SRI SARADA COLLEGE FOR WOMEN

(AUTONOMOUS)

Reaccredited with 'B++' Grade by NAAC

(Affiliated to Periyar University)

SALEM-16

DEPARTMENT OF ZOOLOGY

TANSCHE SYLLABUS

B.Sc., ZOOLOGY

(For the Students admitted from 2024-2025 onwards)

SRI SARADA COLLEGE FOR WOMEN (AUTONOMOUS), SALEM-16

DEPARTMENT OF ZOOLOGY

B.Sc. ZOOLOGY

PROGRAMME STRUCTURE UNDER CBCS

(For the Students Admitted from the Academic Year 2024-2025 Onwards)

Total Credits: 140 + Extra Credits (Maximum 28)

FIRST YEAR **SEMESTER – I**

Part	Course	Course Title	Paper Code	Credit	No.of Hours/ Week
I	Language-I	Tamil/Hindi/Sanskrit	24ULTC1/24ULHC1/ 24ULSC1	3	6
II	English	English-I	24ULEC1	3	6
III	Core Course-I	Invertebrata	24UZOCC1	6	6
		Invertebrata and Chordata Practical	24UZOQC1	-	3
	Elective: I (GE)	Botany –I	24UZOGEC1	3	3
	Elective: I (GE)	Botany Practical	24UZOBGECQ	-	2
IV	Skill Enhancement Course SEC-1 (NME)	Biocomposting for Entrepreneurship	24UZOSEC1	2	2
	Skill Enhancement-Foundation Course	Animal Biodiversity	24UZOSEFC	2	2
		TOTAL		**19**	**30**
V	**Articulation and Idea Fixation Skills**				
	Physical Fitness Practice 35 Hours Per Semester				
	Advanced Diploma in Sericulture Level-I : Certificate Course100 hours Per Semester				

FIRST YEAR **SEMESTER - II**

Part	Courses	Course Title	Paper Code	Credit	No. of Hours
I	Language	Tamil / Hindi / Sanskrit-II	24ULTC2/ 24ULHC2/ 24ULSC2	3	6
II	English	General English - II	24ULEC2	3	6
III	Core Course - II	Chordata	24UZOCC2	5	6
	Core Course - III	Invertebrata and Chordata Practical	24UZOQC1	3	3
	Elective: II (GE)	Botany - II	24UZOBGEC 2	3	3
	Elective: I (GE)	Botany Practical	24UZOBGEC Q	4 (2 +2)	2
IV	Skill Enhancement Course - (NME-II)	Wildlife conservation and Management	24UZOSEC2	2	2
	Skill Enhancement Course – III (Indian Knowledge system)	Traditional knowledge on Ethnozoology	24UZOSEC3	2	2
			Total	**25**	**30**
V	**Articulation and Idea Fixation Skills**				
	Physical Fitness Practice 35 Hours per Semester				
	Advanced Diploma in Sericulture Level-II : Diploma course 100 Hours per Year				
	Extra credits are given for extra skills and courses qualified in MOOC / NPTEL				

Second Year **Semester-III**

Part	Courses	Course Title	Paper Code	Credit	No. of Hours
I	Language	Tamil / Hindi / Sanskrit-III	24ULTC3/ 24ULHC3/ 24ULSC3	3	6
II	English	English - III	24ULEC3	3	6
III	Core Course - IV	Cell Biology	24UZOCC3	3	3
	Core Course - V	Genetics	24UZOCC4	4	4
		Cytology, Genetics and Developmental Biology Practical	24UZOCCQ2	-	2
	Elective: III (GE)	Chemistry-I	24UZOGEC3	3	3
	Elective: III (GE)				
		Chemistry Practical -I	24UZOGECQ3	2	2
IV	Skill Enhancement Course - IV	Aquarium Keeping (Entrepreneurial Based)	24UZOSEC4	1	1
	Skill Enhancement Course -V (Discipline/Subject specific)	Economic Zoology	24UZOSEC5	2	2
	E.V.S		24UEVSC	-	1
			Total	**21**	**30**
V	**Articulation and Idea Fixation Skills**				
	Physical Fitness Practice 35 Hours per Semester				
	Advanced Diploma in Sericulture Level-II : Diploma course 100 Hours per Year				
	Extra credits are given for extra skills and courses qualified in MOOC / NPTEL				

Second Year **Semester-IV**

Part	Courses	Course Title	Paper Code	Credit	No. of Hours
I	Language	Tamil / Hindi / Sanskrit-IV	24ULTC4/ 24ULHC4/ 24ULSC4	3	6
II	English	English - IV	24ULEC4	3	6
III	Core Course - VII	Developmental Biology	24UZOCC5	5	5
	Core Course - VIII	Cytology, Genetics and Developmental Biology Practical	24UZOCCQ2	3	3
	Elective: IV (GE)	Chemistry-II	24UZOGEC4	3	3
	Elective: IV (GE)	Chemistry Practical - II	24UZOGECQ4	2	2
IV	Skill Enhancement Course – VI (Discipline/Subject specific)	Food, Nutrition and Health	24UZOSEC6	2	2
	Skill Enhancement Course –VII (Discipline/Subject specific)	Basics of Marine Biology	24UZOSEC7	2	2
	E.V.S		24UEVSC	2	1
			Total	**25**	**30**
V	**Articulation and Idea Fixation Skills**				
	Physical Fitness Practice 35 Hours per Semester				
	Advanced Diploma in Sericulture Level-II : Diploma course 100 Hours per Year				
Extra credits are given for extra skills and courses qualified in MOOC/ NPTEL					

SEMESTER – I

Course Code CC1	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
24UZOCC1	**INVERTEBRATA**	Core	Y	-	-	-	6	6	30	70	100

Learning Objectives	
CO1	To understand the basic concepts of lower animals and observe the structure and functions.
CO2	To illustrate and examine the systemic and functional morphology of various group of invertebrates.
CO3	To differentiate and classify the various groups of animal modes of life and to estimate the biodiversity.
CO4	To compare and distinguish the general and specific characteristics of reproduction in lower animals.
CO5	To infer and integrate the parasitic and economic importance of invertebrate animals

UNIT	Details	No. of Hours	Course Objectives
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*) **Porifera:** General characters and classification up to Classes. Type study - Sycon - Canal system in sponges	12	CO1,CO3, CO4,
II	**Coelenterata:** General characters and classification up to classes – Type study - *Obelia* Corals and coral reefs - Polymorphism - Economic importance. **Platyhelminthes:** General characters and classification of up to classes. Type study – *Taenia solium* – Parasitic adaptations. Host-parasitic interactions of Helminth parasites.	12	CO2
III	**Aschelminthes**: General characters and classification of up to classes - Type study - *Ascaris lumbricoides.* Nematode Parasites and diseases - *Wuchereria bancrofti*, *Enterobius vermicularis*, *Ancylostoma duodenale*. Parasitic adaptations.	12	CO3,CO4, CO5

	Annelida: General characters and classification up to Classes. Type study –*Nereis* , Metamerism Modes of life in Annelids.		
IV	**Arthropoda:** General characters and classification of Phylum Arthropoda up to Classes. Detailed study: *Penaeus indicus*. Affinities of *Peripatus* – Larval forms in Crustacea. Economic importance of Insects. Insect pests of Agricultural Importance- Pest of rice: Rice stem borer (*Scirpophaga incertulas*) – Pest of Sugarcane: The shoot borer (*Chilo infuscatellus*) – Pest of coconut: The rhinoceros beetle (*Oryctes rhinoceros*). Principles of Integrated Pest Management.	12	CO1,CO2, CO4,CO5
V	**Mollusca:** General characters and classification of Phylum Mollusca up to Classes. Detailed study: *Pila globosa*. Foot and torsion in Mollusca. **Echinodermata:** General characters and classification of Phylum Echinodermata up to Classes. Detailed study: *Asterias.* Water vascular system in Echinodermata – Larval forms of Echinoderms.	12	CO1,CO2, CO4,CO5
		60	

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 invertebrate.	PO1,PO4, PO6
CO3	Differentiate and classify the animal's mode of life in various taxa and estimate the biodiversity.	PO1, PO4
CO4	Compare and distinguish the various physiological processes and organ systems in lower animals.	PO3,PO4, PO5, PO6
CO5	Infer and integrate the parasitic and economic importance of invertebrate animals.	PO4, PO5, PO6,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/	
Methods of Evaluation		
Internal Evaluation	Continuous Internal Assessment Test, Model examinaton	30 Marks
	Assignments, open book Test, Surprise Test	
	Seminars, Poster presentation	
	Attendance and Class Participation	
External Evaluation	End Semester Examination	70 Marks
	Total	100 Marks
Methods of Assessment		
Recall (K1)	Simple definitions, MCQ, Recall steps, Concept definitions	
Understand/ Comprehend (K2)	MCQ, True/False, Short essays, Concept explanations, Short summary or overview	

Application (K3)	Suggest idea/concept with examples, Suggest formulae, Solve problems, Observe, Explain
Analyze (K4)	Problem-solving questions, Finish a procedure in many steps, Differentiate between various ideas, Map knowledge
Evaluate (K5)	Longer essay/ Evaluation essay, Critique or justify with pros and cons
Create (K6)	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	S	S	S	M	M	M	M	L
CO 2	M	M	M	S	M	M	M	L
CO 3	M	M	S	S	M	S	M	L
CO 4	M	M	M	S	S	M	M	L
CO 5	M	M	S	M	L	L	L	S

S-Strong(3) **M-Medium (2)** **L-Low (1)**

CORE LAB COURSE (PRACTICAL–I)SEMESTER – II

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
24UZOQC1	**INVERTEBRATA AND CHORDATA LABCOURSE**	Core	Y	-	Y	-	3	3	40	60	100

Learning Objectives	
CO1	To identify the different groups of invertebrate and chordate animals by observing their external characteristics.
CO2	To understand the organs, organ system and their functions in lower animals.
CO3	To get knowledge about the different modes of life and their adaptation based on the environment.
CO4	Able to dissect and display the internal organs and mount the mouthparts and scales of invertebrates and to know about the classification, adaptations and affinities of Chordate animals.

Content	Details	No. of Hours	Course Objectives
Major Dissection	1. Cockroach: Digestive system and Nervous system. 2. Earthworm: Viscera and Lateral hearts. 3. Prawn: Nervous system and Appendages. 4. Fish: External features and Digestive system.	12	CO1
Minor Dissection	**Mounting:** **1.** Earthworm: Body setae and Pineal setae. **2.** Freshwater muscle: Pedal ganglia. **3.** Mouth parts - Honey Bee, Housefly and Mosquito. **4.** Fish: Placoid and Ctenoid scales,	12	CO2
	Osteology: Frog: Skull and lower jaw, Vertebral column, Pectoral girdle, Pelvic girdle, Fore limb, Hind limb. Pigeon - skull and lower jaw, synsacrum.	12	CO3
	Specimen and Slides: **(i).Protozoa:** Amoeba, Paramoecium, Entamoeba histolytica, Plasmodium vivax **(ii).Porifera:** Sycon, Spongilla, Spicules, Gemmule **(iii).Coelenterata:** Obelia–Colony & Medusa, Aurelia, **(iv).Platyhelminthes:** Planaria, Fasciola hepatica, Fasciola larval forms – Miracidium, Redia, Taenia solium **(v).Nemathelminthes:** Ascaris (Male & Female),Ancylostoma, Wuchereria **(vi).Annelida:** Nereis, Hirudinaria, Trochophore larva **(vii).Arthropoda:** Scorpion, Scolopendra, Sacculina, Limulus, Peripatus, Larvae- Nauplius, Mysis, Zoea (**Viii). Mollusca**: Pila, Unio,Sepia,Loligo, Octopus,	12	CO4

	Nautilus, Glochidium larva **(ix). Echninodermata:** Asterias, Echinus, Bipinnaria larva		

Spotters	**(viii).Mollusca:** Pila, Unio,Sepia , Loligo,Octopus, Nautilus, Glochidium larva **(ix).Echinodermata:** Asterias, Echinus, Bipinnaria larva. **(xi)Hemichordata:** Balanoglossus **(xii) Protochordata:** Amphioxus **(xiii)Cyclostomata:** Petromyzon **(xiv).Pisces:** Channa, Pleuronectes, Hippocampus, Echieneis, Labeo, Catla. **Scales:** Placoid, Cycloid, Ctenoid **(xv).Amphibia:** Ichthyophis, Hyla, Bufo, Rana, larva **(xvi).Reptilia:**Draco,Chemaeleon, Gecko,Vipera russelli, Naja, Bungarus, Crocodilus, Ptyas. **(xvii).Aves:** Archaeopteryx, Columba ,Corvus, Pavo; Collection and study of different types of feathers: Quill, Contour, Filoplume, Down **(xviii).Mammalia:** Funambulus, Manis, Loris, Hedgehog.		
	Total	**60**	

Course Outcomes		
Course Outcomes	On completion of this course ,students will;	
CO1	Identify and label the external features of different groups Of invertebrate and chordate animals.	PO1
CO2	Illustrate and examine the circulatory system, nervous System and reproductive system of invertebrate and chordate animals.	PO1,PO2
CO3	Differentiate and compare the structure , function and mode Of life of various groups of animals.	PO4,PO6
CO4	Compare and distinguish the dissected internal organs Of lower animals.	PO4,PO5,PO6
CO5	Prepare and develop the mounting procedure of Economically important invertebrates and chordates.	PO3,PO8

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 andA dhikari,2011.Biology of Animals: Volume I, New Central Book Agency;3rd revised edition.1008pp.
3.	Sinha,Chatterjee andChattopadhyay,2014. Advanced Practical Zoology, Books&AlliedLtd;3rdRevisededition,1070pp.
4.	Lal,S.S, 2016. Practical Zoology Invertebrate, Rastogi Publications.
5.	Verma,P.S.2010.AManualofPracticalZoology:Invertebates,SChand,497pp.
6.	LalSS,2009.PracticalZoologyVertebrate,RajpalandSonsPublishing, 484pp.
7.	VermaP.S,2000.AManualofPracticalZoology:Chordates,S.ChandLimited,627pp.

