



Mother Teresa Women's University

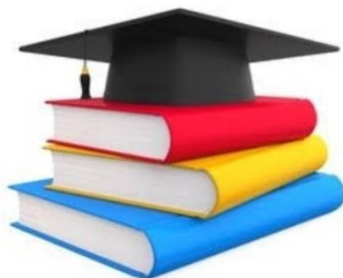
Kodaikanal-624102



Department of Biotechnology

B.Sc. – ZOOLOGY

Curriculum Framework, Syllabus and Regulations **(Based on TANSCHÉ syllabus under Choice Based Credit System)**



(For the candidate to be admitted from the academic year-2023-2024)

**B.Sc. ZOOLOGY
(2023 – 2024)**

1. About the Programme

B.Sc. Zoology is a 3-year undergraduate programme which deals with the study of animals. The syllabus covers the basic understanding of Invertebrates, Chordates, Physiological process, Ecology, Developmental and Cell Biology etc. This undergraduate programme is generally, divided into six semesters. The programme incorporates core papers, electives and practical. The delivery methods involve theoretical classes, lab work and hands-on practical training, outdoor tours etc. The students completing this programme generally go for higher education to build a career in academics, public and private sectors.

2. Programme Educational Objectives (PEOs)

PEO1	To provide quality education in a branch of Biological science i.e., Zoology and encourage the students for self-employment in applied branches of Zoology
PEO2	To facilitate higher education and research in Zoology
PEO3	To take appropriate steps towards conservation of resources, endemic and endangered animal species
PEO4	To apply knowledge to solve the issues related to animal sciences and provide consultancy
PEO5	To develop the ability for the upliftment of society

3. Eligibility

- i. Candidate should have passed the Higher Secondary Examination conducted by the Board of Higher Secondary Examination, Govt. of Tamilnadu or any other Examination accepted by the syndicate as equivalent there to with at least one of the following subject Biology/Zoology
- ii. Candidate should have secured at least 55% in the above subject and above in the aggregate.
A relaxation of 10% in the total percentage will be given to SC, ST candidates

4. General Guidelines for UG Programme:

i. Duration: The programme shall extend through a period of 6 consecutive semesters and the duration of a semester shall normally be 90 days or 450 hours. Examinations shall be conducted at the end of each semester for the respective subjects.

ii. Medium of Instruction: English

iii. Evaluation: Evaluation of the candidates shall be through Internal and External assessment. The ratio of formative and summative assessment should be 25:75 for both Core and Elective papers.

Evaluation Pattern

	Theory		Practical	
	Min	Max	Min	Max
Internal	10	25	10	25
External	30	75	30	75

- **Internal (Theory): Test (15) + Assignment (5) + Seminar/Quiz (5) = 25**
- **External Theory: 75**

5. Classification of Successful candidate:

% of Marks scored	Division
35 to 49	III Class
50 to 59	II Class
60 to 79	I Class
80 and above	I Class with Distinction

- **Question Paper Pattern for External examination for all course papers.**

Max. Marks: 75

Time: 3 Hrs.

S.No.	Part	Type	Marks
1	A	10*1 Marks=10 Multiple Choice Questions (MCQs): 2 questions from each Unit	10
2	B	5*4=20 Two questions from each Unit with Internal Choice (either / or)	20
3	C	3*15=45 Open Choice: Any three questions out of 5 : one question from each unit	45
Total Marks			75

*** Minimum credits required to pass: 140**

6. Attendance

Students must have earned 75% of attendance in each course for appearing for the examination, Students who have earned 74% to 71% of attendance to be applied for condonation in the prescribed form with the prescribed fee. Students who have earned 70% to 65% of attendance to be applied for condonation in the prescribed form with the prescribed fee along with the Medical Certificate. Students who have attended below 65% are not eligible to appear for the examination and they shall re-do the semester(s) after completion of the course, with the prior permission of the Controller of the Examination and The Registrar of the University.

7. Any Other Information:

In addition to the above regulations, any other common regulations pertaining to the UG Programme are also applicable for this programme.

Maternity Leave – The student who avails maternity leave may be considered to appear for the examination with the approval of Staff i/c, Head of the Department, Controller of Examination and The Registrar.

PROGRAMME OUTCOMES

On completion of B.Sc., Zoology Programme, the students will be able

PO1	To understand the broad essential information about animals especially classification, structure, development, adaptations and evolution.
PO2	To get an exposure to the advanced field like genetic engineering, biotechnology and bioinformatics and analyze the relationship between organisms and environment.
PO3	To acquire the anatomical and functional knowledge about microbes, animals and Human.
PO4	To develop practical and applied knowledge of lab techniques in different spheres of zoology.
PO5	To produce intellectually sound in life science for accomplishing scientific transformation.
PO6	To involve in scientific research activities for the betterment of Society.
PO7	To analyze and apply the acquired knowledge of biological science in different fields by integrating the functional levels for progressive growth.
PO8	To mould in self-employment skills in order to develop entrepreneurship for their future well-being.

PROGRAMME SPECIFIC OUTCOMES

Upon completion of B.Sc., Zoology Degree Programme the graduates will be able to

PSO1	Understand the Physiology, Developmental biology, Evolution of animals and their adaptive importance.
PSO2	Acquire the functional knowledge about Cell, Microbial Pathology, and Genetic interaction there by realizing the role of health, immunity and vaccines.
PSO3	Gain knowledge about the applications in Sericulture, Aquaculture, Apiculture, Vermiculture, Poultry farming, there by imparting skills for source of income and self-employment.
PSO4	Expose to the Practical's in Zoology and learn to apply in day today life with statistical tools.
PSO5	Develop knowledge on biological domain and make awareness in the society.

Course code	List of Courses	Title	Credit	No. of Hours	CIA	ESE	Total
SEMESTER I							
U23TAL11	Language-1- Tamil		3	6	25	75	100
U23ENL21	Language-2- English		3	6	25	75	100
U23ZOT101	Core Theory – 1: Invertebrata I		5	5	25	75	100
U23ZOT102	Core Theory – 2: Invertebrata II		5	5	25	75	100
U23ZOA11	Allied-1: Botany		3	4	25	75	100
U23ZOS11	Skill enhancement Course – 1: Apiculture		2	2	25	25	100
U23ZOFC1	Foundation course- Parasitology		2	2	25	25	100
	Total		23	30	-	-	700
SEMESTER II							
U23TAL12	Language-1: Tamil		3	6	25	75	100
U23ENL22	Language-2: English		3	6	25	75	100
U23ZOT203	Core Theory – 3: Chordata		5	5	25	75	100
U23ZOP201	Core Practical - 1: Invertebrata & Chordata		5	5	25	75	100
U23ZOA22	Allied-2: Practical- Botany		3	4	25	75	100
U23ZOS22	Skill enhancement course – 2: Soft Skills		2	2	25	75	100
U23ZONM21	Naan Muthalvan Course - 1		2	2			
U23ZOS23A/ U23ZOS23B	Skill enhancement course – 3: A. Medical laboratory techniques / B. Biocomposting for Entrepreneurship		2	2	25	75	100
	Total		23	30	-	-	700
SEMESTER III							
U23TAL13	Language-1 Tamil		3	6	25	75	100

