptingobjective, unbiased and truthful actions in all aspects of work. **PO 14: Leadership readiness/qualities:** Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination, in a smooth andefficient way. **PO 15: Lifelong learning:**Ability to acquire knowledge and skills, including „learning how to learn‟, that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed atpersonal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of work place through knowledge/skill development/reskilling.
Programme Specific Outcomes: **(These are mere guidelines. Faculty can create POs based on their curriculum or adopt from UGC or University for their Programme)**	**PSO1 – Placement:** To prepare the students who will demonstrate respectful engagement with others' ideas, behaviors, beliefs and apply diverse frames of reference to decisions and actions. **PSO 2 - Entrepreneur:** To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations **PSO3 – Research and Development:** Design and implement HR systems and practices grounded in research that comply with employment laws, leading the organization towards growth and development. **PSO4 – Contribution to Business World:** To produce employable, ethical and innovative professionals to sustain in the dynamic business world. **PSO 5 – Contribution to the Society:** To contribute to the development of the society by collaborating with stakeholders for mutual benefit

CHOICE BASED CREDIT SYSTEM - LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK

(Those who have joined in the Academic year 2023-24 onwards)

B.Sc Zoology

Part	Courses	Subject	Code	Cr.	Hrs
		SEMESTER I			
I	Lang. – I	nghJj;jkpo; - **I**	230103101	3	6
II	Lang. - II	General English	231003101	3	4
III	CC – 1 - T	Invertebrata – I	232303101	3	4
	CC – 1 – P	Invertebrata Lab	232303102	2	2
	CC – 2	Invertebrata - II	232303103	2	2
	EC – I T	Chemistry for Biological Science I	232203121	3	4
	EC – I P	Chemistry Practical for Physical and Biological Science	232203122	1	2
IV	SEC –I (NME)	Ornamental Fish Farming and Management	234603123	2	2
IV	FC	Economic Zoology	234403123	2	2
	AECC- I	Soft Skill - I	236003101	2	2
	Total			**23**	**30**
		SEMESTER II			
I	Lang. -I	nghJj;jkpo; - **II**	230103201	3	6
II	Lang. -II	General English	231003201	3	4
III	CC – 3	Chordata	232303201	5	5
	CC - 4	Chordata Lab	232303202	2	3
	EC – II – T	Chemistry for Biological Science – II	232203221	3	4
	EC – II - P	Chemistry Practical for Physical and Biological Science	232203222	1	2
IV	SEC –II (NME)	Bio composting for Entrepreneurial ship	234603223	2	2
	SEC - III	Animal Behaviour	234403223	2	2
	AECC –II	Soft Skill - II	236003201	2	2
				23	**30**
		SEMESTER III			
I	Lang. -I	nghJj;jkpo; - **III**;	230103301	3	6
II	Lang. -II	General English	231003301	3	4
III	CC – 5 P	Cell Biology	232303301	3	3
	CC – 5 T	Cell biology Lab	232303302	1	2
	CC - 6	Genetics	232303303	3	3
	EC –3 T	Allied Botany – I	232303304	3	4
	EC – 3 P	Allied Botany Lab	232303305	1	2
IV	SEC –IV	Aquarium Keeping	234403323	2	2
	SEC – V	Wild Life	238203323	1	1
	AECC – III	Soft Skill - III	236003301	2	2
	EVS	Environmental Studies	234103301	1	1
				23	**30**

SEMESTER IV					
I	Lang. – I	nghJj;jkpo; - **IV**	230103401	3	6
II	Lang. - II	General English	231003401	3	4
III	CC – 7	Developmental Biology	232303401	4	4
	CC - 8	Developmental Biology Lab	232303402	3	3
	EC – IV T	Allied Botany – II	232303403	3	4
	EC – IV P	Botany Lab – II	232303404	1	2
IV	SEC –VI	Nanobiology	234403423	2	2
IV	SEC –VII	Human reproductive Biology	238203423	2	2
	AECC- Soft Skill – 4	Soft Skill – IV	236003401	2	2
	EVS	Environmental Studies	234103401	1	1
	Total			**24**	**30**
SEMESTER V					
III	CC – 9	Evolutionary Biology	232303501	4	5
	CC - 10	Animal Physiology	232303502	4	5
	CC - 11	Environmental Biology	232303503	4	5
	Core 12	Project with Viva voce	232303504	4	4
	EC – V	Biophysics & Biostatistics	232303505	3	5
	EC – VI	Elective - VI	232303506	3	5
IV		Value Education	234303501	1	1
		Internship/Industrial Training(carried out in II year summer vacation)30 hrs	232303507	2	
				25	**30**
SEMESTER VI					
III	CC – 13	Animal Biotechnology	232303601	4	5
	CC – 14	Microbiology	232303602	4	5
	CC – 15	Core Lab	232303603	4	5
	EC –7	Agricultural Entomology	232303604	3	5
	EC - 8	Elective - VIII	232303605	3	5
IV	Processional competency skill enhancement course	Professional competency skill	232303606	2	4
		Value Education	234303601	1	1
V		Extension Activity (outside college hrs)	232303607	1	
				22	**30**

ALLIED – ZOOLOGY FOR CHEMISTRY					
Sem	**Title of the Paper**	**SUB CODE**	**Hrs.**	**Cr.**	**Generic/Discipline Specifit**
I	Allied - Animal Diversity	232303121	4	4	EC 1 - Theory
I	Animal Diversity, Genetics, Cell Biology and Bio chemistry Lab	-	2	-	EC 1 - Practical
II	Genetics, Cell Biology and Bio Chemistry	232303221	4	2	EC 2 - Theory
II	Animal Diversity, Genetics, Cell Biology and Bio chemistry Lab	232303222	2	2	EC 2 - Practical

Title of the Course		INVERTEBRATA - I						
Part		III						
Category	Core 1	Year	I	Credits	3	Course Code	232303101	
		Semester	I					
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total	CIA	External	Total
		4	-	--	4	25	75	100

Learning Objectives

LO1	To understand the basic concepts of lower animals and observe the structure and functions.
LO2	To illustrate and examine the systemic and functional morphology of various group of invertebrates.
LO3	To differentiate and classify the various groups of animal modes of life and to estimate the biodiversity.
LO4	To compare and distinguish the general and specific characteristics of reproduction in lower animals.
LO5	To infer and integrate the parasitic and economic importance of invertebrate animals