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.andSpicer,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.AtextBookofPracticalZoology:Invertebrate,Rastogi,Meerut
6.	RobertWilliamHegner,2015.PracticalZoology,BiblioLife,522pp.
7.	Young,J,Z.,1972.Thelifeofvertebrates.OxfordUni. London.

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/

Methods of Evaluation		
Internal Evaluation	Internal Assessment Test, Model Practical examination	40 Marks
	Observation Record	
	Attendance and Regulatory in Lab Participation	
External Evaluation	End Semester Practical Examination	60 Marks
	Total	100 Marks

Methods of Assessment	
Recall(K1)	Simple definitions, MCQ, Recall steps, Concept definitions, Dissection and mountings.
Understand/ Comprehend (K2)	Explain the concept of animal adaptation and biological significance to respective model (specimen-Spotters) of life, MCQ, Short essays.
Application (K3)	Define the morphological observation of selected animals.
Analyze (K4)	Define the structure and functions of animal parts.
Evaluate (K5)	Analyze the microscopic organisms, Dissection, Draw labeled sketches.
Create(K6)	Discussion, Identify and draw selected parts of animal's origin, Debating.

Mapping with Programme Outcomes:

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

S-Strong (3) M-Medium(2) L-Low (1)

GENERIC ELECTIVE I : BOTANY-I

Title of the Course	GENERIC ELECTIVE – I (GE) : BOTANY – I					
Paper Number	Generic Elective - I					
Category	Core	**Year**	I	**Credits**	3	**Course Code**
		Semester	I			24UZOGEC1
Instructional Hours per week		**Lecture**	**Tutorial**		**LabPractice**	**Total**
		3	-		-	3
Pre-requisite	To study the basics of botany.					

Learning Objectives	
C1	To study morphological and anatomical adaptations of plants of various habitats.
C2	To demonstrate techniques of plant tissue culture.
C3	To familiarize with the structure of DNA, RNA.
C4	To carryout experiments related with plant physiology.
C5	To perform biochemistry experiments.

Course outcomes: On completion of this course, the students will be able to: CO	**Programme Outcomes**
1. Increase the awareness and appreciation of human friendly algae and their economic importance.	K1
2. Develop an understanding of microbes and fungi and appreciate their adaptive strategies.	K2
3. Develop critical understanding on morphology, anatomy and reproduction of Bryophytes, Pteridophytes and Gymnosperms.	K3
4. Compare the structure and function of cells and explain the development of cells.	K4
5. Understand the core concepts and fundamentals of plant biotechnology and genetic engineering.	K5

UNIT	**CONTENTS**
I	**Algae:** General characters of algae - Structure, reproduction and life cycle of the following genera - *Anabaena* and *Sargassum* and economic importance of algae.
II	**Fungi, Bacteria and Virus:** General characters of fungi, structure, reproduction and life cycle of the following genera – *Penicillium* and *Agaricus* and economic importance of fungi. Bacteria - general characters, structure and reproduction of *Escherichia coli* and economic importance of bacteria. Virus - general characters, structure of TMV, structure of bacteriophage.
III	**Bryophytes, Pteridophytes and Gymnosperms:** General characters of Bryophytes, Structure and life cycle of *Funaria*. General characters of Pteridophytes, Structure and life cycle of *Lycopodium*. General characters of Gymnosperms, Structure and life cycle of *Cycas*.

IV	**Cell Biology:** Prokaryotic and Eukaryotic cell- structure /organization. Cell organelles - ultra structure and function of chloroplast, mitochondria and nucleus. Cell division - mitosis and meiosis.
V	**Genetics and Plant Biotechnology:** Mendelism - Law of dominance, Law of segregation, Incomplete dominance. Law of independent assortment. Monohybrid and dihybrid cross - Test cross - Back cross. Plant tissue culture - *In vitro* culture methods. Plant tissue culture and its application in biotechnology.
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC–CSIR/GATE/TNPSC/ others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this Course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Texts	1. Singh,V.,Pande,P.C andJain,D.K. 2021. A Text Book of Botany. Rastogi Publications, Meerut. 2. Bhatnagar, S.P and AlokMoitra. 2020. Gymnosperms, New Age International (P) Ltd., Publishers, Bengaluru. 3. Sharma,O.P.2017. Bryophyta, MacMillanIndiaLtd.Delhi. 4. Lee, R.E. 2008. Phycology, IV Edition, Cambridge University Press, New Delhi. 5. Rao, K., Krishnamurthy, K.V and Rao, G.S. 1979. Ancillary Botany,S. Viswanathan Pvt. Ltd., Madras.
Reference books:	1. Parihar, N.S. 2012. An introduction to Embryophyta – Pteridophytes- Surjeet Publications, Delhi. 2. Alexopoulos, C.J. 2013. Introduction to Mycology. Willey Eastern Pvt. Ltd. 3. Vashishta, P.C. 2014. Botany for Degree Students Gymnosperms. Chand & Company Ltd, Delhi. 4. Coulter, M. Jhon, 2014. Morphology of Gymnosperms. Surjeet Publications, Delhi. 5. Vashishta, P.C. 2014. Botany for Degree Students Algae. 2014. Chand & Company Ltd, Delhi. 6. Parihar, N.S. 2013. An introduction to Embryophyta – Bryophytes -, Surjeet Publications, Delhi. 7. Pandey B.P. 1986, Text Book of Botany (College Botany) Vol I &II, S.Chand and Co. New Delhi.
Web Resources	1. https://www.kobo.com/us/en/ebook/the-algae-world 2. http://www.freebookcentre.net/biology-books-download/Fungi-(PDF-15P).html 3. http://scitec.uwichill.edu.bb/bcs/bl14apl/bryo1.htm 4. https://www.toppr.com/guides/biology/plant-kingdom/pteridophytes/ 5. https://arboretum.harvard.edu/wp-content/uploads/2013-70-4-beyond-pine-cones-an-introduction-to-gymnosperms.pdf 6. https://www.us.elsevierhealth.com/medicine/cell-biology 7. https://www.us.elsevierhealth.com/medicine/genetics ***8. https://www.kobo.com/us/en/ebook/plant-biotechnology-1***

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3
CO3	2	3	3	3	3	1	3	3	3	3
CO4	3	3	2	3	3	3	2	3	2	3
CO5	3	2	2	2	2	2	2	1	2	1

S-Strong (3) M-Medium (2) L-Low(1)

GENERIC ELECTIVE I :BOTANY PRACTICAL

Title of the Course	GENERIC ELECTIVE I : BOTANY PRACTICAL					
Paper Number	Generic Elective Practical - I					
Category	Core	**Year**	I	**Credits**	2	**Course Code**
		Semester	I			24UZOBGECQ
Instructional Hours per week		**Lecture**		**Tutorial**	**Lab Practice**	**Total**
		-		-	2	2
Pre-requisite	Practicals pertaining to above subjects is important to get knowledge on various aspects of plants.					

Learning Objectives	
C1	To enhance information on the identification of each taxonomical group by developing the skill-based detection of the morphology and microstructure of microorganisms, algae, and fungi.
C2	To comprehend the fundamental concepts and methods used to identify Bryophytes, Pteridophytes and Gymnosperms through morphological changes and evolution.
C3	Understanding the structure and functions of cell.
C4	Understanding the laws of inheritance, genetic basis of loci and alleles.
C5	Understanding the core concepts of Biotechnology.

Course outcomes: On completion of this course, the students will be able to: CO	**Programme Outcomes**
1. Study the internal organization of algae and fungi.	K1
2. Develop skill – based detection of microstructure of microorganisms.	K2
3. Develop critical understanding on morphology, anatomy and reproduction of Bryophytes, Pteridophytes and Gymnosperms..	K3
4. Understand structure and function of cell.	K4
5. Understand the core concepts and fundamentals of plant biotechnology and genetic engineering.	K5

EXPERIMENTS

1. Make suitable micro preparation of the types prescribed in Algae, Fungi, Bryophytes, Pteridophytes and Gymnosperms.
2. Micro photographs of the cell organelles ultra structure.
3. Simple genetic problems.
4. Spotters - Algae, Fungi, Bryophytes, Pteridophytes, Gymnosperms, Cell biology and Biotechnology.

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Reference Books	1. Nancy Serediak and M. Huynh. 2011. Algae identification lab Guide. Accompanying manual to algae identification field guide, Ottawa Agriculture Agri food Canada publisher. 2. Mohammed Gufran Khan, Shite Gatew and Bedilu Bekele. 2012. Practical manual for Bryophytes and Pteridophytes. Lambert Academic Publishing.
Web resources	1. https://www.amazon.in/Practical-Manual-Pteridophyta-Rajan-Sundara/dp/8126106883 2. http://www.cuteri.eu/microbiologia/manuale_microbiologia_pratica.pdf 3. https://www.amazon.in/Manual-Practical-Bryophyta-SureshKumar/dp/B0072GNFX4

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	3	3	3	3	3	3	3	3	3
CO 2	3	3	3	3	3	3	3	3	3	3
CO 3	2	3	3	3	3	1	3	3	1	3
CO 4	3	3	2	3	3	3	3	2	3	3
CO 5	3	2	2	2	2	2	2	1	2	2

S-Strong (3) **M-Medium (2)** **L-Low(1)**

SKILL ENHANCEMENT COURSE (NME-I)

BIOCOMPOSTING FOR ENTREPRENEURSHIP (24UZOSEC1)

Hours:2 **Credit:2**

Learning Objectives:

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

Unit – I

Biocomposting – Definition, types and ecological importance.

Unit – II

Types of Biocomposting technology – Field pits/ground heaps/ tank/large-scale/batch andcontinuous methods.

Unit – III

Preparation of Biocompost pit and bed using different amendments.

Unit – IV

Applications of Biocompost in soil fertility maintenance, promotion of plant growth, value added products, waste reduction, etc.

Unit – V

Economics of establishment of a small biocompost unit – project report proposal for Self HelpGroup (Income and employment generation).

References

- 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.

Course outcomes:

- The students will gain knowledge about the process of Biocomposting.
- Students will be able to demonstrate Biocomposting techniques for various end applications like solid waste management, industrial waste recycling using sugarcane bagasse, etc.
- To gain knowledge about the economic cost of establishing small Biocompost units asa cottage industry.

SKILL ENHANCEMENT FOUNDATION COURSE

ANIMAL BIODIVERSITY (24UZOSEFC)

Learning Objectives:

- To Preserve the diversity of species
- Sustainable utilization of species and Ecosystem
- To maintain life-supporting systems and essential ecological processes.

Unit I:

Broad classification of Animal Kingdom- Principles of Taxonomy: Nomenclature: Binomal, Trinomial nomenclature.

Unit II:

Minor phyla: Structural peculiarities and affinities of:Gastrotricha, Rotifera, Entoprocta, Phoronida, Ectoprocta and Branchiopoda.

Unit III:

Protozoa: Polymorphism in Protozoa, Reprodudion and feeding in Protozoa. Porifera:Interrelationship between different classes.

Coelenterata: Polymorphism in Coelenterates. Ctenophora: Structural peculiarities and affinities.

Unit IV:

Origin of Bilateria: Origin and evolution treands in coelom formation. Theories on origin of metamerism. Plntyhelminthus: Functional morphology and adaptive biology for parasitic mode of life. Annelida: Interrelationship between classes of annelida. Phylogeny of Arthropoda Mollusca and Ehinodermata.

Unit V:

Amphibia: Evolution of Ambhibia. Adaptive radiation in Ambhibia.Reptilia: Evolution of Reptilia. – Adaptive radiation of Reptiles. Aves: Birds as glorified reptiles, Adaptive radiation in birds. Mammals: Evolution of Mammals,Adaptive radiation in Mammal.