U23ENL23	Language-2 English	3	6	25	75	100
U23ZOT304	Core Theory – 4: Cell Biology	5	5	25	75	100
U23ZOT305	Core Theory – 5: Genetics	5	5			
U23ZOA33	Allied III – Theory - Chemistry	3	4	25	75	100
U23ZOS34A / U23ZOS34B	Skill enhancement course – 4: A. Animal Husbandry / B. Aquaculture	1	2	25	75	100
U23ZONM32	Naan Muthalvan Course - 2	2	2	25	75	100
	Total	22	30			700
SEMESTER IV						
U23TAL14	Language-1: Tamil	3	6	25	75	100
U23TAL24	Language-2: English	3	6	25	75	100
U23ZOT406	Core Theory – 6: Developmental Biology	5	5	25	75	100
U23ZOP402	Core Practical – 2: Practical in Cell Biology, Genetics, Developmental Biology	5	5	25	75	100
U23ZOA44	Allied IV – Chemistry Practical	3	3	25	75	100
U23ZOS45A / U23ZOS45B	Skill enhancement course – 5: A. Sericulture / B. Poultry Farming	2	2	25	75	100
U23ZONM43	Naan Mudhalvan Course - 3	2	2	25	75	100
U23ZO4EVS	Environmental Science	2	2	25	75	100
	Total	25	31			800
SEMESTER V						
U23ZOT507	Core Theory – 7: Animal Physiology	4	5	25	75	100
U23ZOT508	Core Theory – 8: Microbiology	4	5	25	75	100
U23ZOT509	Core Theory – 9: Biochemistry and Immunology	4	5	25	75	100
U23ZOP503	Core Practical – 3: Practical in Animal physiology, Microbiology Biochemistry and Immunology	4	5	25	75	100
U23ZOE51A/ U23ZOE51B	Elective-1: A. Animal Behaviour / B. Cancer biology	3	3	25	75	100

U23ZOE52A/ U23ZOE52B	Elective -2: A. Biophysics and Biostatistics/ B. Wildlife conservation and Management	3	3	25	75	
U23ZO5VE	Value Education	2	2	25	75	100
U23ZO5INT	Internship/Industrial Training	2	-			100
U23ZONM54	Naan Mudhalvan Course - 4	2	2	25	75	100
	Total	28	30			800
SEMESTER VI						
U23ZOT610	Core Theory – 10: Biotechnology	4	6	25	75	100
U23ZOT611	Core Theory – 11: Environmental Biology and Evolution	4	6	25	75	100
U23ZOP604	Core Practical – 4: Biotechnology, Environmental Biology and Evolution	4	6	25	75	100
U23ZOE63A/ U23ZOE63B	Elective-3: Bioinformatics / Insect Vectors and Disease	3	5	25	75	100
U23ZOE64A/ U23ZOE64B	Elective-4: Agricultural Entomology / Bioinstrumentation	3	5	25	75	100
U23ZO6EXT	Extension activity	1				100
U23ZONM65	Naan Mudhalvan Course - 5	2	2	25	75	100
	Total	21	30			900

SEMESTER – I

Course Code CC1	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
U23ZOT101	INVERTEBRATA I	Core	Y	-	-	-	4	4	25	75	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 - <i>Paramecium</i> and <i>Plasmodium</i> - Parasitic protozoans (<i>Entamoeba</i> , <i>Trypanosoma</i> & <i>Leishmania</i>) - Economic importance Nutrition in protozoa - Host-parasitic interactions in <i>Entamoeba</i> and <i>Plasmodium</i> -Locomotion in protozoa							12	CO1		
II	Porifera: General characters and classification up to Classes. Type study - Ascon & Sycon - Canal system in sponges - Skeleton in sponges, Economic importance, Canal system in sponges - Reproduction in sponges.							12	CO2		

III	Coelenterata : General characters and classification up to classes – Type study - <i>Obelia</i> and <i>Aurelia</i> - Corals and coral reefs - Polymorphism - Economic importance - Mesenteries in Anthozoa - Economic importance of corals and coral reefs - Polymorphism in Hydrozoa.	12	CO3
IV	Platyhelminthes : General characters and classification of up to classes. Type study – <i>Fasciola hepatica</i> . Nematelminthes: <i>Taenia solium</i> – Parasitic adaptations. Host- parasitic interactions of Helminth parasites. Nematode Parasites and diseases - <i>Wuchereria bancrofti</i> , <i>Enterobius vermicularis</i> , <i>Ancylostome duodenale</i> . Aschelminthes : General characters and classification of up to classes - Type study - <i>Ascaris lumbricoides</i>	12	CO4
V	Annelida : General characters and classification up to Classes. Type study – <i>Nereis</i> and <i>Hirudinaria granulosa</i> . Metamerism Nephridium and coelomoducts - Modes of life in Annelids. REproduction in polychaetes.	12	CO5
Total		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 invertebrata.	PO1, PO2	
CO3	Differentiate and classify the animal's mode of life in various taxa and estimate the biodiversity.	PO4, PO6	
CO4	To compare and distinguish the various physiological processes and organ systems in lower animals.	PO4, PO5, PO6	
CO5	Infer and integrate the parasitic and economic importance	PO3, PO8	

	of invertebrate animals.	
Text Books (Latest Editions)		
1.	Ekambaranatha Iyer, 2000. A Manual of Zoology, 10 th edition, Viswanathan, S., Printers & Publishers Pvt Ltd	
2.	Jordan, E.L. and Verma P.S, 1995. Invertebrate Zoology, 12 th 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	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		
CO 4				S	S	M		
CO 5			S					S

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

Course Code	Course Name	U	a	L	T	P	S	U	I	Marks		
CC2										CIA	External	Total
U23ZOT102	INVERTEBRATA II	Core	Y	-	-	-	4	4	25	75	100	
Learning Objectives												
CO1	To understand the structures and distinct features of invertebrate phyla.											
CO2	To understand and able to distinguish the characteristic features of each phylum											
CO3	To understand the economic importance of invertebrates											
CO4	To understand the interaction of invertebrates with the environment.											
CO5	To understand the evolutionary position of different groups of invertebrates											
UNIT	Details							No. of Hours	Course Objectives			
I	Arthropoda: General characters and classification of Phylum Arthropoda up to Classes. Detailed study: <i>Penaeus indicus</i> . Affinities of <i>Peripatus</i> – Larval forms in Crustacea – Organization of Centipede and Millipede.							12	CO1, CO2			
II	Mollusca: General characters and classification of Phylum Mollusca up to Classes. Detailed study: <i>Pila globosa</i> . Foot and torsion in Mollusca, Economic importance of Molluscs – Cephalopoda as the most advanced invertebrate.							12	CO1, CO2, CO4, CO5			
III	Echinodermata: General characters and classification of Phylum Echinodermata up to Classes. Detailed study: <i>Asterias</i> . Water vascular system in Echinodermata – Larval forms of Echinoderms.							12	CO1, CO2, CO3, CO5			
IV	Detailed study: <i>Periplaneta americana</i> . Insect pollinators- predators – parasites. Insects associated with human diseases: Mosquitoes, housefly, bed bug, human head louse. Insects associated with household materials: Ants, Termites, Silver fish.							12	CO4, CO5			