UNIT	Details	No. of Periods for the Unit
I	**Protozoa:** Introduction to Classification, taxonomy and nomenclature. General characters and classification of Phylum Protozoa up to classes. Type study - *Paramecium* and *Plasmodium* - Parasitic protozoans (*Entamoeba*, *Trypanasoma* &*Leishmania*) - Economic importance Nutrition in protozoa - Host-parasitic interactions in *Entamoeba* and *Plasmodium*-Locomotion in protozoa	**12**
II	**Porifera:** General characters and classification up to Classes. Type study - Ascon & Sycon - Canal system in sponges - Skeleton in sponges, Economic importance, Canal system in sponges - Reproduction in sponges.	**12**
III	**Coelenterata :** General characters and classification up to classes – Type study - *Obelia* and *Aurelia* - Corals and coral reefs - Polymorphism - Economic importance - Mesenteries in Anthozoa - Economic importance of corals and coral reefs - Polymorphism in Hydrozoa.	**12**
IV	**Platyhelminthes:** General characters and classification of up to classes. Type study – *Fasciola hepatica*. Nemathelminthes: *Taenia solium* – Parasitic adaptations. Host- parasitic interactions of Helminth parasites. Nematode Parasites and diseases - *Wuchereria bancrofti*, *Enterobius vermicularis*, *Ancylostome duodenale*. Aschelminthes : General characters and classification of up to classes - Type study - *Ascaris lumbricoides*	**12**
V	**Annelida:** General characters and classification up to Classes. Type study – *Nereis* and *Hirudinaria granulosa*.Metamerism Nephridium and coelomoducts - Modes of life in Annelids.REproduction in polychaetes.	**12**

Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Understand the basic concepts of invertebrate animals and recall its structure and functions.	PO1
CO2	Illustrate and examine the systemic and functional morphology of various groups of invertebrata.	PO1, PO2
CO3	Differentiate and classify the animal's mode of life in various taxa and estimate the biodiversity.	PO4, PO6
CO4	To compare and distinguish the various physiological processes and organ systems in lower animals.	PO4, PO5, PO6
CO5	Infer and integrate the parasitic and economic importance of invertebrate animals.	PO3, PO8

Text Books (Latest Editions)	
1.	Ekambaranatha Iyer, 2000. A Manual of Zoology, 10th edition, Viswanathan, S., Printers & Publishers Pvt Ltd
2.	Jordan, E.L. and Verma P.S, 1995. Invertebrate Zoology, 12th edn. S. Chand& Co.
3.	Kotpal, R.L, 1992. Protozoa, Porifera, Coelenterata, Annelida, Arthropoda.
References Books (Latest editions, and the style as given below must be strictly adhered to)	
1.	Ruppert and Barnes, R.D. (2006). Invertebrate Zoology, VIII Edition. Holt Saunders International Edition.
2.	**Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). The Invertebrates: A New Synthesis, III Edition, Blackwell Science**
3.	Barrington, E.J.W. (1979). Invertebrate Structure and Functions. II Edition, E.L.B.S. and Nelson
4.	Hyman L.H, 1955. The invertebrates - Vol. I to Vol. VII – Mc Graw Hill Book Co.
5.	Parker, J. and Haswell , 1978. A text book of Zoology Vol. I - Williams and Williams.
Web Resources	
1.	https://www.nationalgeographic.com/animals/invertebrates/
2.	https://bit.ly/3kABzKa
3.	https://www.nio.org/
4.	https://greatbarrierreef.org/

Mapping with Programme Outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**
CO1	S							
CO2	M	S						
CO3				S		S		
CO4				S	S	M		
CO5			S					S

3 – Strong, 2 – Medium , 1 – Low

Title of the Course		**Invertebrata Lab**						
Part		**III**						
Category	Core 1 – P	**Year**	I	**Credits**	2	**Course Code**	**232303102**	
		Semester	I					
Instructional Hours per week		**Lecture**	**Tutorial**	**Lab Practice**	**Total**	**CIA**	**External**	**Total**
			-	2	2	25	75	100

Learning Objectives	
LO1	To identify the different groups of invertebrate animals by observing their external characteristics.
LO2	To understand the organs, organ system and their functions in lower animals.
LO3	To get knowledge about the different modes of life and their adaptation based on the environment.
LO4	Able to dissect and display the internal organs and mount the mouthparts and scales of invertebrates.

UNIT	**Details**	**No. of Periods for the Unit**
I	**Major Dissection :** Cockroach: Circulatory system, Nervous system, Reproductive system. Leech : Nervous System, Reproductive system. Earthworm: Nervous System, Reproductive system. *Pila globosa*: Nervous system. Prawn: Nervous system (including Appendages).	
II	**Minor Dissection:** Cockroach: Digestive system. Earthworm: Viscera, Lateral hearts. *Pila globosa*: Digestive system (Including radula). Freshwater Mussel: Digestive system.	
III	**Mounting:** Earthworm: Body setae; Pineal setae. *Pila globosa*: Radula. Freshwater muscle: Pedal ganglia.	
IV	**Mounting :** Cockroach: Salivary apparatus, Mouth parts - Honey Bee, House fly and Mosquito mouth parts.	
V	**Spotters :(i). Protozoa:** Amoeba, Paramoecium, Paramoecium Binary fission and Conjugation, Vorticella, Entamoeba histolytica, Plasmodium vivax **(ii). Porifera:** Sycon, Spongilla, Euspongia, Sycon - T.S & L.S, Spicules, Gemmule **(iii). Coelenterata:** Obelia – Colony & Medusa, Aurelia, Physalia, Velella, Corallium, Gorgonia, Pennatula **(iv). Platyhelminthes:** Planaria, Fasciola hepatica, Fasciola larval forms – Miracidium, Redia, Cercaria, Echinococcus granulosus, Taenia solium, Schistosoma haematobium **(v). Nemathelminthes:** Ascaris(Male & Female), Drancunculus, Ancylostoma, Wuchereria **(vi). Annelida:** Nereis, Aphrodite, Chaetopteurs, Hirudinaria, Trochophore larva **(vii). Arthropoda:** Cancer, Palaemon, Scorpion, Scolopendra, Sacculina, Limulus, Peripatus, Larvae - Nauplius, Mysis, Zoea, Mouth parts of male & female Anopheles and Culex, Mouthparts of Housefly and Butterfly. **(viii). Mollusca:** Chiton, Pila, Unio, Pteredo, Murex, Sepia, Loligo, Octopus, Nautilus, Glochidium larva **(ix). Echinodermata:** Asterias, Ophiothrix, Echinus, Clypeaster, Cucumaria, Antedon, Bipinnaria larva	

Course Outcomes	
Course Outcomes	On completion of this course, students will;
CO1	Identify and label the external features of different groups of invertebrate animals.

CO2	Illustrate and examine the circulatory system, nervous system and reproductive system of invertebrate animals.
CO3	Differentiate and compare the structure, function and mode of life of various groups of animals.
CO4	To compare and distinguish the dissected internal organs of lower animals.
CO5	Prepare and develop the mounting procedure of economically important invertebrates.