REFERENCE / BOOKS

1. Barnes R. D. (1982) Invertebrates Zoology 6th endn. Toppan International Co.,
2. Hyman L.H. (1940 - 1959). The Invertebrata, Vol. I to VI.
3. Carter, G. S. A. (1946) General Zoology of Invertebrates 2nd endn. (Wick and JacksonLtd., London).
4. Borradile, L.A. (1955) The Invertebrata.2nd endn. Cambridge University Press.
5. Barrington, E. J. W. (1969) Invertebrate Structure and functions. EnglishLanguage.Book Society.
6. Kotpal, R.L. (1982) Protozoa, Porifera, Coelenterata, Helminthes, Annelida, Arthropoda,Mollusca, Echinodermata and Minor Phyla. Rastogi Publications.
7. Moore, R. C. Lalicker, C. G. and Fisher, A. G. (1952) Invertebrate Fossils, Mc. GrawHillBook Co., New York.
8. Gardinar, M. S. (1972) Biology of the invertebrates, Mc Graw Hill Book Co., NewYork.
9. Waterman, AJ. (1971) Chordate Structure and Function. Macmillan Co. London.
10. Jolie, M. (1968) Chordate Morphology. East West Press.
11. Romer, A.S. (1976) Vertebrate Body.
12. Young, J.Z. (1950) Life of Vertebrates. Clarendon Press Oxford.

13. Colbert, E.H. (1955) Evolution of the Vertebrates. John Wiley and Sons Inc. New York.
14. Kotpal, R. L. The Birds. Rastogi Publications.
15. Hobart M. Smith. Evolution of Chordate structure, Holt, Rinehart and Winston. Inc.NewYork.
16. Halstead, L.B. (1969). The Pattern of Vertebrate Evolution. Freeman and Co. SanFrancisco. U. S. A.
17. Kapoor, V.C. (1991) Theory and Practice of Animal Taxonomy. Oxford and IBH Publishing Co., Pvt. Ltd. New Delhi.

Course outcomes:

- To get knowledge on viable populations of species, Genetic resources and adaptive potential
- Students will get awareness on organisms and conservation of species that are on the verge of extinction.
- Helps to maintain healthy and diverse ecosystems.

SEMESTER - II

Course Code CC3	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
24UZOCC2	**CHORDATA**	Core	Y	-	-	-	5	5	30	70	100

Learning Objectives	
CO1	To understand the structures and distinct features of Phylum Chordata.
CO2	To understand and able to distinguish the characteristic features of each subphylum and class.
CO3	To understand the economic importance of vertebrates
CO4	To know about the adaptations of vertebrates
CO5	To understand the evolutionary position of different groups of vertebrates

UNIT	Details	No. of Hours	Course Objectives
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*).	12	CO1, CO2
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.	12	CO1, CO2, CO4, CO5
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.	12	CO1, CO2, CO3, CO4, CO5
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.	12	CO1, CO2, CO4, CO5
V	**Aves and Mammalia:** Aves: General characters and classification – Type study - *Columba livia* - Origin of birds, Flight adaptations, Migration.	12	CO1, CO2, CO4, CO5

	Mammalia: General characters and classification - Type study - Rabbit - Adaptive radiation in mammals - Egg laying mammals, Marsupials, Flying mammals, Aquatic mammals, Dentition in mammals.		
	Total	**60**	
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.	PO1	
CO2	Explain, and relate the origin, structural organization and evolutionary aspects of vertebrates.	PO1, PO2	
CO3	Analyze, compare and distinguish the developmental stages and describe the important biological process.	PO3, PO4, PO5	
CO4	Correlate the different modes of life and parental care among different vertebrates.	PO3, PO5, PO6	
CO5	Summarise the morphology and ecological adaptations in vertebrates and list out the economic importance.	PO2, PO3, PO5, PO8	
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.		

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	
Methods of Evaluation		
Internal Evaluation	Continuous Internal Assessment Test	25 Marks
	Assignments	
	Seminars	
	Attendance and Class Participation	
External Evaluation	End Semester Examination	75 Marks
	Total	100 Marks
Methods of Assessment		
Recall (K1)	Simple definitions, MCQ, Recall steps, Concept definitions	
Understand/ Comprehend (K2)	MCQ, True/False, Short essays, Concept explanations, Short summary or overview.	
Application (K3)	Suggest idea/concept with examples, Suggest formulae, Solve problems, Observe, Explain	
Analyze (K4)	Problem-solving questions, Finish a procedure in many steps, Differentiate between various ideas, Map knowledge	
Evaluate (K5)	Longer essay/ Evaluation essay, Critique or justify with pros and cons	
Create (K6)	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations	

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	S							
CO 2	M	S						
CO 3		S	S	S	S	S		S
CO 4			S	S	S	M		
CO 5			S		S			S

S-Strong(3) M-Medium (2) L-Low (1)

GENERIC ELECTIVE II : BOTANY - II

Title of the Course	GENERIC ELECTIVE II : BOTANY-II					
Paper Number	Generic Elective - II					
Category	Core	**Year**	I	**Credits**	3	**Course Code**
		Semester	II			24UZOBGEC2

Instructional Hours per week	**Lecture**	**Tutorial**	**Lab Practice**	**Total**
	3	-	-	3

Pre-requisite	To study basics of botany.

Learning Objectives

C1	To be familiar with the basic concepts and principles of plant systematics.
C2	Learn the importance of plant anatomy in plant production systems.
C3	Understand the mechanism underling the shift from vegetative to reproductive phase.
C4	To learn about the physiological processes that underlie plant metabolism.
C5	To know the energy production and its utilization in plants.

Course outcomes: On completion of this course, the students will be able to: CO	**Programme Outcomes**
1. Understand the fundamental concepts of plant anatomy and embryology	K1
2. Analyze and recognize the different parts of plants based on Morphology	K2
3. Understand the water relation of plants with respect to various physiological processes	K3
4. Classify aerobic and anaerobic respiration	K4
5. Classify plant systematics and recognize the importance of herbarium and virtual herbarium	K5

UNIT	**CONTENTS**
I	**MORPHOLOGY OF FLOWERING PLANTS:** Plant and its parts. Structure and function of root and stem. Leaf and its parts. Leaf types: simple and compound. Phyllotaxy and types. Inflorescence - Racemose, Cymose and Special type. Terminology with reference to flower description.
II	**TAXONOMY:** Study of the range of characters and plants of economic importance in the following families: Leguminosae (3 sub families included), Asclepiadaceae, Acanthaceae, Euphorbiaceae and Poaceae

III	**ANATOMY** Tissue and tissue systems: Simple and complex tissues. Anatomy of monocot and dicot roots - anatomy of monocot and dicot stems - anatomy of dicot and monocot leaves.
IV	**EMBRYOLOGY** Structure of mature anther and ovule - Types of ovules, structure of embryo sac, pollination and double fertilization, structure of dicotyledonous and monocotyledonous seeds.
V	**PLANT PHYSIOLOGY** Absorption of water, photosynthesis - light reaction - Calvin cycle; respiration – Glycolysis- Krebs cycle- electron transport system. Transpiration. Growth hormones - auxins and cytokinins and their application
Extended Professional Component (is a part of internal component only, Not to be included inthe External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Texts	1. Sharma, O.P. 2017. Plant Taxonomy. (II Edition).The McGraw Hill Companies. 2. Bhojwani, S.S. Bhatnagar, S.P and Dantu, P.K. 2015. The Embryology of Angiosperms (6th revised and enlarged edition). Vikas Publishing House, New Delhi. 3. Maheshwari, P. 1963. Recent Advances in Embryology of Angiosperms. Intl. Soc. Plant Morphologists, New Delhi. 4. Salisbury, F. B.C.W. Ross.1991. Plant Physiology. Wassworth Pub. Co. Belmont. 5. Ting, I.P. 1982. Plant Physiology. Addison Wesley Pb. Philippines.

Reference Books	1. Lawrence.G.H.M. 1985. An Introduction to Plant Taxonomy, Central Book Depot, Allahabad. 2. Bhojwani, S.S and Bhatnagar, S.P. 2000. The Embryology of Angiosperms (4th revised and enlarged edition). Vikas Publishing House, New Delhi. 3. Pandey, B.P. 2012. Plant Anatomy. S Chand Publishing. 4. Jain, VK. 2006. Fundamentals of Plant Physiology, S. Chand and Company Ltd. 5. Rajni Gupta. 2012. Plant Taxonomy: Past, Present and Future. Vedams (P) Ltd. New Delhi. 6. Jain, V.K. 2006. Fundamentals of Plant Physiology, S.Chand and Company Ltd., New Delhi. 7. Verma, S.K. 2006. A Textbook of Plant Physiology, S.K.Chand& Co., New Delhi.

Web Resources	1. https://books.google.co.in/books/about/Plant_Taxonomy.html?id =0bYs8F0Mb9gC&redir_esc=y 2. https://books.google.co.in/books/about/PLANT_TAXONOMY_ 2E.html?id=Roi0lw SXFnUC&redir_esc=y 3. https://archive.org/EXPERIMENTS/plantanatomy031773mbp 4. https://www.amazon.in/Embryology-Angiosperms-6th-S-P-Bhatnagarebook/dp/B00UN5KPQG 5. https://www.crcpress.com/Plant-Physiology/StewartGlobig/p/book/9781926692692

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	3	3	3	3	3	3	3	3	3
CO 2	3	3	3	3	3	3	3	3	3	3
CO 3	2	3	3	3	3	1	3	3	1	3
CO 4	3	3	2	3	3	3	3	2	3	3
CO 5	3	2	2	2	2	2	2	1	2	2

S-Strong (3) M-Medium (2) L-Low(1)

GENERIC ELECTIVE II : BOTANY PRACTICAL

Title of the Course	GENERIC ELECTIVE II: BOTANY PRACTICAL					
Paper Number	Generic Elective Practical – II					
Category	Core	**Year**	I	**Credits**	2	**Course Code**
		Semester	II			24UZOBGECQ

Instructional Hours per week	**Lecture**	**Tutorial**	**Lab Practice**	**Total**
	-	-	2	2

Pre-requisite	Practicals pertaining to above subjects is important to get knowledge on various aspects of plants.

Learning Objectives	
C1	To enhance information on the identification of each taxonomical group by developing the skill-based detection of the morphological characters.
C2	To be familiar with the basic concepts and principles of plant systematics.
C3	Understand the fundamental concepts of Plant Anatomy.
C4	Understand the fundamental structures of reproductive parts.
C5	To learn about the physiological processes that underlie plant metabolism.

Course outcomes: On completion of this course, the students will be able to: CO	**Programme Outcomes**
1. Understand the morphological structure of Angiosperm.	K1
2. Study the classical taxonomy with reference to different parameters.	K2
3. Understand the fundamental concepts of plant anatomy.	K3
4. Understand the reproductive process.	K4
5. Study the effect of various physical factors on photosynthesis.	K5

EXPERIMENTS

1. To describe in technical terms, plants belonging to any of the family prescribes and to identify the family.
2. To dissect a flower, construct floral diagram and write floral formula.
3. Economic importance of Families studied
4. Demonstration experiments
   1. Ganong's Light screen
   2. Ganong's respiroscope
   3. Ganong's Potometer
5. To make suitable micro preparations of anatomy materials prescribed in the syllabus.
6. Spotters - Morphology and Embryology.

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Reference Books	1. Subramaniam, N.S. 1996. Laboratory Manual of Plant Taxonomy. Vikas Publishing House Pvt. Ltd., New Delhi.

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	3	3	3	3	3	3	3	3	3
CO 2	3	3	3	3	3	3	3	3	3	3
CO 3	2	3	3	3	3	1	3	3	1	3
CO 4	3	3	2	3	3	3	3	2	3	3
CO 5	3	2	2	2	2	2	2	1	2	2

S-Strong (3) **M-Medium (2)** **L-Low(1)**

SKILL ENHANCEMENT COURSE (NME-II)

WILDLIFE CONSERVATION AND MANAGEMENT-24UZOSEC2

Hours-2 **Credit-2**

Learning Objectives

1. To understand and discuss the importance of wildlife, its values, modern concepts in wildlife management, and relevant conservation policies.
2. To assess and instil strong foundations on wildlife policies and be familiar with a variety of laws and regulations.
3. To analyse and design appropriate approaches to turn conflict into tolerance and coexistence, with an emphasis on the human dimensions of human-wildlife interactions.
4. To evaluate and integrate all the related areas like Fundamentals in Ecology, Forestry, Natural Resource Conservation Approaches and develop the role PVA models for protection of Endangered species.
5. To explain the advanced scientific basis for wildlife management and discuss National and International Efforts for successful wildlife conservation.

Unit I :Biodiversity Extinction and Conservation Approaches :

Perspectives and Expressions. Identification and prioritization of Ecologically sensitive area (ESA). Coarse filter and fine filter approaches. Regional and National approaches for biodiversity conservation.

Unit II: Theory and Analysis of Conservation of Populations :

Stochastic perturbations - Environmental, Demographic, spatial and genetic stochasticity. Population viability analysis-conceptual foundation, uses of PVA models. Management Decisions for small populations using PVA models. Minimum viable populations & recovery strategies for threatened species.

Unit III: National and International Efforts for Conservation :

International agreements for conserving marine life, Convention on wetlands of International Importance (Ramsar convention), Conservation of Natural Resources. Overview of conservation of Forest &Grassland resources. CITES, IUCN, CBD National Forest Policy, 1988, National Wildlife Action Plan 2017-2031, Wildlife Protection Act 1972, National and State Biodiversity Action Plans and other Forests and Environmental Acts.