V	<p>Insect pests: Insect pests, life cycle and types of damage to plants. Pest of rice: Rice stem borer (<i>Scirpophaga incertulas</i>) – Pest of Sugarcane: The shoot borer (<i>Chilo infuscatellus</i>) – Pest of c</p> <p>Oconut: The rhinoceros beetle (<i>Oryctes rhinoceros</i>) Pest of cotton: The spotted bollworm(<i>Earias insulana</i>) – Pests of vegetables: Brinjal-The shoot and fruit borer (<i>Leucinodes orbonalis</i>) – Cauliflower: The diamond black moth(<i>Plutella xylostella</i>)Pests of fruits: Citrus butterfly(<i>Papilio demoleus</i>) – Pest of stored products: The rice weevil(<i>Sitophilus oryzae</i>). Principles of Integrated Pest Management.</p>	12	CO4, CO5
Total		60	
Course Outcomes			
Course Outcomes	On completion of this course, students will;		
CO1	Classify, Identify and recall the name and distinct features of invertebrate groups.	PO1	
CO2	Explain, and relate the origin, structural organization and evolutionary aspects of invertebrates.	PO1, PO2	
CO3	Analyze, compare and distinguish the developmental stages and describe the important biological process.	PO3, PO4, PO5	
CO4	Correlate the interaction of invertebrates with humans and critique its economic importance.	PO4, PO5, PO6	
CO5	Summarize the physiology, ecological adaptations to stimulate and integrate the significance of invertebrates to the environment, humans, and agriculture.	PO1, PO2, PO3, PO8	
Text Books (Latest Editions)			
1.	Ekambaranatha Ayyar, and T. N. Ananthkrishnan, 2000. A Manual of Zoology. Vol 1 (Invertebrata). Part II – Viswanathan Pvt. Ltd, 842pp		
2.	Jordan, E.L. and Verma P.S, 1995. Invertebrate Zoology, 12 th edn. S. Chand & Co.		

3.	Kotpal R.L. 2019. Modern Text Book of Zoology, Invertebrates 9 th Ed., Rastogi Publications, Gangotri, Shivaji Road, Meerut, 1004 pp.	
4.	Vasantharaj David, B. 2001. Elements of Economic Entomology, Popular Book Depot, Chennai. 400pp.	
5.	Ruppert and Barnes, R.D. 2006. Invertebrate Zoology, VIII Edition. Holt Saunders International Edition, Belmont, CA: Thomson-Brooks/Cole, 928pp.	
References Books (Latest editions, and the style as given below must be strictly adhered to)		
1.	Barrington, E.J.W., 2012, Invertebrate structure and function. Boston – Houghton. Mifflin and ELBS, London.	
2.	Bhamrah, H.S. and Kavitha Juneja, 2002. A text book of Invertebrates. Alinol Publications Private Limited, 4374/4B. Ansari Road, Dayaganj, New Delhi.	
3.	Hyman L.H, 1955. The invertebrates – Vol. I to Vol. VII – McGraw Hill Book Co.	
4.	Kotpal, 1992. Protozoa, Porifera, Coelenterata, Annelida, Arthropoda, Mollusca, Echinodermata, R.L- Rastogi Publication.	
5.	Parker, J. and Haswell, 1978. A text book of Zoology Vol. I - Williams and Williams.	
6.	Srivastava, M.D.L and Srivastava, 1969. A text book of Invertebrate Zoology, U.S-Central Book Depot, Allahabad.	
7.	Verma, A. Invertebrates: Protozoa to Echinodermata. Narosa Publishing House Private Limited. 35-36 Greems Road, Thousand Lights, Chennai.	
Web Resources		
1.	https://www.nationalgeographic.com/animals/invertebrates/	
2.	https://bit.ly/3kABzKa	
3.	https://www.nio.org/	
4.	https://bit.ly/3lJdUX0	
Methods of Evaluation		
Internal Evaluation	Continuous Internal Assessment Test	
	Assignments	
	Seminars	
	Attendance and Class Participation	
		25 Marks
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		
CO 4			S	S	S	M		
CO 5			S					S

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

Course Code		APICULTURE			
U23ZOS11		L	T	P	C
		-	2	-	2
Cognitive Level	K2: Understand K3: Apply				
Learning objective	<ul style="list-style-type: none"> ➤ To gain knowledge about the honey bees, its life style and social behaviour. ➤ To learn apiculture, and recognize the list of honey bees ➤ To know the economic importance of bee products ➤ To understand the biological features of honey bee and economic importance and get self-employment. 				
Unit I	Introduction to Apiculture				
Introduction to Apiculture – Scope of Apiculture. Honey bee – Classification, types of honey bees – <i>Apis dorsata</i> , <i>Apis florea</i> , <i>Apis indica</i> and Dammer bee, Bee colony- function of members – Different kinds of cells, Bee hive and its architecture, communication in bees.					
Unit II	Bee colony				
Bee colony- function of members – Different kinds of cells, Bee hive and its architecture, communication in bees.					
Unit III	<i>Apis indica</i>				
<i>Apis indica</i> – social life in Indian honey bee. Morphology of Queen, Drones and Workers.					
Unit IV	Bee keeping				

Bee keeping – methods of bee keeping in India – Primitive hives – wall type, movable type, bamboo hive. Modern hives – long troth frame hive, Newtons hive. Appliances use in bee keeping.		
Unit V	Economic importance of bee products	
Economic importance of bee products – chemical composition, Nutritive value and medicinal uses of honey, bee wax, bee venom and disease of honey bees.		
Text Book	<ol style="list-style-type: none"> 1. Dr. N. Arumugam, Applied Zoology Saras Publication, Nagerkovil, 2014. 2. Ravindranathan K. R, A text book of Economic Zoology Dominant Publishers and distributors, New Delhi.2005. 	
Reference Book	<ol style="list-style-type: none"> 1. M. S. Nalina sundari, Entomology M. J. P Publications, Chennai, 2006. 2. Sharma P.L & Singh S. Hand book of Bee Keeping, Agrobios Publ, India, 2001. 3. Ravindranathan K. R. A text book of Economic Zoology. Dominant Publishing & distributors, New Delhi, 2005. 	
E-references	<ol style="list-style-type: none"> 1. http:// www.fao.org>docrep>pdf 2. http:// www.uaex.edu>special-programs>bee keeping 	
Course out come	Upon completion of this course, the students will be able to	
	CO	Course Outcomes
	CO1	comprehend the scope of apiculture and honey bees classification
	CO2	learn bee colony and different kinds of cells
	CO3	acquire the knowledge Apis indica and morphology of queen, drones and workers
	CO4	understand biological features of bee keeping
	CO5	know the nutritive value and economic importance to become potential entrepreneur
		Knowledge Level
		K2
		K2
		K2
		K2
		K3