Text Books (Latest Editions)	
1.	Ekambaranatha Iyyar and T. N. Ananthakrishnan, 1995 A manual of Zoology Vol.I (Part 1, 2) S. Viswanathan, Chennai
2.	Ganguly, Sinha an d A dhikari , 2 0 11 . Biology of Animals: Volume I, New Central Book Agency; 3rd revised edition. 1008 pp.
3.	Sinha, Chatterjee and Chattopadhyay, 2 0 1 4. Advanced Practical Zoology, Books & Allied Ltd; 3rd Revised edition, 1 07 0 pp.
4.	Lal ,S. S, 2016 . Practical Zoology Invertebrate, Rastogi Publications.
5.	Verma, P. S. 2010. A Manual of Practical Zoology: Invertebates, S Chand, 4 97pp.
References Books (Latest editions, and the style as given below must be strictly adhered to)	
1.	Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). *The Invertebrates: A New Synthesis*, III Edition, Blackwell Science.
2.	Barnes, R.D. (1982). *Invertebrate Zoology*, V Edition. Holt Saunders International Edition.
3.	Barrington, E.J.W. (1979). *Invertebrate Structure and Functions*. II Edition, E.L.B.S. and Nelson
4.	Boradale, L.A. and Potts, E.A. (1961). *Invertebrates: A Manual for the use of Students*. Asia Publishing Home.
5.	Lal, S.S. 2005. A text Book of Practical Zoology: Invertebrate, Rastogi, Meerut
Web Resources	
1.	https://nbb.gov.in/
2.	http://www.agshoney.com/training.htm
3.	https://icar.org.in/
4.	http://www.csrtimys.res.in/
5.	http://csb.gov.in/
6	https://iinrg.icar.gov.in/
7	https://www.nationalgeographic.com/animals/invertebrates/

Mapping with Programme Outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**
CO1	S							
CO2	M	S						
CO3				S		S		
CO4				S	S	M		
CO5			S					S

3 – Strong, 2 – Medium , 1 – Low

Title of the Course		**INVERTEBRATA - II**						
Part		**III**						
Category	Core 2-	**Year**	I	**Credits**	2	**Course Code**	**232303103**	
		Semester	I					
Instructional Hours per week		**Lecture**	**Tutorial**	**Lab Practice**	**Total**	**CIA**	**External**	**Total**
		2	-	--	2	25	75	100

Learning Objectives	
LO1	To understand the structures and distinct features of invertebrate phyla.
LO2	To understand and able to distinguish the characteristic features of each phylum
LO3	To understand the economic importance of invertebrates
LO4	To understand the interaction of invertebrates with the environment.
LO5	To understand the evolutionary position of different groups of invertebrates

UNIT	**Details**	**No. of Periods for the Unit**
I	**Arthropoda:** General characters and classification of Phylum Arthropoda up to Classes. Detailed study: *Penaeus indicus*. Affinities of *Peripatus* – Larval forms in Crustacea – Organization of Centipede and Millipede.	**6**
II	**Mollusca:** General characters and classification of Phylum Mollusca up to Classes. Detailed study: *Pila globosa*. Foot and torsion in Mollusca, Economic importance of Molluscs – Cephalopoda as the most advanced invertebrate.	**6**
III	**Echinodermata:** General characters and classification of Phylum Echinodermata up to Classes. Detailed study: *Asterias.* Water vascular system in Echinodermata – Larval forms of Echinoderms.	**6**
IV	**Detailed study:***Periplaneta americana*. Insect pollinators- predators – parasites. Insects associated with human diseases: Mosquitoes, housefly, bed bug, human head louse. Insects associated with household materials: Ants, Termites, Silver fish.	**6**
V	**Insect pests:** Insect pests, life cycle and types of damage to plants. Pest of rice: Rice stem borer (*Scirpophaga incertulas*) – Pest of Sugarcane: The shoot borer (*Chilo infuscatellus*) – Pest of coconut: The rhinoceros beetle (*Oryctes rhinoceros*) Pest of cotton: The spotted bollworm (*Earias insulana*) – Pests of vegetables: Brinjal-The shoot and fruit borer (*Leucinodes orbonalis*) – Cauliflower: The diamond black moth(*Plutella xylostella*)Pests of fruits: Citrus butterfly(*Papilio demoleus*) – Pest of stored products: The rice weevil(*Sitophilus oryzae*). Principles of Integrated Pest Management.	**6**

Course Outcomes	
Course Outcomes	On completion of this course, students will;
CO1	Classify, Identify and recall the name and distinct features of invertebrate groups..
CO2	Explain, and relate the origin, structural organization and evolutionary aspects of invertebrates.
CO3	Analyze, compare and distinguish the developmental stages and describe the important biological process.
CO4	Correlate the interaction of invertebrates with humans and critique its economic importance.
CO5	Summarize the physiology, ecological adaptations to stimulate and integrate the significance of invertebrates to the environment, humans, and agriculture.

Text Books (Latest Editions)	
1.	Ekambaranatha Ayyar, and T. N. Ananthakrishnan, 2000. A Manual of Zoology. Vol 1 (Invertebrata). Part II – Viswanathan Pvt. Ltd, 842pp
2.	Jordan, E.L. and Verma P.S, 1995. Invertebrate Zoology, 12th edn. S. Chand& Co.
3.	Kotpal R.L. 2019. Modern Text Book of Zoology, Invertebrtes 9th Ed., Rastogi Publications, Gangotri, Shivaji Road, Meerut, 1004 pp.
References Books (Latest editions, and the style as given below must be strictly adhered to)	
1.	Barrington, E.J.W., 2012, Invertebrate structure and function. Boston – Houghton. Miffin and ELBS, London.
2.	Bhamrah,H.S. and Kavitha Junea, 2002. A text book of Invertebrates. Alilnol Publications Private Limited, 4374/4B.Ansari Road, Dayaganj, New Delhi.
3.	Hyman L.H, 1955. The invertebrates – Vol. I to Vol. VII – McGraw Hill Book Co.
4.	Kotpal, 1992. Protozoa, Porifera, Coelenterata, Annelida, Arthropoda, Mollusca, Echinodermata, R.L- Rastogi Publication.
5.	Parker, J. and Haswell , 1978. A text book of Zoology Vol. I - Williams and Williams.
6.	Srivastava, M.D.L and Srivastava, 1969. A text book of Invertebrate Zoology, U.S-Central Book Depot, Allahabad.
7.	Verma, A. Invertebrates: Protozoa to Echinodermata. Narosa Publishing House Private Limited.35-36 Greams Road, Thousand Lights, Chennai.
Web Resources	
1.	https://www.nationalgeographic.com/animals/invertebrates/
2.	https://bit.ly/3kABzKa
3.	https://www.nio.org/
4.	https://bit.ly/3lJdUX0

Mapping with Programme Outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**
CO1	S							
CO2	M	S						
CO3			S	S	S	S		
CO4			S	S	S	M		
CO5			S					S

3 – Strong, 2 – Medium , 1 - Low

Title of the Course		**Allied - ANIMAL DIVERSITY (For Chemistry Major Students)**						
Part		**III**						
Category	EC 1 - T	**Year**	I	**Credits**	4	**Course Code**	**232303121**	
		Semester	I					
Instructional Hours per week		**Lecture**	**Tutorial**	**Lab Practice**	**Total**	**CIA**	**External**	**Total**
		4	-	--	4	25	75	100