UNIT IV: WILDLIFE IN INDIA : Wildlife wealth of India & threatened wildlife, Reasons for wildlife depletion in India, Wildlife conservation approaches and limitations. Wild life Habitat: Characteristic, Fauna and Adaptation with special reference to Tropical forest. Protected Area concept: National Parks, Sanctuaries and Biosphere Reserves, cores and Buffers, Nodes and corridors. Community Reserve and conservation Reserves.

UNIT V: MANAGEMENT OF WILDLIFE : Distribution, status. Habitat utilization pattern, threats to survival of Slender Loris, Musk deer, Great Indian Bustard, Olive Ridley turtle. Wildlife Trade & legislation, Assessment, documentation, Prevention of trade, Wild life laws and ethics.

Text Books:

1. Robinson W L and Eric G Bolen, 1984. Wildlife Ecology and Management, Maxmillan Publishing Company, New York, p 478.
2. Aaron, N.M.1973 Wildlife ecology, W.H. Freeman Co. San Francisco, U.S.A.
3. Dasmann R F, 1964. Wildlife Biology, John Wiley & Sons, New York, p 231.
4. Justice Kuldip Singh 1998. Handbook of Environment, Forest and Wildlife Protection Laws in India, Natraj Publishers, Dehradun.
5. Hosetti, B.B. 1997 Concepts in Wildlife Management, Daya Publishing House, Delhi.
6. Sutherland, W.J 2000. The conservation handbook: Research, Management and Policy. Blackwell Science.
7. Caughley.G and Sinclaire, A.R.E 1994 Wildlife ecology and management. Blackwell Science.

Suggested Readings

1. Gilas R H Jr.(ed.), 1984. Wildlife Management Techniques, 3rd ed. The Wildlife Society, Washington D.C., Nataraj Publishers, Dehra Dun, p 547.
2. Rodgers W A, 1991. Techniques for Wildlife Census in India - A Field Manual: Technical Manual - T M - 2. WII.
3. Saharia V B, 1982. Wildlife of India, Natraj Publishers, Dehra Dun.
4. Goutam Kumar Saha and SubhenduMazumdar, 2017. Wildlife Biology: An Indian Prospective, PHI Publisher, Delhi.
5. Katwal/Banerjee, 2002. Biodiversity conservation in managed and protected areas, Agrobios, India.
6. Gopal, Rajesh,1992. Fundamentals of Wildlife Management, Justice Home, Allahabad, India.

Web resources

1. https://bit.ly/39oPj44
2. https://bit.ly/3lHdEYJ
3. https://bit.ly/3CwBCfY
4. https://bit.ly/3EDYr3a
5. https://bit.ly/3tVtG4U

Course outcomes (COs)

1. To understand and recall the importance of wildlife, extinction and Conservation Approaches of wildlife.
2. To integrate and assess the National, international approaches for biodiversity conservation.
3. To analyse and differentiate threats to wildlife, various action plans, conservation strategies on wildlife of India to turn conflict into tolerance and coexistence.
4. To explain the role PVA models, Wildlife conservation approaches, and limitations.
5. To construct and simulate National and International strategies for Conservation, Wild life laws and ethics.

SKILL ENHANCEMENT COURSE – III (Indian Knowledge System)

TRADITIONAL KNOWLEDGE ON ETHNOZOOLOGY – 24UZOSEC3

Hours: 2 **Credit:2**

LEARNING OBJECTIVES

1. To understand how traditional practices can contribute to the conservation of fauna and ecosystems and to develop strategies for sustainable resource management.
2. To recognize the cultural and spiritual importance of animals in Indian traditions and to promote the understanding and preservation of these beliefs.
3. To explore the traditional medicinal uses of animals and their potential for modern medicine and drug discovery
4. To assess the role of Ethnozoological practices in the livelihoods of local communities and explore opportunities for self reliant sustainable economic development.
5. To study the ethical aspects of using animals in cultural practices and assess their compliance with wildlife protection laws.

UNIT:I- Introduction to Traditional and Ethnozoological Practices

Define traditional and ethnozoological knowledge - Historical overview of ethnozoology in India- Significance of Conservation and studying indigenous animal - Explore the role of indigenous knowledge in the context of Indian animal practices-

UNIT:II Ethnozoological Classification and Practices in Animal Husbandry

Examine traditional methods of classifying animals - Traditional methods of animal breeding and management - Indigenous practices in animal healthcare and disease management - Animal nutrition using traditional resources and knowledge.

UNIT:III Ethnozoological Practices in Indian Culture

Cultural and religious significance of animals in India- Rituals and festivals related to animals- Examples of specific cultural practices involving animals.

UNIT:IV Traditional Knowledge in Animal Products

Production and utilization of traditional animal products - Indigenous processing and preservation techniques.

UNIT: V Ethical and Conservation Issues

Challenges and potential solutions for preserving biodiversity and traditional knowledge - Explore the legal issues surrounding traditional and ethnozoological knowledge - Intellectual property rights and protection of traditional knowledge.

Reference Books:

1. Jain.S.K and Mukherjee.M.K. () Indian Ethnobiology

2. Rajesh kumar Abhay and Deep Narayan Pandey (2023) Constraints in Achieving sustainability of India, The energy and Resources Institute,

3. Bhattacharya.D.K. () The cultural dimension of Ecology

4. Biswajit Mohapatra (2021) Ethnobiology of protected areas, InSc Publishing House, 1st edition, p 291

5. Introduction to Ethnobiology (216) Springer Ulysses Paulino Albuquerque Romulo Romeu Nobrega Alves

6. Anderson, Anderson.E.N, Deborah Pearsall, Eugene Hunn and Nancy Turner(2011)Ehinobiology, Wiley-Backwell

7. Gary Paul, Nabhan and Paul E.Minnis (2016) Ethnobiology for the future linking the Cultural and ecological diversity, University of Arizoa Press, 3rd Edition

8. Ulysses Paulino Albuquerque, Patricia Muniz De Medeiros and Alejandro Casas (2015) Evolutionary Ethniobiology, Springer

9. Mohammed A.Seid (2014) Introduction to Ethnobiology: Theory and Methodology, Createspace

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	S							
CO 2	M	S						
CO 3		S	S	S	S	S		S
CO 4			S	S	S	M		
CO 5			S		S			S

S-Strong(3) M-Medium (2) L-Low (1)

SEMESTER – III

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
24UZOCC3	**CELL BIOLOGY**	Core	-	-	-	-	3	3	30	70	100

Learning Objectives	
CO1	To understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes and organelles.
CO2	To understand how these cellular components are used to generate and utilize energy in cells.
CO3	To understand the cellular components underlying mitotic cell division.
CO4	To apply the knowledge of cell biology to selected examples of changes or losses in cell function.

UNIT	**Details**	**No. of Hours**	**Course Objectives**
I	**History of Cell Biology** - Tools and Techniques of Cell, Cell Fractionation, Homogenization, Centrifugation, Isolation of sub cellular Components. Micro Technique Methods - Histological techniques - Staining - Vital Stains - Cytoplasmic and Nuclear Stains. Microscopes - Types - Light, Phase contrast, SEM, TEM - Units of measurement.	12	CO1, CO2
II	**The Cell** - Cell theory - Viruses - Bacteriophages - Types and Structure - Bacteria - Bacterial membrane - Ultra structure of Animal cell - Cytoplasm - Structure and Composition, Function - Extra Cytoplasmic Structure - Cilia Flagella - Cytoplasmic Inclusions.	12	CO1, CO2, CO4, CO5
III	**Cell components** - Plasma Membrane Ultra Structure - Different Models - Functions - Ultrastructure, Composition and Function of Endoplasmic reticulam, Ribosomes, Golgi Complex, Lysosomes, Centrioles, Microtubules Microfilaments, Mitochondria and Microsomes.	12	CO1, CO2, CO3, CO4, CO5
IV	**Nucleus** - Ultrastructure, Composition and Functions - Nuclear Membrane - Nucleoplasm - Chromosomes - Heterochromatin and Euchromatin - Nucleolus - DNA and RNAs - Protein Synthesis & regulation.	12	CO1, CO2, CO4, CO5
V	**Cell Divisions and Cell Cycle** - Amitosis, Mitosis and Meiosis and their Significance - Cancer, Biology – Characteristics of cancer cells, types, theories on	12	CO1, CO2, CO4, CO5

	Carcinogenesis, Ageing of Cells – Apoptosis and Stem cell studies.		
	Total	**60**	
Course Outcomes			
Course Outcomes	On completion of this course, students will;		
CO1	Understand and recall the basic structure, origin and development of cell organelles.	PO1	
CO2	Integrate and assess the biochemical, cytological and histological tools to infer cellular basis of organization.	PO1, PO2, PO3	
CO3	Analyze and differentiate organisms based on structure, composition and inter and intra cellular interactions.	PO3, PO4, PO5	
CO4	Explain the role of cells and cell organelles in various biological processes.	PO2, PO3, PO5, PO6, PO8	
CO5	Construct and simulate the role of different cytological tools and techniques to explain the structure and complexity of cells and cell organelles.	PO3, PO4, PO5, PO6, PO7, PO8	
Text Books (Latest Editions)			
1.	Verma, P.S. and V. K.Agarwal, 1995. Cell and Molecular Biology, 8th Edition, S.Chand & co., New Delhi - 110 055.		
2.	Verma P.S. and Agarwal V.K. (2016) Cell Biology (Cytology, Biomolecules, Molecular Biology), Paperback, S. Chand and Company Ltd.		
3.	Ambrose, E.J. and Dorothy, M. Easty, 1970. Cell Biology, Thomas Nelson & Sons Ltd., 500 pp.		
4.	Kumar P. and Mina U. (2018) Life Sciences: Fundamentals and Practice, Part-I, 6th Edn., Pathfinder Publication. p.608.		
5.	VeerBala Rastogi, Introductory cytology. Kedar Nath Ram Nath. Meerut 250 001.		
6.	N. Arumugam, Edition : 10, Saras Publication.		
References Books (Latest editions, and the style as given below must be strictly adhered to)			
1.	Albert B., Hopkin K., Johnson A.D., Morgan D., Raff M., Roberts K. and Walter P. (2018) Essential Cell Biology 5th Edn.,(paperback) W.W. Norton & Company p.864.		
2.	Burke, Jack. D., 1970. Cell Biology, Scientific Book Agency, Calcutta.		
3.	Challoner J. (2015) The Cell: A visual tour of the building block of life, The University of Chicago Press and Ivy Press Ltd., p.193.		
4.	Cohn, N. S., 1979, Elements of Cytology, Freeman Book Co., New Delhi – 110007, 495 pp		
5.	Cooper G.M. (2019) The Cell – A Molecular Approach, 8th Edn., Sinauer Associates Inc., Oxford University Press p.813.		
6.	DeRobertis, E.D.P. and E.M.F. De Robertis, 1988. Cell and Molecular Biology, 8th Edition, International Edition, Info med, Hong Kong, 734pp.		
7.	Dowben, R., 1971. Cell Biology, Harper International Edition. Harper and Row Publisher, New York, 565 pp.		
8.	Giese, A.C., 1979. Cell Physiology, Saunders Co., Philadelphia, London, Toronto,		

	609 pp.
9.	Hardin J. and Bertoni G. (2017) Becker's World of the Cell. 9th Edn (Global Edition). Pearson Education Ltd., p. 923
10.	Karp G., Iwasa J. and Masall W. (2015) Karp's Cell and Molecular Biology Concepts and Experiments. 8th Edn. John Wiley and Sons. p.832.
11.	Loewy, A.G. and P.Sickevitz, 1969. Cell Structure and Function, Amerind Publishing Co., NewDeihi - 110 020, 516 pp.
12.	Mason K.A., Losos J.B. and Singer S.R. (2011) Raven and Johnson's Biology. 9th Edn. Mc Graw Hill publications. p.1406.
13.	Powar, C.B., 1989. Essential of Cytology, Himalaya Publishing House, Bombay - 400 004, 368 pp.
14.	Swansen, C.P. and P.L.Webster, 1989. The Cell, Prentice Hall of India Pvt. Ltd., New Delhi - 110 001, 373 pp.
15.	Urry L.A. Cain M.L., Wasserman S.A., Minorsky P.V., Jackson R.B. and Reece J.B. (2014) Campbell Biology in Focus. Pearson Education. p.1080.
Web Resources	
1.	http://www.microscopemaster.com/organelles.html
2.	https://bit.ly/3tXwDSB
3.	https://bit.ly/3tWNpRX
4.	https://bit.ly/3AuYR9M
5.	https://rsscience.com/cell-organelles-and-their-functions/

Methods of Evaluation		
Internal Evaluation	Continuous Internal Assessment Test, Model Examination	30 Marks
	Assignments, Poster presentation, Quiz,	
	Seminars, Surprise Test, Open Book Test	
	Attendance and Class Performance	
External Evaluation	Semester Examination	70 Marks
	Total	100 Marks

Methods of Assessment	
Recall (K1)	Simple definitions, MCQ, Recall steps, Concept definitions
Understand/ Comprehend (K2)	MCQ, Short essays, Concept explanations
Application (K3)	Concept with examples, Observation, Explanation
Analyze (K4)	Differentiate between various ideas, Map knowledge
Evaluate (K5)	Longer essay/ Evaluation essay, Critique or justify with pros and cons
Create (K6)	Check knowledge in specific, Discussion, Debating or Presentations

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	S	L	L	L	L	L	L	L
CO 2	L	S	S	S	S	L	L	S
CO 3	L	S	S	S	S	S	L	S
CO 4	L	S	M	L	L	M	L	L
CO 5	L	L	L	S	S	S	L	S

S-Strong(3) M-Medium (2) L-Low (1)

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
24UZOCC4	**GENETICS**	Core	Y	-	-	-	4	4	30	70	100

Learning Objectives	
1	Students will understand causal relationships between molecule/cell level phenomena (modern‖ genetics) and organism-level patterns of heredity (classical‖ genetics).
2	To know the causes and effects of mutations.
3	To comprehend the importance of genetic variation in evolution.
4	To know about the harmful effects of genetic variations in humans, their Cumulative effect in human population and the molecular basis of variations.