Unit IV	Parasitic Nematodes		
Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of <i>Ascaris lumbricoides</i> , <i>Ancylostoma duodenale</i> , <i>Wuchereria bancrofti</i> and <i>Trichinella spiralis</i> . Study of structure, life cycle and importance of <i>Meloidogyne</i> (root knot nematode), <i>Pratylenchus</i> (lesion nematode)			
Unit V	Parasitic Arthropoda		
Biology, importance and control of ticks, mites, <i>Pediculus humanus</i> (head and body louse), <i>Xenopsylla cheopis</i> and <i>Cimex lectularius</i> . Parasitic Vertebrates - A brief account of parasitic vertebrates; <i>Cookicutter Shark</i> , <i>Candiru</i> , <i>Hood Mockingbird</i> and <i>Vampire bat</i>			
Text Books	<ol style="list-style-type: none"> 1. Arora, D. R and Arora, B. Medical Parasitology. II Edition. CBS Publications and Distributors.2001. 2. Parija, S. C. Textbook of medical parasitology, protozoology & helminthology (Text and colour Atlas), II Edition, All India Publishers & Distributors, Medical Books Publishers, Chennai, Delhi-1998 		
Reference Books	<ol style="list-style-type: none"> 1. Ahmed, N., Dawson, M., Smith, C. and Wood, Ed. Biology of Disease. Taylor and Francis Group.2007. 2. K. D. Chatterjee. Parasitology: Protozoology and Helminthology. XIII Edition, CBS Publishers & Distributors (P) Ltd.2009. 		
E-Reference	https://www.nature.com/subjects/parasitology#:~:text=Parasitology%20is%20the%20scientific%20discipline,host%20response%20to%20these%20agents.		
Course outcome	Upon completion of this course, the students will be able to		
	CO	Course Outcomes	Knowledge Level
	CO1	understand the general introduction about parasitism	K1
	CO2	know the morphological feature of parasites	K2
	CO3	comprehend the platyhelminthes parasitic life	K2
	CO4	acquire knowledge on nematode parasites	K2
	CO5	gain knowledge about vertebrate parasites	K2

SEMESTER – II

Course Code CC3	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
U23ZOT203	CHORDATA	Core	Y	-	-	-	4	4	25	75	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 (<i>Balanoglossus</i>), Urochordata (<i>Ascidia</i>), Cephalochordata (<i>Amphioxus</i>).							12	CO1, CO2		
II	Prochordates and Agnatha: Characteristics of subphylum vertebrata, Classification of Vertebrata upto Class level, Agnatha (<i>Petromyzon</i>), - Pisces (<i>Scoliodon sorrakowah</i>) 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 - <i>Rana hexadactyla</i> - 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 – (<i>Calotes versicolor</i> (<i>endoskeleton of Varanus</i>)) - 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: Ayes: General characters and classification – Type study - <i>Columba livia</i> - Origin of birds, Flight adaptations, Migration. Mammalia: General characters and classification - Type study - Rabbit - Adaptive radiation in mammals - Egg laying mammals, Marsupials, Flying mammals, Aquatic mammals, Dentition in mammals.	12	CO1, CO2, CO4, CO5
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.	
8.	Young, J. Z. (2004). The Life of Vertebrates. III Edition. Oxford university press.	
Web Resources		
1.	http://tolweb.org/Chordata/2499	
2.	https://www.nhm.ac.uk/	
3.	https://bit.ly/3Av1Ejg	
4.	https://bit.ly/3kqTfYz	
5.	https://biologyeducare.com/aves/	
6.	https://www.vedantu.com/biology/mammalia	
Methods of Evaluation		
Internal Evaluation	Continuous Internal Assessment Test	
	Assignments	
	Seminars	
	Attendance and Class Participation	
		25 Marks
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)

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
U23ZOP201	Practical in Invertebrata and Chordata	Core	Y	-	-	-	4	4	25	75	100
Learning Objectives											
CO1	To identify the different groups of invertebrate and vertebrate animals by observing their external characteristics.										
CO2	To understand the organs, organ system and their functions in animals.										
CO3	To know about the classification, adaptations and affinities of invertebrates and chordate animals.										
CO4	Able to dissect and display the internal organs and mount the mouthparts and scales of invertebrates and vertebrates										
UNIT	Details							No. of Hours	Course Objectives		
I	Major Dissection : Cockroach: Circulatory system, Nervous system, Reproductive system. Leech: Nervous System, Reproductive system. Earthworm: Nervous System, Reproductive system. <i>Pila globosa</i> : Nervous system. Prawn: Nervous system (including Appendages).							12	CO1		

	Chordata dissection: Frog (Demo)/ Fish: External features, Digestive system, Arterial system, Venous system, 5 th Cranial nerve, 9 th and 10 th cranial nerves, Male and female urinogenital system.		
II	Minor Dissection: Cockroach: Digestive system. Earthworm: Viscera, Lateral hearts. <i>Pila globosa</i> : Digestive system (Including radula). Freshwater Mussel: Digestive system.	12	CO2
III	Mounting: Earthworm: Body setae; Pineal setae. <i>Pila globosa</i> : Radula. Freshwater muscle: Pedal ganglia. Cockroach: Salivary apparatus, Mouth parts - Honey Bee, House fly and Mosquito mouth parts. Fish: Placoid and Ctenoid scales, Frog: Hyoid apparatus and Brain (Demo).	12	CO3
	Osteology: Frog: Skull and lower jaw, Vertebral column, Pectoral girdle, Pelvic girdle, Forelimb, Hindlimb. Chelonia - Anapsid skull, Pigeon - skull and lower jaw, synsacrum.		
IV	Mounting :	12	CO4
V	Spotters: (i). Protozoa: Amoeba, Paramoecium, Paramoecium Binary fission and Conjugation, Vorticella, Entamoeba histolytica, Plasmodium vivax (ii). Porifera: Sycon, Spongilla, Euspongia, Sycon - T.S & L.S, Spicules, Gemmule (iii). Coelenterata: Obelia – Colony & Medusa, Aurelia, Physalia, Velella, Corallium, Gorgonia, Pennatula (iv). Platyhelminthes: Planaria, Fasciola hepatica, Fasciola larval forms – Miracidium, Redia, Cercaria, Echinococcus granulosus, Taenia solium, Schistosoma haematobium (v). Nematelminthes: Ascaris (Male & Female), Dracunculus, Ancylostoma, Wuchereria (vi). Annelida: Nereis, Aphrodite, Chaetopteurs, Hirudinaria, Trochophore larva (vii). Arthropoda: Cancer, Palaemon, Scorpion, Scolopendra, Sacculina, Limulus, Peripatus, Larvae - Nauplius, Mysis, Zoea, Mouth parts of male & female Anopheles and Culex, Mouthparts of Housefly and Butterfly. (viii). Mollusca: Chiton, Pila,	12	CO5