Learning Objectives

- ***To study the diversity of animals with unique characteristic features of different classes of animals.***

UNIT	Details	No. of Periods for the Unit
I	Classification of Invertebrata up to class level: General characters of Invertebrata: Protozoa, Porifera, Coelenterata, Platyhelminthes, Aschelminthus, Annelida, Arthropoda, Mollusca and Echinodermata. Life cycle pathology and treatement of Plasmodium.	**12**
II	Earthworm –Morphology, Digestive system – Excretory system, Nervous system and Reproductive System. Prawn - Morphological characters, appendages.	**12**
III	General characters of Chordata :Classification of chordata – up to classes. Pisces, Amphibia, Reptiles, Aves and mammals. Shark – Morphology, Urogenital system, Sense organs – Lateral Line Sense organ Migration in fishes Parental care in Amphibia	**12**
IV	Identification of Poisonous and Non Poisonous snakes. Poison apparatus, Biting Mechanism and First aid. Flight adaptation in birds.	**12**
V	Rabbit – Digestive system, Nervous system and Urinogenital system. Types of Dentitionin Mammals.	**12**

Course Outcomes	
Course Outcomes	On completion of this course, students will be able;
CO1	disseminate the knowledge on importance and conservation of biodiversity of animal fauna to common man
CO2	identify the group/phylum of the animal fauna
CO3	differentiate the venomous and non-venomous snakes and do first aid to snake bite victim
CO4	make survey of animal fauna
CO5	explain the various systems and functions of invertebrate and chordate species.

Text Books (Latest Editions)

01. EkambaranathaAyyar, A Manual of Zoology, Volume – I & II, S.Viswanathan (Printers and Publishers) Private Limited, Chennai.
02. Kotpal R.L., Vertebrate Zoology, Rastogi Publications, Meerut, 2003.

References Books **(Latest editions, and the style as given below must be strictly adhered to)**
01. Arumugam N., A Text Book of Invertebrata, Saras Publications, Kottar, Nagercoil, 2008. 02. Arumugam N., A text book of Chordata, Saras Publications, Nagarkovil -2006.
Web Resources
http://www.wordnik.com http://www.biologydiscussion.com https:ucmp.berkeley.edu https://www.indianreptiles.org

Mapping with Programme Outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**
CO1	3	3	3	3	2
CO2	2	2	3	2	3
CO3	3	3	2	1	1
CO4	3	2	2	3	2
CO5	3	1	1	3	3

3 – Strong, 2 – Medium , 1 – Low

Title of the Course		**ORNAMENTAL FISH FARMING AND MANAGEMENT**						
Part		**IV**						
Category	SEC – I NME	**Year**	I	**Credits**	2	**Course Code**	234603123	
		Semester	I					
Instructional Hours per week		**Lecture**	**Tutorial**	**Lab Practice**	**Total**	**CIA**	**External**	**Total**
		2	-	-	2	25	75	100

Learning Objectives	
LO1	To highlight the importance of ornamental fish culture in relation to entrepreneurship development.
LO2	To enable the identification, culture and maintenance of commercially important ornamental fishes.
LO3	To provide the knowledge on the techniques of ornamental fish breeding, rearing, disease control and economics of ornamental fish farming.

UNIT	**Details**	**No. of Periods for the Unit**
I	Introduction to ornamental fish keeping. Scope and importance of ornamental fish culture. Domestic and global scenario of ornamental fish trade and export potential. Commercially important ornamental fishes - Indigenous and exotic varieties.	**6**
II	Biology of egg layers and live bearers. Food and feeding in ornamental fishes. Formulated feed and Live feed; Live feed culture. Breeding, hatchery and nursery management of egg layers (eg. Goldfish) and live bearers (eg. Guppy).	**6**
III	Aquarium design and construction; Accessories - aerators, filters and lighting. Aquarium plants and their propagation. Maintenance of aquarium and water quality management. Ornamental fish diseases, their prevention, control and treatment methods.	**6**
IV	Conditioning, packing, transport and quarantine methods. Economics, trade regulations, domestic and export marketing strategies.	**6**
V	**Practical** 1) Identification of locally available ornamental fishes - Egg layers and live bearers. 2) Identification of locally available live feed organisms.	**6**

Course Outcomes	
Course Outcomes	On completion of this course, students will be able;
CO1	The students will be able to identify, culture, maintain and market the commercially important ornamental fishes.
CO2	The knowledge and skills gained on the different aspects of ornamental fish keeping will enable the students to develop entrepreneurship potential and help in self employment.

References Books (Latest editions, and the style as given below must be strictly adhered to)	
1.	Swain SK., Sarangi N. and Ayyappan S. 2010. Ornamental fish farming. ICAR, New Delhi.
2	Ahilan, B., Felix N. and Santhanam R. 2008. Text book of aquariculture. Daya Publishing House, New Delhi.
3.	Dey V.K.A. 1997. A handbook on aquafarming ornamental fishes. MPEDA, Kochi.
Web Resources	
1	http://ecoursesonline.iasri.res.in/course/view.php?id=297
2	https://www.ofish.org/
3	https://krishijagran.com/agripedia/income-generation-by-ornamental-fish-culture/
4	https://99businessideas.com/ornamental-fish-farming/

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5
CO1	3	3	1	2	3
CO2	3	2	3	3	1
CO3	3	3	3	3	2
CO4	2	1	1	3	2
CO5	3	1	3	3	3

3 – Strong, 2 – Medium , 1 - Low

Title of the Course		**ECONOMIC ZOOLOGY**						
Part		**IV**						
Category	FC	**Year**	I	**Credits**	2	**Course Code**	**234403123**	
		Semester	I					
Instructional Hours per week		**Lecture**	**Tutorial**	**Lab Practice**	**Total**	**CIA**	**External**	**Total**
		2	-	-	2	25	75	100

Learning Objectives	
LO1	To understand the culturing techniques and production methods of different farm animals.
LO2	To know the life history of animals and disease control methods used in farming.
LO3	To understand the concept of breeding, cross breeding and the importance of high yield varieties.
LO4	To know about the marketing strategies.