UNIT	**Details**	**No. of Hours**	**Course Objectives**
I	**Mendelian genetics:** Mendelian experiments, laws of Mendel, Monohybrid, Dihybrid, back and test cross; **Interaction of genes:** Incomplete dominance (Inheritance of flower colour in mirabilis), co dominance (ABO blood group), complementary genes (flower colour in sweet pea), supplementary genes (Inheritance of Combs in Fowls), inhibiting genes, lethal genes. Polygenic inheritance - skin colour; **Multiple alleles** - Blood groups and their inheritance in man – Rh factor – Erythroblastosis foetalis.	12	CO1, CO2
II	**Linkage:** Linked genes, complete and incomplete linkage. **Crossing over:** molecular mechanisms of crossing over, kinds of crossing over, models of recombination. **Chromosome mapping:** Chromosomal map & its construction **Sex Determination:** Sex determination in Man and Drosophila, Gynandromorphism - Barr bodies.	12	CO1, CO2, CO4, CO5
III	**Gene Mutation and Chromosomal Aberration:** Variation in chromosome number and structure: position effect, chromosomal mutation and evolution. Gene mutation: types, molecular basis of mutation, mutational hot spots, reversion; radiation and chemical agents as mutagens; Detection of mutation - ClB method. **Sex linked inheritance** - eye colour in Drosophila, colour blindness and hemophilia in man **Extra chromosomal inheritance** - shell coiling, kappa particles.	12	CO1, CO2, CO3, CO4,CO5
IV	**Modern Genetics:** Concept of Gene: Cistron – split gene – promoter – repetitive DNA – Transposons. **Bacterial genetics**- Transformation – Conjugation – F factor - Sexduction – Transduction –Generalised & Specialised - Plasmids. –Operon concept- Lac operons. **Human Genetics:** Karyotype and ideogram; sex determination - Barr body technique, drumstick method	12	CO1, CO2, CO4, CO5

V	**Genetic disorders in Man:** Down's syndrome, Turner's and Klinefelter's syndrome, Cri-du-chat, Inherited single gene disorder – sickle cell anemia, cystic fibrosis, Thalasemia **In Born Errors of Metabolism:** Phenylketonuria, Alkaptonuria, Albinism **Genetic Counselling:** Pedigree Analysis, positive and Negative Eugenics – Euphenics – Euthenics. **Population Genetics:** Gene pool - Gene frequency – Factors affecting Hardy – Weinberg law - Genetic equilibrium - Factors affecting gene frequency.	12	CO1, CO2, CO4, CO5
	Total	**60**	

Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Understand the basis of inheritance and expression of genes.	PO1
CO2	Correlate changes in genetic makeup and phenotypic changes in progeny.	PO2, PO3,
CO3	Analyse the causes of variations in genetic material andpredict the effect in a population using different techniques.	PO4, PO5,P06
CO4	Explain the role of cellular processes and different genetic elements in the expression of genes.	PO5
CO5	Compile the factors which contribute to changes in gene expression and specify the changes which contribute toevolution.	PO7 PO8

Text Books (Latest Editions)	
1.	Verma P. S. and V. K. Agarwal., 2018. Genetics, S. Chand & Company Pvt Ltd.
2.	Genetics. R.P. Meyyan . 2015. Saras Publication. Kanyakumari.
References Books (Latest editions, and the style as given below must be strictly adhered to)	
3.	Verma P.S and Agarwal V.K., 2006. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology, S. Chand & Company Ltd.
4.	Strickberger M. W., 1995. Genetics, Prentice Hall India Learning Private Limited.
5.	Guptha G. K., 2013. Genetics Classical to Modern, Rastogi publishers, Meerut.
6.	Dobzhansky T., 1982. Genetics and The Origin of Species, Columbia University.
7.	Alice Marcus (2009) Genetics, Ist edition, MJP publishers. India
8.	Veer Bala Rastogi., 2019. Text Book of Genetics, Medtech

Web Resources	
1.	https://go.nature.com/2XE8V1q
2.	https://bit.ly/3zoTt6B
3.	https://bit.ly/2XAm7oa
4.	https://bit.ly/2XEbhxi
5.	https://bit.ly/3AB4bso
6.	https://bit.ly/39pZSE4
7.	https://www.genome.gov/genetics-glossary/Sex-Linked
8.	https://www.vedantu.com/biology/mutagens

Methods of Evaluation		
	Continuous Internal Assessent Test, Model Examination	
	Assignments, Poster presentation, Quiz,	30 Marks

Internal Evaluation	Seminars, Surprise Test, Open Book Test Attendance and Class Performance	
External Evaluation	Semester Examination	70 Marks
	Total	100 Marks
Methods of Assessment		
Recall (K1)	Simple definitions, MCQ, Recall steps, Concept definitions	
Understand/ Comprehend (K2)	MCQ, Short essays, Concept explanations, Short summary oroverview	
Application (K3)	Suggest idea/concept with examples, Suggest formulae, Solve problems, Observe, Explain	
Analyze (K4)	Problem-solving questions, Finish a procedure in many steps, Differentiate between various ideas, Map knowledge	
Evaluate (K5)	Longer essay/ Evaluation essay, Critique or justify with pros and cons	
Create (K6)	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations	

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	S	L	L	L	L	M	M	L
CO 2	M	S	S	L	S	L	M	M
CO 3	M	L	S	S	S	S	M	S
CO 4	M	S	L	L	L	M	L	M
CO 5	L	S	S	S	S	S	L	S

S-Strong (3) M-Medium (2) L-Low (1)

CORE LAB COURSE (PRACTICAL – III)
SEMESTER –III and IV

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
24UZOCCQ2	CYTOLOGY, GENETICSAND DEVELOPMENTAL BIOLOGY LAB COURSE - III	Core	Y	-	Y	-	3	3	40	60	100

Learning Objectives	
CO1	To encourage students to interpret the organization of genomic material and to research theories of genetic inheritance.
CO2	To impart the skills required to prepare samples of genetic molecules and to determine their purity, structure and characteristics and to analyze genomic preparations.
CO3	To study the changes in genetic material and to predict and consider the consequences of those changes.
CO4	To encourage students to report and justify the results of molecular, genetic and developmental experiments in an accurate and meaningful manner.

Part	Details	No. of Hours	Course Objectives
I	**Major Dissection - Cell Biology** 1. Preparation and Identification of slides of Mitotic divisions with onion root tips. 2. Preparation and Identification of different stages of Meiosis in Grasshopper Testes. 3. Staining and observation of polytene chromosomes in salivary glands of chironomous larva. 4 . Culturing and Handling of Drosophila: a) Media Preparation b) Cleaning and Sterilization of bottles c) Handling of Drosophila	15	CO1
II	**Minor Dissection / Mounting - Cell Biology and Genetics** **1.** Buccal epithelium (Barr body) preparation **2.** Karyotyping (with the help of photographs) – normal male and female karyotypes and study of karyotypes of different genetic syndromes. **3.** Verification of the Mendelian laws of inheritance using coloured beads. Observation on genetic traits. ***4.*** Sex Comb of *Drosophila melanogaster* (Mounting - Demo)	15	CO2
III	**Cell Biology - Demo** Microtomy: Preparing & Sectioning Paraffin Embedded Tissue Study of wing mutant in Drosophila- curly wing and vestigial wing.	12	CO3

V	**Spotters** **Cell Biology** 1. Microtome 2. Centrifuge 3. Homogenizer 4. Compound Microscope **Genetics** 1. Drosophila Body Color Mutant - Ebony body 2. Drosophila Body Color Mutant - Yellow body 3. Drosophila: Eye color mutant - Bar eye 4. Drosophila: Eye color mutant - White eye 5. Drosophila: Eye color mutant - Sepia eye **Developmental Biology** 1. Sperm of Mammal 2. Mammalian Ovum 3.Study of various breeds of layers and broilers (photographs) 4.Chick Embryo – 24 hrs 5.Chick Embryo – 48 hrs 6.Chick Embryo – 72 hrs 7.Chick Embryo – 96 hrs 8.Blastula of frog 9.Gastrula of frog 10.Morula of frog 11.Placenta of Sheep 12. Placenta of Pig	18	CO5
	Total	**60**	

Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Recall, examine and interpret the organization of genomic material and to research theories of genetic inheritance.	PO1
CO2	Analyse samples of genetic molecules and to determine their purity, structure and characteristics.	PO1, PO2
CO3	Analyse with genomic preparations and devise techniques to distinguish genetic material in different organisms to survey biodiversity.	PO4, PO6
CO4	Understand the changes in genetic material and to predict and consider the consequences of those changes.	PO4, PO5, PO6
CO5	Relate and justify the results of molecular, genetic and animal developmental experiments in an accurate and meaningful manner.	PO3, PO8

Text Books - (Latest Editions)	
1.	Surya Nandan Meena, Milind Naik, 2019. Advances in Biological Science Research: A Practical Approach, Academic Press, New York, USA.
2.	Michael Perlin, William Beckerson, Adarsh Gopinath, 2017. Cell, Genetics, and Molecular Biology: A Lab Manual (First Edition), Cognella Inc., USA.
3.	Saxena J., Baunthiyal M., Ravi I., 2015. Laboratory Manual of Microbiology, Biochemistry and Molecular Biology, Scientific Publishers, India.

4.	Bansal M.P., 2013. Molecular Biology and Biotechnology: basic experimental protocols, The Energy and Resources Institute (TERI), New Delhi, India.
5.	Chaitanya K.V., 2013. Cell and molecular biology: A Lab Manual, Phi Learning Pvt. Ltd., New Delhi, India.
References Books (Latest editions, and the style as given below must be strictly adhered to)	
1.	Andreas Hofmann, Samuel Clokie, 2018. Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology, Cambridge University Press, UK.
2.	Bancroft, J.D. and Gamble, M (2007) Theory and Practice of Histological Techniques, 6 th Edition, Churchill Livingstone.
3.	Ian Freshney R., 2010. Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications, John Wiley & Sons, USA.
4.	Leonard Davis, Mark Dibner, James Battey, 2012. Basic Methods in Molecular Biology, Elsevier Science Pubilshing Co., NY, USA.
5.	Luiz Carlos (2005) Basic Histology: Text and Atlas (11th Ed). Medical.
6.	Robert F. Schleif, Pieter C. Wensink, 2012. Practical Methods in Molecular Biology, Springer-Verlag, NY, USA.
7.	Ross, M.H,, Kaye, G.I. & Pawlina, W. (2002) Histology: A text and atlas (4th ed). Lippincoat Williams & Wilkins.
8.	Sarah Stauffer, Aaron Gardner, Wilko Duprez, Dewi Ayu Kencana Ungu, Philip Wismer, 2018. Labster Virtual Lab Experiments: Basic Genetics, Springer Publishers, NY, USA.
Web Resources	
1.	https://www.jove.com/
2.	https://vlab.amrita.edu/?sub=3&brch=77
3.	http://cbii-au.vlabs.ac.in/
4.	https://media.hhmi.org/biointeractive/vlabs/transgenic_fly/index.html
5.	https://www.ibiology.org/biology-techniques/

Methods of Evaluation		
Internal Evaluation	Continuous Internal Assessment Test	40 Marks
	Observation	
	Lab Quiz	
	Attendance and Class performance	
External Evaluation	Semester Practical Examination	60 Marks
	Total	100 Marks

Methods of Assessment	
Recall (K1)	Simple definitions, MCQ, Recall steps, Concept definitions
Understad/ Comprehend (K2)	MCQ, Short essays, Concept explanations.
Application (K3)	Concept with examples, Observation, Explanation
Analyze (K4)	Differentiate between various ideas, Map knowledge
Evaluate (K5)	Dissection, Draw labeled sketches, Record
Create (K6)	Check knowledge in specific, Discussion, Debating or Presentations

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	S	L	L	L	L	L	L	L
CO 2	M	S	L	L	L	L	L	L
CO 3	L	L	L	S	L	S	L	L
CO 4	L	L	L	S	S	M	L	L
CO 5	L	L	S	L	L	L	L	S

S-Strong(3) M-Medium (2) L-Low (1)

<table>
<tr><td>Title of the Course</td><td colspan="7">ELECTIVE: III (GE) CHEMISTRY - I
(FOR BOTANY & ZOOLOGY)</td></tr>
<tr><td>Paper No.</td><td colspan="7">Elective -I(GE)</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Generic Elective</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td>Course Code</td><td>24UBOGEC3/ 24UZOGEC3</td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>3</td><td>-</td><td colspan="3">-</td><td colspan="2">3</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher secondary chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims at providing knowledge on
● basics of atomic orbitals, chemical bonds, hybridization and fundamentals of organic chemistry
● concepts of nuclear chemistry and industrial chemistry
● importance of specialty drugs and artificial sweeteners
● separation and purification techniques.</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I 15 Hours
Chemical Bonding and Nuclear Chemistry
Chemical Bonding: Molecular Orbital Theory-bonding, antibonding and non-bonding orbitals. MO diagrams for Hydrogen, Helium, Nitrogen; discussion of bond order and magnetic properties.
Nuclear Chemistry: Fundamental particles - Isotopes, Isobars, Isotones and Isomers-Differences between chemical reactions and nuclear reactions- group displacement law. Nuclear binding energy - mass defect - calculations. Nuclear fission and nuclear fusion - differences – Stellar energy. Applications of radioisotopes – carbon dating, rock dating and medicinal applications.