	<p>Unio, Pteredo, Murex, Sepia, Loligo, Octopus, Nautilus, Glochidium larva (ix). Echinodermata: Asterias, Ophiothrix, Echinus, Clypeaster, Cucumaria, Antedon, Bipinnaria larva.</p> <p>SpecimenandSlides:(i) Hemichordata: Balanoglossus, Tornaria larva (ii). Protochordata: Amphioxus, Amphioxus T.S. through pharynx (iii). Cyclostomata: Petromyzon, Myxine, Ammocoetus larva (iv). Pisces: Sphyrna Pristis, Torpedo, Channa, Pleuronectes, Hippocampus, Exocoetus, Echieneis, Labeo, Catla, Clarius, Auguilla, Protopterus, Scales: Placoid, Cycloid, Ctenoid (v). Amphibia: Ichthyophis, Amblystoma, Siren, Hyla, Rachophous, Bufo, Rana, Axolotal larva (vi). Reptilia : Draco, Chamaeleon, Gecko, Uromastix, Vipera russelli, Naja, Bungarus, Enhydrina, Typhlops, Testudo, Trionyx, Crocodilus, Ptyas. (vii). Aves: Archaeopteryx, Passer, Psittacula, Bubo, Alcedo, Columba, Corvus, Pavo; Collection and study of different types of feathers: Quill, Contour, Filoplume, Down (viii). Mammalia: Ornithorhynchus, Tachyglossus, Pteropus, Funambulus, Manis, Loris, Hedgehog</p>		
	Total	60	
Course Outcomes			
Course Outcomes	On completion of this course, students will;		
CO1	Identify and label the external features of different groups of animals.	PO1	
CO2	Illustrate and examine the circulatory system, nervous system and reproductive system of invertebrate/vertebrate animals.	PO1, PO2	
CO3	Differentiate and compare the structure, function and mode of life of various groups of animals.	PO4, PO6	
CO4	To compare and distinguish the dissected internal organs of animals.	PO4, PO5, PO6	
CO5	Prepare and develop the mounting procedure of economically important invertebrates/vertebrates	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 and Adhikari, 2011. Biology of Animals: Volume I, New Central Book Agency; 3rd revised edition. 1008 pp.		
3.	Sinha, Chatterjee and Chattopadhyay, 2014. Advanced Practical Zoology, Books & Allied Ltd; 3rd Revised edition, 1070 pp.		
4.	Lal, S. S, 2016. Practical Zoology Invertebrate, Rastogi Publications.		
5.	Verma, P. S. 2010. A Manual of Practical Zoology: Invertebrates, S Chand, 497pp.		
References Books (Latest editions, and the style as given below must be strictly adhered to)			
1.	Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). <i>The Invertebrates: A New Synthesis</i> , III Edition, Blackwell Science.		
2.	Barnes, R.D. (1982). <i>Invertebrate Zoology</i> , V Edition. Holt Saunders International Edition.		
3.	Barrington, E.J.W. (1979). <i>Invertebrate Structure and Functions</i> . II Edition, E.L.B.S. and Nelson		
4.	Boradale, L.A. and Potts, E.A. (1961). <i>Invertebrates: A Manual for the use of Students</i> . Asia Publishing Home.		
5.	Lal, S.S. 2005. A text Book of Practical Zoology: Invertebrate, Rastogi, Meerut		
6.	Robert William Hegner, 2015. Practical Zoology, BiblioLife, 522pp.		
7.	Young, J.Z., 1972. The life of vertebrates. 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/		
	https://iinrg.icar.gov.in/		
	https://www.nationalgeographic.com/animals/invertebrates/		
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		
CO 4				S	S	M		
CO 5			S					S

S-Strong (3)

M-Medium (2)

L-Low (1)

Skill enhancement course

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	Externa l	Total
U23ZOS 23A	MEDICAL LABORATORY TECHNIQUES	SEC	Y	-	-	-	2	2	25	75	100
Learning Objectives											
CO1	To understand the different protocols and procedures to collect clinical sample.										
CO2	To explain the characteristics of clinical samples										
CO3	To demonstrate skill in handling clinical equipment.										
CO4	To evaluate the safety precautions while handling clinical samples.										
CO5	To evaluate the safety precautions while handling clinical samples.										
UNIT	Details							No. of Hours	Course Objectives		
I	Unit I Laboratory Safety and Human Health and Hygiene : Laboratory safety –toxic chemicals and biohazards waste- biosafety level- good laboratory practice – hygiene and health issue – physiology effect of alcohol, tobacco, smoking & junk food & its treatment - biomedical waste management.							6	CO1		
2	Unit II Haematology : Composition of blood and their function- collection of blood & lab procedure-haemopoiesis-							6	CO2		

	types of anaemia- mechanism of blood coagulation- bleeding time- clotting time- determination of hemoglobin- erythrocyte sedimentations rate- packed cell volume- Total count of RBC & WBC- Differential count WBC- blood grouping and typing- haemostasis- bleeding disorder of man - Haemolytic disease of newborn, Platelet count, reticulocytes count, Absolute Eosinophil count.		
3	Unit III Medical Microbiology and Instrumentation Techniques : Definition and scope of microbiology- structure and function of cells - parasites - Entamoeba- Plasmodium- Leishmania and Trypanosome- Computer tomography (CT scan) – Magnetic Resonance imaging – flowcytometry – treadmill test – PET.	6	CO3
4	Unit VI Medical Physiology : Cardiovascular system- Blood pressure - Pulse – regulation of heart rate, cardiac shock. Heart sounds, Electrocardiogram (ECG) – significance – ultra sonography- Electroencephalography (EEG).	6	CO4
5	Unit V Diagnostic Pathology : Handling and labelling of histology specimens - Tissue processing - processing of histological tissues for paraffin embedding, block preparation. Microtomes – types of microtome- sectioning, staining –staining methods- vital staining - mounting- problems encountered during section cutting and remedies - Frozen section techniques- freezing microtome.	6	CO5
	Total	30	
Course Outcomes	On completion of this course, students will;		
CO1	Understand protocols and procedures to collect clinical samples for blood analysis and to study human physiology.	PO1	
CO2	Explain the characteristics of clinical samples.	PO1, PO2, PO3	
CO3	Demonstrate skill in handling clinical equipment.	PO3, PO4, PO5	
CO4	Evaluate the hematological and histological parameters of biological samples.	PO2, PO3, PO5, PO6, PO8	
CO5	Elaborate the role of medical laboratory techniques in health care industry.	PO3, PO4, PO5, PO6, PO7, PO8	
Text Books			
1	Godker, P. B. and Darshan, P, Godker, 2011. Text book of medical Laboratory Technology, Mumbai.		
2.	Guyton and Hall, 2000. Text Book of medical Physiology, 10 th edition, Elseiner, New Delhi.		
3.	Mukerjee, K.L, 1999. Medical Laboratory Technology- Vol,I,II,III. Tata MC GrawHill, New Delhi.		
4.	Sood, R, 2009. Medical Laboratory technology, Methods and interpretation.		
References Books (Latest editions, and the style as given below must be strictly adhered to)			

1.	Manoharan,A, and Sethuraman, 2003. Essential of Clinical Heamatology, Jeyppee brothers, New Delhi.	
2.	Richard, A, McPherson, Mathew, R, Pincus, 2007. Clinical and management by laboratory methods, Elsevier, Philadelphia. Published by Tata McGraw-Hill Education Pvt. Ltd.,	
3.	Ochei. J., A. Kolhatkar (2000). Medical Laboratory science: Theory and practice, Published by Tata McGraw-Hill Education Pvt. Ltd, First edition	
Web Resources		
1.	https://bit.ly/3tUs8In	
2.	https://bit.ly/2XKu7mT	
3.	https://bit.ly/3hNS1EP	
4.	https://bit.ly/2ZgrLga	
5.	https://bit.ly/3hTBO1b	
Methods of Evaluation		
Internal Evaluation	Continuous Internal Assessment Test	25 Marks
	Assignments	
	Seminars	
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	

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.

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 as a cottage industry.

Unit – I

Biocomposting – Definition, types and ecological importance.

Unit – II

Types of Biocomposting technology – Field pits/ground heaps/ tank/large-scale/batch and continuous 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 Help Group (Income and employment generation).

Practical

- Preparation procedures for Biocompost pit.
- Selection of Biocompost material, separation of Compostable and Non-compostable materials.
- Packing and marketing of Biocompost.
- Field visit to Biocomposting unit.

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](http://1105.www.biogreenhouse.org).