UNIT	**Details**	**No. of Periods for the Unit**
I	Economic Entomology: Apiculture: Species of honey bees – Social organisation of honey bee – selection of bees and location for apiary – Newton's bee hive – products of bee keeping – enemies and diseases of honey bees. Sericulture: Species of silkworm – life history of mulberry silkworm – Rearing of silkworm – pests and diseases of silkworm. Lac Culture: Introduction – Life history – Host plants – cultivation of Lac – Enemies of lac cultivation – Economic importance of Lac.	**6**
II	**Vermiculture :** Introduction: Types of earthworms – ecological classifications of earthworms – Physical, chemical and biological changes caused by earthworms in the soil – Natural enemies of earthworms. Vermicomposting: vermicomposting methods – factors affecting vermicomposting –Vemiculture unit. Harvesting of vermicompost – vermicast – advantages of vermicompost – vermiwash and its applications.	**6**
III	**Aquaculture :** Fresh water aquaculture: Carp culture – types of ponds – preparation – maintenance – harvesting and management. Integrated and composite culture. Prawn culture. Marine Aquaculture: Edible – pearl oyster culture. Ornamental fish culture: Aquarium fishes– Aquarium maintenance in home.	**6**
IV	**Poultry Farming :** Poultry industry in India – Poultry for sustainable food production and livelihood - Commercial poultry farming – Nutritive value of egg and meat- Broiler management (Definition; Housing and equipment; Brooding, feeding and health cover of broilers; Record keeping; Broiler integration) – Layer management (Brooder; Grower and layer management; Culling of layers; Marketing of eggs and meat). Women in backyard poultry farming.	**6**
V	**Dairy Farming :**Dairy farming – advantages of dairying – classification of breeds of cattle – Indigenous and exotic breeds – Selection of dairy cattle. Breeding – artificial insemination – Dairy cattle management – housing – water supply – cattle nutrition feeding standards – Common contagious diseases. Milk - Composition of milk – milk spoilage – pasteurization – Role of milk and milk products in human nutrition – Dairying as a source of additional income and employment.	**6**

Course Outcomes	
Course Outcomes	On completion of this course, students will be able;
CO1	To identify the breeds and varieties of poultry, fish, bees, and cattle and understand the basic aspects of farming.
CO2	To assess and integrate the available tools and techniques to increase the productivity in farms.
CO3	To analyse the pros and cons of different methods of farming and marketing strategies of products.
CO4	To evaluate the use of available resources in improving the breeds, vermicomposting, farm products etc..
CO5	To design new methods to improve farm animals with increased productivity and disease resistance and to construct new methods in vermicomposting.

Text Books (Latest Editions)	
1	Sastry, N.S.R., C.K.Thomas and R.A.Singh, 2015. Livestock Production Management, 4th Ed.Kalyani Publishers, New Delhi. Mary violet Christy, A. 2014. Vermitechnology, MJP Publishers, Chennai.
2	ICAR, 2013. Hand book of Animal Husbandry, 4th Ed., ICAR Publication, Pusa, New Delhi.
3	Awasthi, V.B., 2012. Introduction to General and Applied Entomology, third edition, Scientific publishers, India.
4	Vasanthraj David, B and Ramamurthy, VV., 2012. Elements of Economic Entomology, Seventh edition, Namrutha publications, Chennai.
5	Shukla &Upadhyay, 2014. Economic Zoology, 5th edn. Rastogi Publication, Meerut New Delhi.
6	Gupta, S.M., 2010. Text book of fishery, Ann Backer, Mumbai.
7	ShailendraGhosh, 2009. Fisheries and aquaculture management, Adhyayan, New Delhi.
8	David, B and Ananthakrishnan, T. N., 2006. General and Applied Entomology, Second edition, Tata McGraw hill publishing company Ltd., New Delhi, India.
9	Jagadish Prasad, 2002. Principles and practices of Dairy Farm Management, 3rd Ed. Kalyani Publishers, Ludhiana.
10	Sukumar, D.E., 2002. Outline of Dairy Technology, Oxford University, New Delhi.
11	Rath, R.K., 2000. Freshwater Aquaculture. Scientific Publishers (India), Jodhpur
12	Ismail, S.A., 1997. Vermitechnology, The biology of earthworms, Orient Longman, India
13	Prabakaran, R. 1998. Commercial Chicken production. Published by P. Saranya, Chennai.
14	Hafez, E. S. E., 1962. Reproduction in Farm Animals, Lea &Fabiger Publisher.
References Books (Latest editions, and the style as given below must be strictly adhered to)	
1	Glenn Munroe, 2017. Manual of on-Farm vermicomposting and vermiculture, Holdanca Farms Ltd, Wallace, Nova Scotia.
2	Hanifa, M.A., 2011. Aquatic resources and aquaculture, Dominent, New Delhi.
3	Gupta, P.K., 2008. Vermicomposting for sustainable agriculture, 2nd Edition, Agrobios, India.
4	Talashikar, S.C., 2008. Earthworms in Agriculture, Agrobios, India.
6	Walstra, P. Wouters, J.T.M. and Geurts, T.J. 2006. Dairy Science and Technology. CRC Press, New York.
7	Dunham, R.A., 2004. Aquaculture and Fisheries Biotechnology Genetic Approaches. CABI publications, U.K.
8	Donald.D Bell and William. D. Weaver, 2002. Commercial chicken meat and egg production, Springer, New York.
9	Eckles C.H. and Anthony, E.L., 2001. Dairy Cattle and milk production, Biotech.
10	Tata McGraw Hill Publishing Co.Pvt.Ltd., New Delhi.
11	Edwards, C.A., and Bother, B., 1996. Biology of earthworms, Chapman Hall Publication company.

12	ICAR, 1997. Handbook of Animal Husbandary– The Indian Council of Agricultural Research, New Delhi.
13	Banerjee G.C., 1992. Poultry, Oxford and IBH, New Delhi.
14	Jhingran, AVG, 1991. Fish and Fisheries of India. Hindustan Publishing Co. New Delhi.
15	James. N. Marner, 1975. Principles of dairy processing, wiley eastern limited, NewDelhi.
16	Baradach, JE. Ryther. JH. and, MC larney WO., 1972. Aquaculture. The farming and Husbandry of Freshwater and Marine Organisms. Wiley InterScience, NewYork.

Web Resources

1	https://bit.ly/3tXHjk8
2	https://bit.ly/3tXHjk8
3	https://bit.ly/3tUTHBu
4	https://bit.ly/3hVv96q
5	https://bit.ly/39nztH1
6	https://bit.ly/3CzasVO
7	https://agritech.tnau.ac.in/org_farm/orgfarm_vermicompost.html
8	https://bit.ly/3nYvgSF
9	http://caa.gov.in/farms.html
10	http://www.csrtimys.res.in/
11	http://www.agshoney.com/training.htm

Mapping with Programme Outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**
CO1	3	3	1	2	3
CO2	3	2	3	3	1
CO3	3	3	3	3	2
CO4	2	1	1	3	2
CO5	3	1	3	3	3

3 – Strong, 2 – Medium , 1 – Low

Title of the Course		**CHORDATA**						
Part		**III**						
Category	Core - 3	**Year**	I	**Credits**	5	**Course Code**	232303201	
		Semester	II					
Instructional Hours per week		**Lecture**	**Tutorial**	**Lab Practice**	**Total**	**CIA**	**External**	**Total**
		5	-	-	5	25	75	100

Learning Objectives	
LO1	To understand the structures and distinct features of Phylum Chordata.
LO2	To understand and able to distinguish the characteristic features of each subphylum and class.
LO3	To understand the economic importance of vertebrates
LO4	To know about the adaptations of vertebrates
LO5	To understand the evolutionary position of different groups of vertebrates