UNIT II 15 Hours
Industrial Chemistry
Fuels: Fuel gases: natural gas, water gas, semi water gas, carbureted water gas, producer gas, CNG, LPG and oil gas (manufacturing details not required).
Silicones: Synthesis, properties and uses of silicones.
Fertilizers: Urea, ammonium sulphate, potassium nitrate, NPK fertilizer, superphosphate, triple superphosphate.

UNIT III 15 Hours
Fundamental Concepts in Organic Chemistry
Hybridization: Orbital overlap hybridization and geometry of CH_4, C_2H_4, C_2H_2 and C_6H_6. Polar effects: Inductive effect and consequences on ka and kb of organic acids and bases, electromeric, mesomeric, hyper conjugation and steric-examples and explanation. Reaction mechanisms: Types of reactions- aromaticity-aromatic electrophilic substitution; nitration, halogenation, Friedel-Craft’s alkylation and acylation.
Heterocyclic compounds: Preparation, properties of pyrrole and pyridine.</td></tr>
</table>

	UNIT IV **15 Hours** **Drugs and Speciality Chemicals** Definition, structure and uses: Antibiotics viz., Penicillin, Chloramphenicol and Streptomycin; Anaesthetics viz., Chloroform and ether; Antipyretics viz., aspirin, paracetamol and ibuprofen; Artificial Sweeteners viz., saccharin, aspartame and cyclamate; Organic halogen compounds viz., Freon, Teflon. **UNIT V** **15 Hours** **Analytical Chemistry** Introduction to qualitative and quantitative analysis. Principles of volumetric analysis. Separation and purification techniques: extraction, distillation and crystallization. Chromatography: principle and applications of column, paper and thin layer chromatography.
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. Veeraiyan, V, *Textbook of Ancillary Chemistry*; High mount publishing house, Chennai, 1st Ed., 2009. 2. Vaithyanathan, S, *Text book of Ancillary Chemistry;* Priya Publications, Karur, 2006. 3. Arun Bahl, Bahl, B. S, *Advanced Organic Chemistry;* S. Chand and Company, New Delhi, 23rd Ed., 2012. 4. Soni, P. L, Chawla, H. M, *Text Book of Inorganic Chemistry*; Sultan Chand & sons, New Delhi, 29th Ed., 2007.
Reference Books	1. Soni, P.L,& Mohan Katyal, *Text book of Inorganic chemistry*; Sultan Chand and Company, New Delhi, 29th Ed., 2007. 2. Sharma, B. K, *Industrial Chemistry*; GOEL publishing house, Meerut, 16th Ed., 2014. *3.* Jayashree Gosh, *Fundamental Concepts of Applied Chemistry,* Sultan & Chand, 1st Ed., 2006.

Course Learning Outcomes

On completion of the course the students should be able to

CO1: describe the theories of chemical bonding, nuclear reactions and its applications.
CO2: evaluate the efficiencies and uses of various fuels and fertilizers.
CO3: explain the type of hybridization, electronic effect and mechanism involved in the organic reactions.
CO4: demonstrate the structure and uses of antibiotics, anaesthetics, antipyretics and artificial sugars.
CO5: identify an appropriate method for the separation of chemical components

<table>
<tr><td>Title of the Course</td><td colspan="8">CHEMISTRY PRACTICAL- I
(Botany & Zoology)</td></tr>
<tr><td>Course No.</td><td colspan="8">Elective -I (GE)</td></tr>
<tr><td>Category</td><td>Generic Elective</td><td>Year</td><td>I</td><td>Credit</td><td>1</td><td>Course Code</td><td colspan="2">24UBOGECQ3
24UZOGECQ3</td></tr>
<tr><td></td><td></td><td>Semester</td><td>I</td><td></td><td></td><td></td><td colspan="2"></td></tr>
<tr><td>Instructional hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td></td><td>-</td><td colspan="2">-</td><td colspan="2">2</td><td colspan="2">2</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Higher Secondary Chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">This course aims to provide knowledge on the
● basics of preparation of solutions.
● principles and practical experience of volumetric analysis.</td></tr>
<tr><td>Course Outline</td><td colspan="8">Volumetric analysis
1. Estimation of sodium hydroxide using standard sodium carbonate.
2. Estimation of hydrochloric acid using standard oxalic acid.
3. Estimation of ferrous sulphate using standard Mohr's salt.
4. Estimation of oxalic acid using standard ferrous sulphate.
5. Estimation of potassium permanganate using standard sodiumhydroxide.
6. Estimation of magnesium using EDTA.
7. Estimation of ferrous ion using diphenyl amine as indicator.</td></tr>
<tr><td>Reference Book</td><td colspan="8">Venkateswaran, V, Veerasamy, R, Kulandaivelu, A.R, Basic Principles of Practical Chemistry; Sultan Chand & sons, 2nd Ed., 199.</td></tr>
<tr><td colspan="9">Course Outcomes
On completion of the course the students should be able to
On successful completion of the course the students should be able to
CO1: gain an understanding of the use of standard flask and volumetric pipettes, burette.
CO2: design, carry out, record and interpret the results of volumetric titration.
CO3: apply their skill in the analysis of water /hardness.
CO4: analyze the chemical constituents in allied chemical products.</td></tr>
</table>

SKILL ENHANCEMENT COURSE-IV(ENTREPRENEURIAL BASED)

AQUARIUM KEEPING (24UZOSEC4)

Credit : 1 **Hours:1**

Learning Objectives

- To create knowledge on self employment opportunity of ornamental fishes
- To provide the knowledge of ornamental fishes and their equipment
- To understand the different breeding techniques of ornamental fishes

Unit I: Introduction and scope - Aquarium fish keeping as hobby and cottage industry. Commercial aspects like national and international market - Self employment opportunity.

Unit II: External morphology of a typical fish. Exotic and endemic varieties of ornamental fishes.

Unit III: Aquarium preparation and maintenance - Kinds of tanks, tank setting, biological filter and aeration, water management, planting, lighting and feeds. Budget for setting up an Aquarium Fish Farm as a Cottage Industry

Unit IV: Live fish transport- handling, feeding and forwarding techniques of fish. Fish Diseases and their control: Anchor worm-Disc Disease-Sleeping disease-white spot.

Unit V: Breeding – Common characters and sexual dimorphism of Fresh water and Marine aquarium ornamental fish varieties such as Guppies, Mollies, Sword tails, Platy, Siamese fighters and Gold fish, Butterfly fish, Koi and Nemo fish.

Reference Books:

1. Santhanam, P., Sukumaran, N. & P. Natarajan, A manual of freshwater aquaculture (1987), Reprint 1999, Oxford & IBH Publishing Company Pvt., Ltd., New Delhi.
2. Cliff Harrison, A colour guide to Tropical Fish (1980), Chartwell Books, INC, Cerkshire, printed in Hon Kong.
3. O'Connell, R. F., The freshwater aquarium (1977), Arco Publishing Company,INC NewYork.
4. JingranV.G., 1991: Fish and Fisheries in India – Hindustan Publ.co. New Delhi
5. Mill Dick, 1993: Aquarium Fish, Daya Pub.co., New Delhi

Course Outcomes	On completion of this course, students will be able to;	
CO1	Differentiate different ornamental fishes and identify the diseases of them	PO1
CO2	Understand and apply working mechanism of equipments used in aquarium and their maintenance	PO4, PO5
CO3	Analyse and apply the technology of rearing and breeding of endemic and exotic ornamental fishes	PO3, PO4, PO5
CO4	Develop entrepreneur potential in the field of aquarium and get self employment.	PO1, PO2, PO3
Methods of Evaluation		
	Continuous Internal Assessment Test, Model Examination 12	

Internal Evaluation	Assignments, Poster presentation, Quiz,	30 Marks
	Seminars, Surprise Test, Open Book Test	
	Attendance and Class Participation	
External Evaluation	Semester Examination	70 Marks
	Total	100 Marks
Methods of Assessment		
Recall (K1)	Simple definitions, MCQ, Recall steps, Concept definitions	
Understand/ Comprehend (K2)	MCQ, Short essays, Concept explanations	
Application (K3)	Concept with examples, Observation, Explanation	
Analyze (K4)	Differentiate between various ideas, Map knowledge	
Evaluate (K5)	Longer essay/ Evaluation essay, Critique or justify with pros and cons	
Create (K6)	Check knowledge in specific, Discussion, Debating or Presentations	

SKILL ENHANCEMENT COURSE- V- (Discipline / Subject Specific)

ECONOMIC ZOOLOGY (24UZOSEC5)

CREDITS: 2 **HOURS : 2**

Learning Objective

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

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- Foul brood disease and Nosema . Sericulture: Species of silkworm – life history of mulberry silkworm – Rearing of silkworm – pests and diseases of silkworm- Grasserie, Muscardine, Flacherie.Lac Culture: Introduction – Life history – Host plants – cultivation of Lac – Enemies of lac cultivation – Economic importance of Lac.

Unit 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 vermicast – advantages of vermicomposting – vermiwash and its applications of vermicomposting

Unit 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

Unit IV:

Poultry Farming : Poultry industry in India – Poultry types- Chicken ,Duck-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).

Unit V:

Dairy Farming: Dairy farming – advantages of dairying – classification of breeds of cattle –- Indigenous (Red Sindhi)and exotic breeds(Jersey) – Selection of dairy cattle. Breeding – artificial insemination –

Dairy cattle management – housing – water supply – cattle nutrition feeding standards – contagious diseases like Anthrax, Septicaemia- 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.

Text Books

1. Sastry, N.S.R., C.K.Thomas and R.A.Singh, 2015. Livestock Production Management, 4thEd.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.

Suggested Readings

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.

5. Abishek Shukla, D ., 2 0 0 9 . A Hand Book of Economic Entomology, Vedamse Books, New Delhi .

6. Banerjee, G.C., 2006. Text book of Animal Husbandry 8thEd.Oxford and IBH Publishing Company Ltd., New Delhi. 7. Walstra, P. Wouters, J.T.M. and Geurts, T.J. 2006.

7.Dairy Science and Technology. CRC Press, New York. 8. Dunham, R.A., 2004.

8.Aquaculture and Fisheries Biotechnology Genetic Approaches. CABI publications, U.K.

9. Donald.D Bell and William. D. Weaver, 2002. Commercial chicken meat and egg production, Springer, New York.

10. Eckles C.H. and Anthony, E.L., 2001. Dairy Cattle and milk production, Biotech. Tata McGraw Hill Publishing Co.Pvt.Ltd., New Delhi.

Web Resources

1. https://bit.ly/3tXHjk8

2. https://bit.ly/3tUTHBu

3. https://bit.ly/3hVv96q

4. https://bit.ly/39nztH1

5. https://bit.ly/3CzasVO

6. https://agritech.tnau.ac.in/org_farm/orgfarm_vermicompost.html

7. https://bit.ly/3nYvgSF

8. http://caa.gov.in/farms.html

9. http://www.csrtimys.res.in/

10. http://www.agshoney.com/training.htm

Course Outcomes (COs)

Course Outcomes	On completion of this course, students will be able to;	
CO1	Identify the breeds and varieties of poultry, fish, bees, and cattle and understand the basic.	PO1
CO2	Understand and integrate the available tools and techniques to increase the productivity in farms	PO4, PO5
CO3	Analyse the pros and cons of different methods of farming and marketing strategies of products.	PO3, PO4, PO5
CO4	Evaluate the use of strategies in improving the breeds, vermicomposting , farm products etc.,	PO1, PO2, PO3
CO5	Design novel methods to improve farm animals with increased productivity and disease resistance and to construct new methods in vermicomposting aspects of farming.	PO1,PO3,PO5, PO6,PO8,PO9, PO12
	Methods of Evaluation	
Internal Evaluation	Continuous Internal Assessment Test, Model Examination	30 Marks
	Assignments, Poster presentation, Quiz,	
	Seminars, Surprise Test, Open Book Test	
	Attendance and Class Participation	
External Evaluation	Semester Examination	70 Marks
	Total	100 Marks
Methods of Assessment		
Recall (K1)	Simple definitions, MCQ, Recall steps, Concept definitions	

Understand/ Comprehend (K2)	MCQ, Short essays, Concept explanations
Application (K3)	Concept with examples, Observation, Explanation
Analyze (K4)	Differentiate between various ideas, Map knowledge
Evaluate (K5)	Longer essay/ Evaluation essay, Critique or justify with pros and cons
Create (K6)	Check knowledge in specific, Discussion, Debating or Presentations

Course Title : ENVIRONMENTAL STUDIES

Course Code : (24UEVSC) Hours/Week:2

Semester : III & IV Course Credit:2

Course Objectives

- To educate the students regarding the environmental issues and problems.
- To give an exposure towards the scientific and socio – economic dimensionsof the environment.
- To impart and enhance the basic knowledge about environment and develop concern towards it.
- To develop the ability to evaluate the measures for the improvement andprotection of environment.
- To sensitize the students on the various environmental issues.
- To integrate different disciplines and fields that intersect with environmental concerns
- To make the younger generations aware of the values of natural resources.