SEMESTER – III

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
U23ZOT304	CELL BIOLOGY	Core	Y	-	-	-	5	5	25	75	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. Histological techniques - Staining - Vital Stains. – Cytoplasmic and Nuclear Stains. Micro Technique Methods, Microscopes - Types - Light, Phase contrast, SEM, TEM - Units of measurement.							12	CO1, CO2		
II	The Cell - Cell theory - Viruses -Types and Structure - Bacteria – Bacterial membrane - Ultra structure of Plant & 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 reticulum, 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 - Nucleolus Cycle - 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	To understand and recall the basic structure, origin and development of cell organelles.		PO1
CO2	To integrate and assess the biochemical, cytological and Histological tools to infer cellular basis of organization.		PO1, PO2, PO3
CO3	To analyze and differentiate organisms based on structure, composition and inter and intra cellular interactions.		PO3, PO4, PO5
CO4	To explain the role of cells and cell organelles in various Biological processes.		PO2, PO3, PO5, PO6, PO8
CO5	To construct and simulate the role of different cytological tools to explain the structure and complexity of cells and cell organelles.		PO3, PO4, PO5, PO6, PO7, PO8
Text Books (Latest Editions)			
1.	Ambrose, E.J. and Dorothy, M. Easty, 1970. Cell Biology, Thomas Nelson & Sons Ltd., 500 pp.		
2.	Kumar P. and Mina U. (2018) Life Sciences: Fundamentals and Practice, Part-I, 6th Edn., Pathfinder Publication. p.608.		
3.	VeerBala Rastogi, Introductory cytology. Kedar Nath Ram Nath. Meerut 250 001.		
4.	Verma, P.S. and V. K. Agarwal, 1995. Cell and Molecular Biology, 8th Edition, S.Chand & co., New Delhi - 110 055, 567 pp.		
5.	Verma P.S. and Agarwal V.K. (2016) Cell Biology (Cytology, Biomolecules, Molecular Biology), Paperback, S. Chand and Company Ltd.		
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	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		S	S	S	S			S
CO 3		S	S	S	S	S		S
CO 4		S	M			M		
CO 5				S	S	S		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
U23ZOT305	GENETICS	Core	Y	-	-	-	5	5	25	75	100
Learning Objectives											
CO1	To understand the structure and functions of nucleic acids in the cell.										
CO2	To know the causes and effects of mutations.										
CO3	To comprehend the importance of genetic variation in evolution.										
CO4	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 and Inheritance: Mendelian genetics: Mendelian experiments, laws of Mendel, Monohybrid, Dihybrid, back and test cross; Interaction of genes: Incomplete dominance, co dominance, complementary genes, supplementary genes, inhibiting genes, lethal genes and atavism. Inheritance: Polygenic inheritance - skin colour; multiple alleles - ABO blood groups and coat colour in rabbit; extra chromosomal inheritance - shell coiling, kappa particles; sex linked inheritance - eye colour in Drosophila, colour blindness and hemophilia in man.							12	CO1, CO2		
II	Linkage and Crossing Over: Linkage: Linked genes, complete and incomplete linkage. Crossing over: molecular mechanisms of crossing over, kinds of crossing over, models of recombination. Chromosome Mapping: inference and coincidence, haploid mapping, somatic cell hybridization.							12	CO1, CO2, CO4, CO5		

III	Cytogenetics: 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 - CIB method and muller-5 method.	12	CO1, CO2, CO3, CO4, CO5
IV	Human and Microbial Genetics: Human genetics: Karyotype and ideogram; sex determination - Barr body technique, drumstick method; chromosomal abnormalities in humans, Pedigree analysis; diagnosis of genetic abnormalities; Eugenics, Euphenics, and Euthenics. Population genetics and evolution: gene pool, gene frequency and genotype frequency; Hardy-Weinberg law of equilibrium. Unit 5: Bacterial genetics:	12	CO1, CO2, CO4, CO5
	Conjugation, transformation, transduction and chromosome mapping.		
V	Molecular Genetics: Insertion elements, transposable elements, retroelements; integrons and antibiotic resistance cassettes; the lactose system and operon model, tryptophanoperon, role and relative positions of promoters and operators, feedback mechanism.	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, PO5	
CO3	Analyse the causes of variations in genetic material and predict the effect in a population using different techniques.	PO2, PO3, PO4, PO5, PO6	
CO4	Explain the role of cellular processes and different genetic elements in the expression of genes.	PO2	
CO5	Compile the factors which contribute to changes in gene expression and specify the changes which contribute to evolution.	PO1, PO3, PO4, PO5, PO6, PO8	
Text Books (Latest Editions)			
1.	David E Sadava, 1993. Cell Biology - Organelle Structure and Function, Jones Bartlett Publishers.		
2.	Guptha G. K., 2013. Genetics Classical to Modern, Rastogi publishers, Meerut.		
3.	Lewin B., 2008. Genes IX, Jones and Bartlett publishers.		
4.	Veer Bala Rastogi., 2019. Text Book of Genetics, Medtech		
5.	Verma P.S and Agarwal V.K., 2006. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology, S. Chand & Company Ltd.		
Mother Teresa Women's University, Kodaikanal, 2018. Genetics, S. Chand & Company Pvt Ltd.			
References Books (Latest editions, and the style as given below must be strictly adhered to)			

1.	Cooper, Geoffrey M., 2018. The cell: A Molecular Approach, Eighth Edition, Oxford University Press.
2.	De Robertis, E. D. P and E.M.F Robertis, 2017. Cell and Molecular Biology 8 th Edition, LWW.
3.	Dobzhansky T., 1982. Genetics and The Origin of Species, Columbia University.
4.	Fletcher H and Hickey I., 2015. Genetics, IV Edition. GS, Taylor and Francis Group, New York and London.
5.	Gardner, Anne. 2009. Human Genetics, Scion Publishing Ltd.
6.	Klug, W. S., Cummings, M. R., Spencer, C. A., 2012. Concepts of Genetics. X

	Edition. Benjamin Cummings.	
7.	Lodish, Harvey, Arnold Berk <i>et al.</i> , 2007. Molecular cell biology. 6th edition, W. H. Freeman.	
8.	Russel, Peter J. 2013. iGenetics: A Molecular Approach, Pearson.	
9.	Strickberger M. W., 1995. Genetics, Prentice Hall India Learning Private Limited.	
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		
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		S	S		S			M
CO 3			S	S	S	S		S
CO 4		S						
CO 5		S	S	S	S	S		S

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

Course Code	U23ZOS34A	ANIMAL HUSBANDRY	L	T	P	C
			2	-	-	2
Learning objective	<ul style="list-style-type: none"> ➤ To understand knowledge about the animal husbandry ➤ To able to Select and identification of breeding animal for livestock ➤ To able to Formulate feed rations for different classes of livestock ➤ To able to Formulate feed rations for different classes of livestock. ➤ Understand the importance of genetic improvement in animal production. ➤ Identify current and future issues relating to animal husbandry. 					
UNIT – I	Introduction to Animal Husbandry					
<p>General Introduction of animal Husbandry- Different Categories of Animals- Importance of domestic animals- scope and Role of livestock and their products in Indian economy and human health, current livestock programmes and policies of State and Nation – Economics of dairy, sheep, goat, poultry, pig and rabbit farming; constraints to the livestock development programs, common offences against animals.</p>						
UNIT – II	Livestock management					
<p>Common terms used in Animal Husbandry – Identification of age of animals – Livestock and poultry breeds and breed characters; housing systems, and requirements of space, ventilation, water, sanitation and waste disposal.</p> <p>Management of milk, meat, egg and wool producing livestock, breeding bulls and draft animals and wild animals in captivity, farm records and their maintenance, systems and strategies for livestock improvement for enhancing productivity.</p>						
UNIT – III	Livestock nutrition					
<p>Nutritional terms and definitions – Role of nutrition in health and production; classification and composition of feed and fodders including forest grasses; anti- nutritional factors and toxins in feeds and fodders; feeding standards and nutrient requirements of different categories of livestock / poultry and computation of rations.</p> <p>Nutritional deficiency and its influence on livestock performance; feed supplements and additives; conservation and preservation of feed and fodders; economic utilization of agro by-products for feeding livestock – Utilization of unconventional feeds.</p> <p>Quality control of feed, feed block/baling, By-Pass Proteins and by-pass Fat, Feeding livestock during scarcity, Metabolic disorders in Livestock and Poultry, Processing of feeds and forage to improve nutritive value.</p>						
UNIT – IV	Livestock breeding and genetics					