UNIT	**Details**	**No. of Periods for the Unit**
I	**General Characters and Classification of Phylum Chordata**: Origin of Chordata, Differences between non-chordates and chordates, General characters, Affinities and Systematic position of Hemichordata (*Balanoglossus*), Urochordata (*Ascidia*), Cephalochordata (*Amphioxus*).	15
II	**Prochordates and Agnatha**: Characteristics of subphylum vertebrata, Classification of Vertebrata upto Class level, Agnatha (*Petromyzon*), - Pisces (*Scoliodon sorrakowah*) General characters and classification, Origin of fishes, Affinities of Dipnoi - Types of scales and fins - Accessory respiratory organs - Air bladder - Parental care - Migration - Economic importance.	15
III	**Amphibia** : General characters and classification - Origin of Amphibia - Type study - *Rana hexadactyla* - Adaptive features of Anura, Urodela and Apoda - Neoteny in Urodela - Parental care in Amphibia.	15
IV	Reptilia : General characters and classification - Type study – (*Calotes versicolor (endoskeleton of Varanus*) - Origin of reptiles and effects of terrestrialisation, Extinct reptiles. Snakes of India. Poison apparatus and biting mechanism of poisonous snakes - Skull in reptiles as basis of classification	15
V	Aves and Mammalia: Ayes: General characters and classification – Type study - *Columba livia* - Origin of birds, Flight adaptations, Migration. Mammalia: General characters and classification - Type study - Rabbit - Adaptive radiation in mammals - Egg laying mammals, Marsupials, Flying mammals, Aquatic mammals, Dentition in mammals.	15

Course Outcomes	
Course Outcomes	On completion of this course, students will;
CO1	Classify, Identify and recall the name and distinct features of different subphylum belonging to phylum Chordata.
CO2	Explain, and relate the origin, structural organization and evolutionary aspects of vertebrates.
CO3	Analyze, compare and distinguish the developmental stages and describe the important biological process.
CO4	Correlate the different modes of life and parental care among different vertebrates.
CO5	Summarise the morphology and ecological adaptations in vertebrates and list out the economic importance.

Text Books (Latest Editions)	
1	Ayyar, E.K. and T.N. Ananthakrishnan, 1992. Manual of Zoology Vol. II (Chordata), S. Viswanathan (Printers and Publishers) Pvt Ltd., Madras, 891p.
2	Jordan, E.K. and P.S. Verma, 1995. Chordate Zoology and Elements of Animal Physiology, 10th edition, S. Chand & Co Ltd., Ram Nagar, New Delhi, 1151 pp.
3	Nigam, H.C., 1983. Zoology of Chordates, Vishal Publications, Jalandhar - 144008, 942.
4	Ganguly, Sinha,. Bharati Goswami and Adhikari, 2004. Biology of animals Vol.II - New central book Agency (p) Ltd.
5	Kotpal. R.L. A, Modern text book of Zoology Vertebrates- Rastogi publications. 2009
References Books (Latest editions, and the style as given below must be strictly adhered to)	
1	Darlington P.J. The Geographical Distribution of Animals, R.E. Krieger Pub. Co.
2	Hall B.K. and Hallgrimsson B. (2008). Strickberger's Evolution. IV Edition. Jones and Bartlett Publishers Inc.
3	Hickman, C.P. Jr., F.M.Hickman and L.S. Roberts, 1984. Integrated Principles of Zoology, 7th Edition, Times Merror/Mosby College Publication. St. Louis. 1065 pp.
4	Newman, H.H., 1981. The Phylum Chordata, Satish Book Enterprise, Agra – 282 003, 477 pp.
5	Parker and Haswell, 1964. Text Book of Zoology, Vol II (Chordata), A.Z.T,B.S. Publishers and Distributors, New Delhi - 110 051, 952 pp.
6	Pough H. Vertebrate life, VIII Edition, Pearson International.
7	Waterman, Allyn J. et al., 1971. Chordate Structure and Function, Mac Millan & Co., New York, 587 pp.
8	Young, J. Z. (2004). The Life of Vertebrates. III Edition. Oxford university press.
Web Resources	
1	http://tolweb.org/Chordata/2499
2	https://www.nhm.ac.uk/
3	https://bit.ly/3Av1Ejg
4	https://bit.ly/3kqTfYz
5	https://biologyeducare.com/aves/
6	https://www.vedantu.com/biology/mammalia

Mapping with Programme Outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**
CO1	S							
CO2	M	S						
CO3		S	S	S	S	S		S
CO4			S	S	S	M		
CO5			S		S			S

3 – Strong, 2 – Medium , 1 - Low

Title of the Course		**CHORDATA LAB**						
Part		**III**						
Category	Core 4	**Year**	I	**Credits**	2	**Course Code**	232303202	
		Semester	II					
Instructional Hours per week		**Lecture**	**Tutorial**	**Lab Practice**	**Total**	**CIA**	**External**	**Total**
		-	-	3	3	25	75	100

Learning Objectives

LO1	To understand the structures and distinct features of phylum chordata.
LO2	To understand and able to distinguish the characteristic features of each subphylum and class.
LO3	To understand and compare the structure of various internal organs in different classes of vertebrates.
LO4	To know about the classification, adaptations and affinities of chordate animals.

UNIT	**Details**	**No. of Periods for the Unit**
I	**Dissections**:Frog (Demo)/Fish:Externalfeatures,Digestivesystem, Arterialsystem,Venoussystem,5thCranialnerve,9thand10thcranial nerves, Male and female urinogenital system.	
II	**Mounting**: Fish: Placoid and Ctenoid scales, Frog: Hyoid apparatus and Brain (Demo).	
III	**Osteology**:Frog:Skullandlowerjaw,Vertebralcolumn,Pectoral girdle,Pelvicgirdle,Forelimb,Hindlimb.Chelonia-Anapsidskull,Pigeon - skull and lower jaw, synsacrum.	
IV	**SpecimenandSlides**:**(i) Hemichordata:** Balanoglossus, Tornaria larva **(ii). Protochordata:** Amphioxus, Amphioxus T.S. through pharynx **(iii). Cyclostomata:** Petromyzon, Myxine, Ammocoetus larva **(iv). Pisces:** Sphyrna Pristis, Torpedo, Channa, Pleuronectes, Hippocampus, Exocoetus, Echieneis, Labeo, Catla, Clarius, Auguilla, Protopterus, Scales: Placoid, Cycloid, Ctenoid **(v). Amphibia:** Ichthyophis, Amblystoma, Siren, Hyla, Rachophous,Bufo,Rana, Axolotal larva **(vi). Reptilia :** Draco, Chemaeleon, Gecko, Uromastix, Vipera russelli, Naja, Bungarus, Enhydrina, Typhlops, Testudo, Trionyx, Crocodilus, Ptyas. **(vii). Aves:** Archaeopteryx, Passer, Psittacula, Bubo, Alcedo, Columba, Corvus, Pavo; Collection and study of different types of feathers: Quill, Contour, Filoplume, Down **(viii). Mammalia:** Ornithorhynchus, Tachyglossus, Pteropus, Funambulus, Manis, Loris, Hedgehog	
V	**Embryology**:StagesinthedevelopmentofAmphioxus,Frogand Chick-Placentain shark and mammals.	