UNIT I - FUNDAMENTALS

Environment-Definition: Scope, Structure and Function of Ecosystems - Producers. Consumers and Decomposers - Energy flow in the Ecosystem - Ecological Succession - Food Chain, Food Webs and Ecological Pyramids - Concept of Sustainable Development.

UNIT II - NATURAL RESOURCES

Renewable Resources - Air, Water, Soil, Land and Wildlife resources; Non-Renewable Resources - Minerals, Coal, Oil and Natural Gas; Environmental problems related to the Extraction and use of Natural Resources.

UNIT III – BIODIVERSITY

Biodiversity – Definition – values - consumption use, Productive social, Ethical, Aesthetic and option Values Threats to Biodiversity - Hotspots of Biodiversity - conservation of Biodiversity: In-situ, Ex-situ, Bio-Wealth National and Global Level.

UNIT IV- ENVIRONMENTAL POLLUTION

Definition - Causes, Effects and Mitigation Measures - Air, Water and Soil Pollution. Noise Pollution, Thermal pollution, Nuclear Hazards, Solid Wastes, Acid

Rain, Climate Change and Global Warming, Environmental Laws and Regulations in India - Earth Summit.

UNIT V- POLLUTION AND ENVIRONMENT

Population Explosion - Environment and Human Health - HIV/AIDS - Women and Child Welfare - Resettlement and rehabilitation of people, Role of Information Technology in Environmental Health. Environmental Awareness. Environmental Disaster Management - Fire Safety and Prevention.

Field work

- Visit to area to document environmental assets: river/forest/flora/fauna,etc.,
- Visit to a local polluted site - Urban/Rural/Industrial/Agricultural.
- Study of common plants, insects, birds and basic principles of identification.
- Study of simple ecosystem - pond, river, Delhi ridge, etc.,

(Equal to 5 lectures)

References:

1. Carson, R. 2002. Silent Spring. Houghton Mifflin Harcourt.
2. Gadgil, M., & Guha, R. 1993. This Fissured land: An Ecological History of India. Univ. of California Press.
3. Gleeson, B. and Low, N. (eds.) 1999. Global Ethics and Environment, London, Routledge.
4. Gleick, P. H. 1993. Water in Crisis. Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press.
5. Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll. Principles of Conservation Biology Sunderland: Sinauer Associates, 2006.
6. Grumbine, R. Edward and Pandit, M.K. 2013. Threats from India's Himalaya dams. Science, 339:36-37.
7. McCully, P. 1996. Rivers no more: the environmental effects of dams (pp. -64). Zed Books.
8. McNeill, John R. 2000. Something New Under the Sun: An Environmental History of the Twentieth Century.
9. Odum, E.P., Odum, H.T. & Andrews, J. 1971. Fundamentals of Ecology. Philadelphia: Saunders.

10. Pepper, I.L., Gerba, C.P. & Brusseau, M.L.2011. Environmental and Pollution Science. Academic Press.
11. Rao, M.N. & Datta, A.K. 1987. Waste Water Treatment. Oxford and IBH Publishing Co. Pvt. Ltd.
12. Raven, P.H., Hassenzahl, D.M. & Berg, L.R. 2012. Environment. 8th edition. John Wiley & Sons.
13. Rosencranz, A., Divan, S., & Noble, M. L. 2001. Environmental Law and policy in India. Tripathi 1992.
14. Sengupta, R. 2003. Ecoloy and economics: An approach to sutainable development. OUP.
15. Singh, J.S., Singh, S.P. and Gupta, S.R. 2014. Ecology, Environmental Science and Conservation. S. Chand publishing, New Delhi.
16. Sodhi, N.S., Gibson, L. & Raven, P.H. (eds). 2013. Conservation Biology: Voices from the Tropics John Wiley & Sons.
17. Thapar. V. 1998. Land of the Tiger: A Natural History of the Indian Subcontinent.
18. Warren, C. E. 1971, Biology and Water pollution Control. WB Saunders.
19. Wilson, E. O. 2006. The Creation: An appeal to save life on earth. New York: Norton.
20. World Commission on Environment and Development 1987. Our common Future. Oxford University Press.,

Course Outcomes (CO):

On completion of the course, students should be able to

CO Number	CO Statement	Knowledge Level
CO1	Demonstrate critical thinking skills In relation to environmental issues.	K2
CO2	Develop an integrative approach to environmental issues with a focus on sustainability.	K3
CO3	Bring an awareness, knowledge and appreciation of intrinsic values of ecological processes and communities.	K1
CO4	Reflect critically about their roles and identities ascitizens, consumers and an environmentalist in the complex, interconnected world.	K4
CO5	Apply systems, concepts and methodologies to analyseand understand interactions between social and environmental processes.	K1

K-1Recall, K-2 Understand, K-3 Apply,K-4 Analyse

Mapping of COs with POs:

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	S	S	L	M	S
CO2	S	M	S	L	M
CO3	S	L	M	S	M
CO4	S	M	M	M	S
CO5	S	S	M	M	S

S - Strong M - Medium L - Low

SEMESTER - IV

Course Code CC5	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
24UZOCC5	**Developmental Biology**	Core	Y	-	-	-	5	5	30	70	100

Learning Objectives	
CO1	To create an awareness to the students about the theories, concepts and basics of Developmental Biology.
CO2	To provide students about the idea of sex cells, fertilization, cleavage, Differentiation and development of organs.
CO3	To make an awareness of the induction, organizers and development of extraembryonic structures.
CO4	To provide adequate explanation to students about the late embryonic Developments and postembryonic development and ageing
CO5	To give an idea about teratogenesis, invitrofertilization, stemcells and Amniocentesis to the students

UNIT	Details	No. of Hours	Course Objectives
I	**Gametogenesis & Fertilization** Basic concepts of developmental biology. Structure & types of Spermatozoa, Mammalian egg – Egg membranes. Types of egg - Spermatogenesis – Oogenesis. Fertilization – mechanism, theories and significance – Parthenogenesis.	12	CO1
II	**Blastulation &Gastrulation** Cleavage-Planes and Patterns, Factors controlling cleavage- Fate map and its construction. Blastulation– types of blastula. Morphogenetic movements - Gastrulation of frog & chick.	12	CO2
III	**Organogenesis** Development of Brain, Eye and Heart in frog. Development of Nervous system in chick. Foetal membranes in chick. Development of Pro, Meso and Metanephric kidneys. Placentation in Mammals.	12	CO3
IV	**Applied Embryology** Organizer concept – Structure – mechanism of induction and competence. Nuclear transplantation - teratogenesis Regeneration: Types - events and factors. Embryonic stem cells & significance. Methods to culture embryo.	12	CO4
V	**Human embryology** Reproductive organs, Menstrual cycle and	12	CO5

	menopause- Pregnancy– trimesters– development. Erythroblastosis foetalis-Twins– types. Infertility–causes-Test tube Baby and Assisted Reproductive Technology– Embryo transfer – Amniocentesis.		
		60	
Course Outcomes			
CO1	To describe and illustrate the significance of cellular Processes in embryonic development.	PO1	
CO2	To relate the factors that contribute to the developmental process, construct fate maps and illustrate the steps in morphogenesis and organogenesis.	PO1, PO2	
CO3	To correlate the involvement of specific cell types in the formation of specific organs and explain the importance of morphogenesis.	PO4, PO6	
CO4	To distinguish between the different types of developmental mechanisms in various organisms and appraise the species-based differences in development.	PO4, PO5, PO6	
CO5	To justify and validate the role of environment and genetics in influencing embryonic development	PO3, PO8	
TextBooks(Latest Editions)			
1.	LewisWolpert2007.Principlesofdevelopment,3rdedition,OxfordUniversity Press, NewDelhi, India		
2.	Subramoniam,T.2003.Developmental Biology, Narosa Publishing House, New Delhi, India.		
3.	Verma,P.S.,Agarwal,V.K.2010.ChordateEmbryology:DevelopmentalBiology, S.Chand & Company, NewDelhi., India.		
ReferencesBooks (Latesteditions,andthestyleasgivenbelowmustbestrictlyadheredto)			
1.	GilbertS.F.2010.Developmental Biology, Sinauer Associates, Massachusetts, USA.		
2.	Balinsky,B.I.1970. Introduction to Embryology, Philadelphia &London, UK.		
3.	Berril,N.J.1971.DevelopmentalBiology,McGrawHill, NewYork,USA.		
4.	RussHodge2010.DevelopmentalBiology, Facts onFile,Inc., NewYork, USA.		
5.	Carlson,Bruce,M.2009. Human embryology and Developmental Biology, Elsevier, Philadelphia, USA		
Web Resources			
1.	https://www.ncbi.nlm.nih.gov/books/NBK10052/		
2.	https://www.cdc.gov/ncbddd/developmentaldisabilities/facts.html		
3.	https://anatomypubs.onlinelibrary.wiley.com/doi/full/10.1002/dvdy.20468		
4.	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5293490/		
Methodsof Evaluation			
	Continuous Internal Assessment Test		

Internal Evaluation	Model Examination	30 Marks
	Quiz with MCQs	
	Case study	
	Project	
	Assignment	
	Seminar	
	Book Review or open book test with peer assessment	
	Attendance and Class Participation	
External Evaluation	End Semester Examination	70 Marks
	Total	100 Marks

Methods of Assessment	
Recall(K1)	Simple definitions, MCQ, Recall steps, Concept definitions
Understand/ Comprehend (K2)	MCQ,True/False,Shortessays,Conceptexplanations,Shortsummaryoroverview
Application (K3)	Suggest idea/concept with examples, Suggest formulae, Solve problems, Observe, Explain
Analyze(K4)	Problem-solving questions, Finish a procedure in many steps, Differentiate Between various ideas, Map knowledge
Evaluate (K5)	Longer essay/ Evaluation essay, Critique or justify with pros and cons
Create(K6)	Check knowledge in specific or off beat situations, Discussion, Debating or Presentations

Mapping with Programme Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO 1	S	S	M	M	L	L	L	L
CO 2	M	S	M	L	M	M	L	M
CO 3	M	M	S	S	S	S	L	S
CO 4	L	L	S	S	S	M	L	L
CO 5	L	L	S	L	L	L	L	S

S-Strong(3) M-Medium (2) L-Low(1)B N

SKILL ENHANCEMENT COURSE –VI

(Discipline/Subject specific)

FOOD, NUTRITION AND HEALTH - 24UZOSEC6

Hours: 2 **Credit: 2**

Learning Objectives:

The course covers the basic concepts of balanced diet for people of different ages besides focusing on the consequences of malnutrition and the deficiency diseases and the diseases caused due to poor hygiene.

Unit I : Nutrition and Dietary nutrients:

Basic concepts of Food: Components and Nutrients. Concept of Balanced Diet, Nutrient Requirements and Dietary Pattern for Different age groups.

Unit II: **Macronutrients and Micronutrients:**

Macronutrients: Carbohydrates, Lipids, Proteins – Definition, Classification, their Dietary Sources and role, and Micronutrients: Vitamins – Water soluble and fat soluble vitamins – their Sources and its Biological importance.

Unit III: **Malnutrition and Nutrient Deficiency Diseases:**

Definition and Concept of Health: Common Nutritional Deficiency Diseases- Protein Malnutrition- Vitamin A deficiency, Iron deficiency and Iodine deficiency disorders - their symptoms, treatment prevention and Government Initiatives to overcome Malnutrition.

Unit IV: **Life Style Dependent Diseases:**

Hypertension, Diabetes mellitus, and Obesity: Causes and Prevention. Social Health Problems: Smoking, Alcoholism, and Narcotics. Acquired Immunodeficiency Syndrome (AIDS): Causes, Treatment, and Prevention.

Unit V: **Diseases Caused by Microorganisms:**

Food and Water-Borne Infections: Bacterial Diseases – Cholera and Typhoid Fever; Viral Diseases – Hepatitis and Poliomyelitis; Parasitic Diseases – Taeniasis and Ascariasis: Their Transmission, Causative Agents, Sources of Infection, Symptoms, and Prevention.