<p>Important breeds of cattle, buffalo, sheep, goat, pig and poultry with special reference to economic characters – Important species of wild animals and their breeding in captivity. Selection of Livestock for production, reproduction and disease resistance traits. Principles of genetics and basis of population genetics, genetic parameters. Nature of DNA and RNA-their models and functions; applications of recombinant DNA technology, cloning and marker Assisted selection and Cytogenetics. Animal breeding policies and programmes in state and Nation.</p>	
UNIT –V	Pathology and parasitology
<p>Concept and causes of diseases in animals; general principles and procedures of necropsy; collection, preservation and dispatch of morbid materials for laboratory diagnosis, disease investigation; common pathological conditions seen in domestic animal.</p> <p>Classification of Parasites – Parasite and parasitism in animals; important morphological features, life-cycles, mode of transmission, pathogenesis, diagnosis, chemotherapy and general control measures of parasites associated with disease in animals, birds and zoo animals.</p> <p>Drug action – Pharmacokinetics (absorption, distribution, biotransformation and excretion), Pharmacodynamics – local and general anesthetics. Antibiotics and chemotherapy – Toxicology - Ethnoveterinary practices.</p>	
Text Books	<ol style="list-style-type: none"> 1. Handbook of Animal Husbandry, by Aruna T. Kumar (2008). 2. Handbook of Animal Husbandry , ICAR, Indian Council of Agricultural Research, 1977
Reference Books	<ol style="list-style-type: none"> 1. A Textbook of Animal Husbandry by G.C Banerjee. Oxford & IBH Publishing, New Delhi

Course Code	U23ZOS34B	AQUACULTURE			
	IV	L	T	P	C
		2	-	-	1
Cognitive Level	K1:Recall	K2:Understand	K3:Apply		
Learning objective	<ul style="list-style-type: none"> ➤ To understand the importance and scope of aquaculture ➤ To gain knowledge in the cultivable fishes and its economic importance ➤ To understand the Preparation of pond, methods of fish cultures and Diseases Manegment. ➤ To gain knowledge Fish breeding techniques ➤ To Provide in depth knowledge on fish preservation and transport technique. 				
UNIT – I	Introduction to Aquaculture:				
Aquaculture - History and present status in India, Types of aquacultures, Cultivable species of fishes and their qualities. Types of fish ponds, Culture of Live feed organisms - Rotifers and Artemia.					
UNIT – II	Types of cultures:				
Types of cultures - Extensive, semi-intensive and intensive culture, Composite fish culture, integrated fish farming - Carps in inland waters, Site selection, Pond construction, pond preparation. Seaweed culture, culture of prawns, pearl oyster culture.					
UNIT – III	Water quality management and Diseases Control:				
Water Quality Management, Fish feed - feed ingredients, feed formulation. Control of predatory organisms, Pathology - Parasitic infection, Diseases of fishes and prawns and their control measures					
UNIT – IV	Fish Breeding:				
Hypophysation or Induced breeding in carps, Hybrid fish, Transgenic fish, Techniques for hatching and spawning, Seed transport and Stocking. Transport of fry and fingerlings. Government participation in aquaculture - CMFRI, CIFRI, MPEDA, FFDA.					
UNIT – V	Preservation techniques:				
Methods of Harvesting - Fishing gears and crafts, Freezing techniques, Canning, Smoking, Fish by - products - fish meal, fish oil and fish pickle. Marketing - Export and Import countries, Quality control.					
Text Books	<ol style="list-style-type: none"> 1. Arumugam, Aquaculture, Saras Publications,2014. 2. K.Pandey & J.P.Shukla, Fish and Fisheries, Rastogi Publication,2016. 3. Pillay, T.V.R., Kutty, M.N., 2005. Aquaculture principles and practices, Wiley publications, India. 3. Jayaraman K.C. 2010. The Fresh water fishes of Indian Region - Navendra Publishing House, Delhi. 				

Reference Books	<ol style="list-style-type: none"> 1. Das. M.K. and R.K. Das .Fish and fisheries in India- Diagnosis and control inland Fisheries Society of India, Barrack pore, west Bengal,2011 2. Govindan, T.K.Fish Processing Technology. Oxford & IBH Publishing Co. Pvt.Ltd.,Kolkata.2010 .
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E-References	<ol style="list-style-type: none"> 1. https://www.mooc-list.com/course/oceanography-key-better-understand-our-world-coursera 2. https://igor.crew.c-base.org/aquaculture.pdf 3. http://www.agrifs.ir/sites/default/files/AQUACULTURE.pdf 4. https://www.cabi.org/uploads/CABeBooks/CAB-eBooks-Col-Aquaculture-and-Fisheries.pdf 5. https://www.blackwellpublishing.com/pdf/catalogue_2007_online_aquaculture.pdf
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Course Outcome	Upon completion of this course, the students will be able to
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CO	Course Outcomes	Knowledge Level
CO1	Understand the ideal cultivable fishes and the importance of live feed in aquaculture.	K1
CO2	Elucidate the types of Culture systems and construction of pond.	K3
CO3	Manage water quality, feed formulation, and disease control.	K2
CO4	Apply modern breeding methods and identify the Govt. institutions for aquaculture development	K2
CO5	Establish own aqua farm with the knowledge on preservation methods. marketing strategy for fishery products and value added products in aquaculture	K3

SEMESTER -IV

Course Code	Course Name	L	T	P	S	P	·	π	Marks
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	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 morphogens.	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
Text Books (Latest Editions)		
1.	Lewis Wolpert 2007. Principles of development, 3rd edition, Oxford University Press, New Delhi, India	
2.	Subramoniam, T. 2003. Developmental Biology, Narosa Publishing House, New Delhi, India.	
3.	Verma, P.S., Agarwal, V. K.2010.Chordate Embryology: Developmental Biology, S. Chand & Company, New Delhi., India.	