Course Outcomes	
Course Outcomes	On completion of this course, students will;
CO1	Identify and recall the name and distinct external and internal features of animals belonging to phylum Chordata.
CO2	Explain the structural organization of various organs and systems in different classes of vertebrates.
CO3	Analyse, compare and distinguish the morphological features and developmental stages of chordates
CO4	Dissect and explain various organs and internal systems in different vertebrates and correlate its function.
CO5	Summarise the morphology and ecological adaptations in vertebrates and list out the economic importance.

Text Books (Latest Editions)	
1	Lal S S, 2009. Practical Zoology Vertebrate, Rajpal and Sons Publishing, 484pp.
2	VermaP.S,2000.AManual ofPracticalZoology:Chordates,S.ChandLimited, 627pp.
References Books (Latest editions, and the style as given below must be strictly adhered to)	
1.	Robert William Hegner, 2015. Practical Zoology, BiblioLife, 522pp.
2.	Young, J,Z., 1972. The life of vertebrates. OxfordUni. London.
Web Resources	
1.	https://www.youtube.com/watch?v=b04hc_kOY10
2.	https://bit.ly/3CzTEy8
3.	http://tolweb.org/Chordata/2499
4.	https://www.nhm.ac.uk/
5.	https://bit.ly/3Av1Ejg

Mapping with Programme Outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**
CO1	S							
CO2	M	S						
CO3				S		S		
CO4				S	S	M		
CO5			S					S

3 – Strong, 2 – Medium , 1 – Low

Title of the Course		**Genetics, Cell Biology and Biochemistry (for Chemistry Major Students)**						
Part		**III**						
Category	EC – 2 T	**Year**	I	**Credits**	2	**Course Code**	**232303221**	
		Semester	II					
Instructional Hours per week		**Lecture**	**Tutorial**	**Lab Practice**	**Total**	**CIA**	**External**	**Total**
		4	-	-	4	25	75	100

Learning Objectives

- ***To introduce the basic concepts of Genetics, Cell Biology and Biochemistry.***

	Details	
I	Mendel Laws: Monohybrid and Dihybrid experiment, Multiple alleles – blood group inheritance. Mendelian traits in man. Sex determination in Man.	**12**
II	DNA as a genetic material – Griffith Experiment. Syndrome: Down's syndrome, Klinfelter's Syndrome, Turner's Syndrome. Genetic code. Extrachromosomal inheritance – Kappa particles in Paramecium	**12**
III	Prokaryotic and Eukaryotic cells: Ultra structure and functions of plasma membrane Mitochondria, Ribosomes, Lysosomes. Protein synthesis – Transcription and Translation in Eukaryotes.	**12**
IV	Structure and functions of Nucleus and Nucleolus. Cell division – Mitosis and Meiosis. Cancer properties, types, causes and treatment.	**12**
V	Classification of carbohydrate, Protein and Lipid Metabolism: Carbohydrate– Glycolysis, Protein - Deamination. Lipid - β oxidation Enzyme – Classification – Mechanism of action.	**12**

Text Books (Latest Editions)

01. Sinnot Dunn and Dob Zansky, Principles of Genetics, Tata McGraw–Hill Co., New Delhi.
02. Power C.B., Cell biology, Himalaya Publishing House, Mumbai – 2007.
03. Ambika Shanmugam, Biochemistry, 4th Edition, Chand Publications, 2007.

References

01. Dr. R.P. Meyan Pillai, Genetics, Saras Publications, India, 2008
02. Arumugam N., Cell Biology, Saras Publications, India, 2006.
03. Arumugam N., Biochemistry, Saras Publications, India, 2010.
04. Winchester A.M., Genetics, Oxford nad IBH Publications Co., New Delhi 1967.
05. DeRobertis, Nuwinski E.O., and Saemy, Cell biology, Srunderand co, Philadelohis, 2009.
06. Srivatsava H., Elements of Biochemistry, Rastogi Publicatuions, 2005.

Web Resources

01. https://www.britannica.com/science/genetics/The-work-of-Mendel
02. https://www.britannica.com/list/6-cell-organelles
03. https://www.biologie.ens.fr/~mthomas/L3/intro_biologie/2-sucres-lipides-acides-nucleiques.pdf

MAPPING OF COs WITH POs

	PO1	**PO 2**	**PO3**	**PO4**	**PO5**
CO 1	3	3	3	3	2
CO 2	2	2	3	2	3
CO 3	3	3	2	1	1
CO 4	3	2	2	3	2
CO 5	3	1	1	3	3

3- Strong 2- Medium 1- Low

Title of the Course		Animal Diversity, Genetics, Cell Biology and Bio chemistry Lab (for Chemistry Major Students)						
Part		III						
Category	EC – 2 P	Year	I	Credits	2	Course Code	232303222	
		Semester	II					

Instructional Hours per week	Lecture	Tutorial	Lab Practice	Total	CIA	External	Total
	-	-	2	2	25	75	100

Learning Objectives

To acquire Identification, Observation and Practical Skill.

Details

Animal Diversity:

Demonstration of

Cockroach : Salivary gland, Digestive system and Nervous system

Earth worm : Body setae

Genetics:

Structure of DNA

Down's Syndrome

Klinfelter's Syndrome

Turner's Syndrome

Observation of simple Mendelian traits in man.

ABO Blood grouping

Cell Biology:

Cell organelles : Mitochondria
Ribosome
Nucleus

Onion Root tip squash : Identification of the mitotic stages.

Biochemistry:

Qualitative analysis of Carbohydrate, Protein and Lipid.

Spotters:

Protozoa : Amoeba,
Paramecium – Conjugation

Porifera : Sponges
Gemmules

Coelenterate : Obelia Colony
Sea anemone

Platyhelminthes : *Fasciola hepatica*
Tapeworm scolex

Nematoda : Ascaris: Male and Female

Annelida : Peripatus

Arthropoda : Prawn
Limulus
Silkworm Larva

Mollusca : Pila
Pearl Oyster, Sepia

Echinodermata : Starfish, Sea cucumber.

References Books

(Latest editions, and the style as given below must be strictly adhered to)

1. Lal S.S., A Text Book of Practical Zoology–Invertebrate, Rastogi Publications, Meerut, 2004.
2. Lal S.S., A Text Book of Practical Zoology I & II, Rastogi Publications, Meerut, 2004.