References:

1. Mudambi, S.R. and Rajagopal,M.V.(2007). Fundamentals of Foods, Nutritionand Diet Therapy; Fifth Ed; New Age International Publishers.
2. Srilakshmi,B.(2007). Food Science; FourthEd; NewAgeInternational(P)Ltd.
3. Swaminathan,M.(1986). Hand book of Foods and Nutrition; Fifth Ed; BAPPCO.
4. Bamji,M.S.;Rao,N.P.andReddy,V.(2009). Text Book of Human Nutrition;Oxford & IBH Publishing Co. Pvt Ltd.
5. Lakra, P.and Singh M.D.(2008). Text book of Nutrition and Health; First Ed; Academic Excellence.
6. Gibney,M.J.etal.(2004). Public Health Nutrition; Blackwell Publishing.

Course outcomes:

1. Understand the role of food and nutrients in health and disease.
2. Gain knowledge about hygiene, food safety, disease transmission.
3. Perform food system management and leadership functions that consider sustainability in business, healthcare, community and institutional areas.

SKILL ENHANCEMENT COURSE - VII (Discipline/Subject specific)

BASICS OF MARINE BIOLOGY - 24UZOSEC7

HOURS:2 **CREDIT:2**

LearningObjectives:

1. To understand and learn the physical, chemical and biological aspects of marine environment and to gain knowledge about the management of oceans.
2. To introduce students to the marine environment and its indigenous organisms.
3. To study the principles, concepts and facts through which the student can better understand and appreciate the nature of the sea and its inhabitants.
4. To acquaint the student with the characteristics used to identify and classify marine plants and animals and to develop an awareness of the career possibilities available to students in this area.

Unit I: Marine Ecology :Introduction to Marine environment- ecological factors- Pelagic environment and adaptations; Benthic environment - deep sea adaptations; Distribution and ecological role of coastal environment : coral reefs.

Unit II: Physical Oceanography : Physical Properties of Seawater-density, surface tension, temperature distribution in the sea. El Nino/La Nina – global impact; Dynamics of the ocean- Waves, Currents and Tides, Tsunami.

Unit III: Chemical Oceanography : Chemical composition of seawater-ionic, constituents, - major and minor elements, trace elements- their importance, distribution. Chemistry of seawater constituents- concept of chlorinity and salinity - biogeochemical cycles: Carbon and Phosphorus

Unit IV: Biological Oceanography: Sea as a biological environment-Phytoplankton and Zooplankton – Methods of collection - Oxidation as carbon (as organic matter). Primary productivity – estimation and factors affecting primary productivity.

Unit V: Marine Pollution and Ocean Management : Ocean pollution- kinds of pollutants-– oil spills, plastics, nuclear waste disposal in marine environment-toxic effects and control measures Eutrophication. Role of National and international agencies and organizations in ocean management. Ocean policy (India) - research and management.

Text Books:

1. Thurman, Harold., 2001.Introduction to Oceanography, Prentice Hall Inc. New Jersey.506 pp.
2. Bertness, M.D, S. D. Gaines and M.K. Hay 2000. Marine Community Ecology SinauerAssociates.
3. Grant Gross, M., 1993 Oceanography: A view of the earth (sixth edition). Prentice Hall Inc. New Jersey.
4. Fincham A. A, 1984. Basic Marine Biology. Cambridge University Press, England. 157 pp.
5. JohnResechJr.1979,MarineBiology.RestonPublishingCompany,Virginia.257pp.

Suggested Readings:

1. BarbaraE.Curry,2016. Advances in Marine Biology, Volume74, Ist Edition. Academic Press ISBN: 9780128036075
2. Peter Castro, Michael E.Huber,2015.Marine Biology; Series Botany, Zoology, Ecology and Evolution. McGraw-Hill Education.
3. PhilipV.Mladenov,2013. Marine Biology: A very short introduction, Ist Edition. Oxford University Press.
4. Venkataraman K, Raghunathan C, Raghuraman R, Sreeraj C. R, 2012. Marine diversity in India. Zoological Survey of India, Kolkata.178 pp.
5. AmyHill.2002.Marine Biology: An Introduction to Ocean Ecosystems (Marine Biology Ser) Walch publishing.
6. Pickard, G.L. and W.J. Emery 1995. Descriptive Physical Oceanography. Pergamon Press, London.
7. Gage.J.D.andP.A.Tyler,1991.Deep Sea Biology, Cambridge University Press, Cambridge
8. RaymontJ.E.G.,1980. Plankton and Productivity in the oceans: Volume1: Phytoplankton, Pergamon Press.
9. Van Der Spoel, S. and Pierrot Bults,A.C(Eds) 1979. Zoogeography and diversity of plankton. Bungs Scientific Publishers Utrecht, 410pp.
10. Riley,J.P. and Skirrow,1975-1984.ChemicalOceanography Vols.1to 1. Academic Press, London

WebResources

1. https://www.livescience.com
2. https://www.icriforum.org
3. https://www.cbd.int

CourseOutcomes (COs)

On completion of this course the student will be able to,

CO1 Define marine ecosystem, recognize and describe the interrelationship between biology and ocean technology.

CO2 Articulateandclassifythedynamicsandthephysicalattributesoftheocean,

CO3 Interpret the factors which affect the global climate.

CO4 Identify and analyze the physical and biological factors of marine environments, and focus life in the open sea.

CO5 Evaluate the impact of variations in abiotic factors in marine productivity and justify the role of human activities in the degradation of marine ecosystems.

CO6 Categorize marine pollutants and develop controlling measures in collaboration with the institutions for ocean management.

<table>
<tr><td>Title of the Course</td><td colspan="7">CHEMISTRY-II
(For Botany/ Zoology)</td></tr>
<tr><td>Course No.</td><td colspan="7">Elective-IV (GE)</td></tr>
<tr><td>Category</td><td>Generic Elective</td><td>Year
Semester</td><td>II
IV</td><td>Credits</td><td>3</td><td>Course Code</td><td>24UBOGEC4/ 24UZOGEC4</td></tr>
<tr><td>Instructional hours per week</td><td>Lecture
3</td><td>Tutorial
-</td><td colspan="3">Lab Practice
-</td><td>Total
3</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Chemistry I for Biological Sciences</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims to provide knowledge on
● Nomenclature of coordination compounds and carbohydrates.
● Amino Acids and Essential elements of biosystem
● Understand the concepts of kinetics and catalysis
● Basics and types of polymers
● Provide fundamentals of photochemistry</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNITI 9 Hours
Co-ordination Chemistry and Water Technology
Co-ordination Chemistry: Definition of terms-IUPAC Nomenclature - Werner’s theory - EAN rule - Pauling’s theory – Postulates –Applications to$[Ni(CO)4]$,$[Ni(CN)4]^{2-}$,$[Co(CN)6]^{3-}$ Chelation-Biological role of Hemoglobin and Chlorophyll (elementary idea) –Applications in qualitative and quantitative analysis.
Water Technology: Hardness of water, determination of hardness of water using EDTA method, zeolitemethod-Purification techniques–BOD and COD.</td></tr>
<tr><td></td><td colspan="7">UNITII 9 Hours
Carbohydrates
Classification, preparation and properties of glucose and fructose. Discussion of open chain ring structures of glucose and fructose.
Glucose- fructose inter conversion. Preparation and properties of sucrose, starch and cellulose.</td></tr>
<tr><td></td><td colspan="7">UNITIII 9 Hours
Amino Acids and Essential elements of biosystem
Classification-preparation and properties of alanine, preparation of dipeptides using Bergmann method-Proteins-classification–structure - Colour reactions – Biological functions – nucleosides -nucleotides–RNAandDNA–structure.Essentialsoftracemetalsinbiological system-Na, Cu, K, Zn, Fe, Mg.</td></tr>
<tr><td></td><td colspan="7">UNITIV 9 Hours
Polymerchemistry
Polymers - monomers, classification of polymers, types of polymerizations-addition and condensation polymerization. Naturalpolymers: polysaccharides - (eg., starch and cellulose).Polyhydrocarbon (eg.,naturalrubber) and polyamide (eg.,protein). Synthetic polymers: preparation and applications of polyethylene, polypropylene, polyester, polyvinylchloride, polyvinylcarbonate, polyamide, polytetrafluoroethylene, syntheticrubber, vulcanization of rubber.</td></tr>
</table>

	UNITV **9 Hours** **Photochemistry** Grothus - Drapper's law and Stark-Einstein's law of photochemical equivalence, Quantum yield- Hydrogen-chlorid ereaction. Phosphorescence, fluorescence, chemilum in escence and photo sensitization and photosynthesis (definitionwithexamples).
Extended Professional Component (is a part of internal component only, Not to be included in the external examination Question paper)	Questionsrelatedtotheabovetopics,fromvariouscompetitiveexaminationsUPSC/JAM /TNPSC others to be solved(To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. VeeraiyanV,*Text book of Ancillary Chemistry*; High mount publishing house, Chennai,1st Ed., 2009. 2. VaithyanathanS,*Text book of Ancillary Chemistry*; Priya Publications, Karur, 2006. 3. Arun Bahl, BahlB.S, *Advanced Organic Chemistry*; S.Chandand Company, New Delhi,23rdEd., 2012. 4. SoniP.L, Chawla HM,*Text Book of Organic Chemistry*; Sultan Chand& sons, NewDelhi, 29thEd., 2007. 5. Gowariker V R, ViswanathanN V, Jayadev Sreedhar, *Polymer Science*, Wiley Eastern Ltd, 1986.
Reference Books	1. Arun Bahl, BahlB.S, *Advanced Organic Chemistry*; S.Chandand Company, New Delhi,23rdEd., 2012. 2. SoniPL, ChawlaHM, *Text Book of Organic Chemistry*; Sultan Chand & sons, NewDelhi,29thEd., 2007. 3. Soni P L, Mohan Katyal, *Text book of Inorganic chemistry*; Sultan Chand andCompany, NewDelhi, 20thEd.,2007. 4. PuriBR, SharmaLR, Pathania MS, *Text book Physical Chemistry*; Vishal Publishing Co., New Delhi,47thEd., 5. Sharma BK, *Industrial Chemistry*; GOEL publishing house, Meerut, sixteenth edition, 2014.

Course Outcomes

On completion of the course the students should be able to

CO1: Write the IUPAC name for complex, different theories to explain the bonding in coordination compounds and water technology.

CO2: Explain the preparation and property of carbohydrate.

CO3: Enlighten the biological role of transition metals, amino acids and nucleic acids.

CO4: Acquire knowledge about the polymer and its types.

CO5: Outline the various type of photochemical process.

<table>
<tr><td>Title of the Course</td><td colspan="7">CHEMISTRY PRACTICAL-II
(Botany/Zoology)</td></tr>
<tr><td>Course No.</td><td colspan="7">Elective-IV(GE)</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Generic Elective</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2">23UBOGECQ4/ 23UZOGECQ4</td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>-</td><td>-</td><td colspan="3">2</td><td colspan="2">2</td></tr>
<tr><td>Prerequisites</td><td colspan="7"></td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims to provide knowledge on
● Identification of organic functional groups
● Different types of organic compounds with respect to their properties.
● Determination of elements in organic compounds.</td></tr>
<tr><td></td><td colspan="7">SYSTEMATIC ANALYSIS OF ORGANIC COMPOUNDS
The analysis must be carried out as follows:
(a) Functional group tests[phenol, acids(mono&di) aromatic primary amine, amides (mono & di),aldehydeand glucose].
(b) Detection of elements(N,S, Halogens).
(c) To distinguish between aliphatic and aromatic compounds.
(d) To distinguish–Saturated and unsaturated compounds.</td></tr>
<tr><td>Reference Books</td><td colspan="7">Venkateswaran V, Veerasamy R, Kulandaivelu A R, Basic Principles of Practical Chemistry; Sultan Chand & sons,2nd Ed.,1997.</td></tr>
<tr><td colspan="8">Course Outcomes
On completion of the course the students should be able to
CO1: observe the physical state, odour, colour and solubility of the given organic compound.
CO2: identify the presence of special elements and functional group in an unknown organic compound performing asystematic analysis.
CO3:analyze the given organic compound and explain there actions behind it.</td></tr>
</table>

Course Outcomes (CO):

On completion of the course, students should be able to

CO Number	CO Statement	Knowledge Level
CO1	Demonstrate critical thinking skills In relation to environmental issues.	K2
CO2	Develop an integrative approach to environmental issues with a focus on sustainability.	K3
CO3	Bring an awareness, knowledge and appreciation of intrinsic values of ecological processes and communities.	K1
CO4	Reflect critically about their roles and identities ascitizens, consumers and an environmentalist in the complex, interconnected world.	K4
CO5	Apply systems, concepts and methodologies to analyseand understand interactions between social and environmental processes.	K1

K-1Recall, K-2 Understand, K-3 Apply,
K-4Analyse

Mapping of COs with POs:

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	S	S	L	M	S
CO2	S	M	S	L	M
CO3	S	L	M	S	M
CO4	S	M	M	M	S
CO5	S	S	M	M	S

S - Strong M - Medium L - Low