Web Resources

01. http://www.bilogy discussion.com

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5
CO1	3	3	1	2	3
CO2	3	2	3	3	1
CO3	3	3	3	3	2
CO4	2	1	1	3	2
CO5	3	1	3	3	3

3 – Strong, 2 – Medium , 1 - Low

Title of the Course		**BIO COMPOSTING FOR ENTREPRENEURIAL SHIP**						
Part		**III**						
Category	SEC – II NME	**Year**	I	**Credits**	2	**Course Code**	**234603223**	
		Semester	II					
Instructional Hours per week		**Lecture**	**Tutorial**	**Lab Practice**	**Total**	**CIA**	**External**	**Total**
		2	-	-	2	25	75	100

Learning Objectives	
LO1	To highlight the importance of Biocomposting for entrepreneurship in waste management.
LO2	To enable students for setting up Biocompost units and bins for waste reduction.

UNIT	**Details**	**No. of Periods for the Unit**
I	Biocomposting – Definition, types and ecological importance.	**6**
II	Types of Biocomposting technology – Field pits/ground heaps/ tank/large-scale/batch and continuous methods	**6**
III	Preparation of Biocompost pit and bed using different amendments.	**6**
IV	Applications of Biocompost in soil fertility maintenance, promotion of plant growth, value added products, waste reduction, etc.	**6**
V	Economics of establishment of a small biocompost unit – project report proposal for Self Help Group (Income and employment generation).	**6**

Course Outcomes	
Course Outcomes	On completion of this course, students will be able;
CO1	The students will gain knowledge about the process of Biocomposting.
CO2	Students will be able to demonstrate Biocomposting techniques for various end applications like solid waste management, industrial waste recycling using sugarcane bagasse, etc
CO3	To gain knowledge about the economic cost of establishing small Biocompost units as a cottage industry

References Books (Latest editions, and the style as given below must be strictly adhered to)	
	Bikas R. Pati& Santi M. Mandal (2016). Recent trends in composting technology.
	Van der Wurff, A.W.G., Fuchs, J.G., Raviv, M., Termorshuizen, A.J. (Editors) 2016. Handbook for Composting and Compost Use in Organic Horticulture. BioGreenhouse COST Action FA 1105, www.biogreenhouse.org
Web Resources	

Mapping with Programme Outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**
CO1	3	3	1	2	3
CO2	3	2	3	3	1
CO3	3	3	3	3	2
CO4	2	1	1	3	2
CO5	3	1	3	3	3

3 – Strong, 2 – Medium , 1 - Low

Title of the Course		**ANIMAL BEHAVIOUR**						
Subject code		**234403223**						
Category	SEC III	**Year**	I	**Credits**	2	**Course Code**	**234403223**	
		Semester	II					
Instructional Hours per week		**Lecture**	**Tutorial**	**Lab Practice**	**Total**	**CIA**	**External**	**Total**
		2	-	--	2	25	75	100

Learning Objectives	
LO1	To learn the origin and development of animal behaviour and to understand the influence of genetics, environment on animal behaviours.
LO2	To understand the biological properties of animal behavior, with an evolutionary and ecological emphasis.
LO3	To Compare innate and learned behavior and differentiate between various mating system.
LO4	To impart the knowledge about visual and auditory communication; courtship, mate choice, and mating systems; social behavior and social systems; and animal personality.
LO5	To discuss how movement and migration behaviors are a result of natural selection.

UNIT	**Details**	**No. of Periods for the Unit**
I	**Genetics and Behaviour** : Genetic material, Genes and chromosomes, Genetic variation, Single and Polygenic inheritance of behaviour, Heritability of behaviour, Natural selection and behaviour, Frequency distribution of phenotypes, Darwinian fitness, Evolution of adaptive strategies.	**6**
II	**Evolution and Social Behaviour :** Sexual selection, Altruism, Sexual strategy and social organisation, Animal perception, Neural control of behaviour, Sensory processes and perception, Visual adaptations to unfavourable environments.	**6**
III	**Animal and the Environment:** Coordination and Orientation, Homeostasis and Behaviour, Physiology and Behaviour in changing environments, Animal Learning, Conditioning and Learning, Biological aspects of learning, Cognitive aspects of learning.	**6**
IV	**Understanding Complex Behaviour :**Instinct and learning, Displacement activities, Ritualization and Communication, Decision making behaviour in Animals, Complex behaviour of hobey bees, Evolutionary optimality, Mechanism of Decision making. The mentality of Animals : Languages and mental representation, non-verbal communication in human, mental images,Intelligence, tool use and culture, Animal awareness and Emotion.	**6**

V	**Chronobiology** : Organization of circadian system in multicellularanimals; Concept of central and peripheral clock system; Circadian pacemaker system in invertebrates with particular reference to Drosophila; Photoreception and photo- transduction; The physiological clock and measurement of day length; Molecular bases of seasonality; The relevance of biological clocks for human welfare - Clock function (dysfunction); Human health and diseases - Chronopharmacology, chronomedicine, chronotherapy.	**6**

Course Outcomes	
Course Outcomes	On completion of this course, students will be able;
CO1	Recall and record genetic basis and evolutionary history of behaviour.
CO2	Classify movement and migration behaviors and explain environmental influence upon behaviour.
CO3	Analyze and identify innate, learned and cognitive behavior and differentiate between various mating systems.
CO4	Assess complexity involved in behavioural traits and evaluate hormones and their role in aggression and reproduction.
CO5	Discuss the rhythmicity of behavioural expressions and the scientific concepts in behavior and behavioral ecology.

Text Books (Latest Editions)	
1	David McFarland, 1985.Animal Behaviour, Longman Scientific & Technical, UK.576pp.
2	HarjindraSingh,1990.ATextBookofAnimalBehaviour,AnomolPublication,293pp.
3	HoshangS.GundeviaandHareGovingSingh,1996.AnimalBehaviour,S.Chand&Co, 280pp.
4	Shukla, J. P 2010, Fundamentals of Animal Behaviour, Atlantic, 587pp.
5	Vinod Kumar, 2002. BiologicalRhythms. NarosaPublishingHouse, Delhi.
References Books (Latest editions, and the style as given below must be strictly adhered to)	
1	Michael D. Breed and Janice Moore, 2012. Animal Behaviour, Academic Press, USA, 359pp.
2	Aubrey Manning and Martin Stamp Dawkins, 2012. An Introduction to Animal Behaviour, 6th Edition, Cambridge University Press, UK. 458pp.
3	Davis E.Davis, 1970. Integral Animal Behaviour, Mac Millan Company,London, 118pp.
4	Jay, C. Dunlap, Jennifer, J. Loros, Patricia J. De Coursey (ed). 2004. Chronobiology Biological time Keeping, Sinauer Associates Inc, Publishers, Sunderland, MA.
Web Resources	
1	https://www.ncbs.res.in/content/animal-behaviour
2	https://bit.ly/3i6wUxR
3	https://www.behaviour.univie.ac.at/
4	https://www.ru.nl/bsi/

Mapping with Programme Outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**
CO1	3	3	1	2	3
CO2	3	2	3	3	1
CO3	3	3	3	3	2
CO4	2	1	1	3	2
CO5	3	1	3	3	3

3 – Strong, 2 – Medium , 1 – Low