References Books (Latest editions, and the style as given below must be strictly adhered to)	
1.	Gilbert S.F. 2010. Developmental Biology, Sinauer Associates, Massachusetts, USA.
2.	Balinsky, B.I. 1970. Introduction to Embryology, Philadelphia & London, UK.
3.	Berril, N.J.1971. Developmental Biology, McGraw Hill, New York, USA.
4.	Russ Hodge 2010. Developmental Biology, Facts on File, Inc., New York, USA.
5.	Carlson, Bruce, M. 2009. Human embryology and Developmental Biology, Elsevier, Philadelphia, USA
Web Resources	
	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/	
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		
CO 4				S	S	M		
CO 5			S					S

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

Course Code	Course Name	L	T	P	S	P	H	Marks
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CC1										CIA	External	Total
U23ZOP402	Practical in Cell Biology, Genetics and Developmental Biology	Core	Y	-	-	-	5	5	25	75	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 and genetic experiments in an accurate and meaningful manner.											
CO5	To gain knowledge about different stages of frog embryo, Chick											
UNIT	Details	No. of Hours	Course Objectives									
I	Cell Biology: 1. Preparation and Identification of slides of Mitotic divisions with onion root tips. 2. Buccal epithelium (Barr body) preparation. 3. Preparations of human blood smear. 4. Polytene Chromosomes in Chironomous larva. Spotters: Identification and study of different stages of Mitosis and Meiosis.											
II	Counting of RBC & WBC Model – Mitochondria, Double stranded DNA, RNA & Nucleus. Spotters – Sphygmomanometer, RBC, WBC											
III	Genetics: Staining and observation of polytene chromosomes in salivary glands of chironomous larva. Karyotyping (with the help of photographs) – normal male and female karyotypes and study of karyotypes of different genetic syndromes. Verification of the Mendelian laws of inheritance using coloured beads. Observation on genetic traits.											
IV	DEVELOPMENTAL BIOLOGY: 1. Chick blastoderm mounting											
Mother Teresa Women's University, Kodaikanal												

	i) 24 Hrs ii) 72 hrs iii) 96 hrs 3. Placental types – Diffuse, Cotyledonary, Discoidal and Zonary		
V	Frog Embryo – 2 cell, 4 Cell, 8 Cell stage Blastula of frog, Gastrula of Frog, Yolk plug stage		

SKILL ENHANCEMENT

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	Externa	Total
U23ZOS 45A	SERICULTURE	SEC	Y	-	-	-	2	2	25	75	100
Learning Objectives											
CO1	To know the history and socio-economic aspects of sericulture.										
CO2	To understand the classification and morphology of silkworm.										
CO3	To obtain the knowledge about the description of Mulberry cultivation and pest management										
CO4	To attain the knowledge about the disease management in sericulture.										
CO5	To understand the methodology followed for the reeling and rearing of sericulture										
UNIT	Details							No. of Hours	Course Objectives		
I	Unit I : Sericulture History Origin and History of sericulture-environmental impacts - Advantages and characteristics - current status of sericulture in India. National Sericulture Project (NSP) - Future scope of sericulture.							6	CO1		
2	Unit II : Biology of Mulberry and Planting Biology of Mulberry- Description and Eco-Mulberry cultivation in India - Selection of land and cultivation of mulberry –Mulberry varieties- Different methods of planting – Organic and in organic manure application. Mulberry pest Management- (Mealy bug – Maconellicoccushirsutus), (hairy caterpillar- Spilosomaobliqua) – (Stem griddler-Stheniasgrisator) : Preventive and control Measures							6	CO2		
3	Unit III Silk worm Taxonomy and Classification Silkworm taxonomy, Classification of silk worms based on number of larval Moults, Moultnism and Voltinism – Tasar, Muga, and Eri. Morphology and life cycle of silk worm (Bombyx mori) and organization of larvae, Pupae and Moth- Structure of the silk gland and importance.							6	CO3		
4	UNIT IV: Farming and Disease Management: Silkworm rearing house models-Disinfection of rearing houses and							6	CO4		
<p style="text-align: center;">Mappila Thoresa Women's Empowerment, Kudlikumbath 624 10E Egg handling –</p>											

	Hatching –Brushing, Silk worm Pests- Uzi fly, Ants and Demisted Beetles- diseases- Bacterial (Flecherie)-fungal (Muscardine) and viral (Grasserie) diseases of silk worm and its preventive measures.		
5	UNIT V: Reeling and Rearing Technologies: Reeling methods – Reeling and Re-reeling –Silk examination, cleaning, lacing, book making and grading of silk. Rearing of silkworm-Chawki rearing or young age worm rearing- Harvesting of cocoon (stifling, storage and sorting) and quality assessment.	6	CO5
	Total	30	

Course Outcomes	On completion of this course, students will;		
CO1	Describe the economic impacts and income generation by sericulture.	PO1	
CO2	Educate the students about the basic biology of Mulberry culture.	PO1, PO2, PO3	
CO3	Expertise in the taxonomy, morphology and life cycle of the silkworm.	PO3, PO4, PO5	
CO4	Relate the strategies involved in the sericulture management system	PO2, PO3, PO5, PO6, PO8	
CO5	Acquired the knowledge about the technologies in sericulture	PO3, PO4, PO5, PO6, PO7, PO8	
Text Books			
1	Applied Zoology by Dr. N. Arumugam, T. Murugan, J, Johnson Rajeshwari, R. RamPrabhu, Saras Publication, 2010.		
2.	G. Ganga & J. Sulochana Chetty, 1997. An introduction to sericulture (Oxford & IBH publ.Co.Pvt. Ltd.)		
3.	Hand Book of Practical Sericulture by Ullal and Narsimhanna. CSB. Bangalore		
References Books (Latest editions, and the style as given below must be strictly adhered to)			
1	Charsley, S.R. (1982). Culture And Sericulture. Academic Press Inc., NewYork, U.S.A		
2.	Rangaswamy .G. (1987) .Manual on sericulture FAO, Vol –IV, Agriculture service bulletin ,CSB ,Bangalore , India .		
3	Dandan.S.B. (2004),Hand book of new sericulture technologies ,Central Silk Board Bangalore,pp 287.		
4	Mahadeveppa, D., Halliyal, V.G., Shankar, A.G. and Bhandiwad, R. (2000), Mulberry Silk ReelingTechnology, Oxford and IBH Publishing Co. PVT. Ltd. New Delhi.		
Web Resources			
1.	https://jncollegeonline.co.in/attendance/classnotes/files/1627051363.pdf		
2.	https://www.davuniversity.org/images/files/study-material/SERICULTURE%20PDF.pdf		
3.	https://egov.uok.edu.in/elearning/tutorials/1011020512BR15103CR15Apiculture%20Lac%20culture%20and%20sericultureapiculture%20lac%20culture%20and%20sericulture%20upload.pdf		
4.	https://agritech.tnau.ac.in/sericulture/disease%20mgt_silkworm.html		
5.	https://www.slideshare.net/MUNESHSEN/sericulture-post-cocoon-technology-processing-of-cocoons		
Mother Teresa Women's University, Kodaikanal – 624 101			
Methods of Evaluation			
49			

Internal Evaluation	Continuous Internal Assessment Test	25 Marks
	Assignments	
	Seminars	
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		S	S	S	S			S
CO 3		S	S	S	S	S		S
CO 4		S	M			M		
CO 5				S	S	S		S

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

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	Externa	Total
U23ZOS45 B	POULTRY FARMING	SEC	Y	-	-	-	2	2	25	75	100
Learning Objectives											
CO1	To explore the cultivation of poultry										
CO2	To understand the methodology of construction of poultry house										
CO3	To create the aware the students for about the poultry disease and its treatment										
CO4	To make the learner well aware of various methods in Poultry Science and its management.										
CO5	To train the students to undertake Poultry farming as income source										
UNIT	Details							No. of Hours	Course Objectives		
I	Unit I : Introduction to poultry science - Poultry Development in India. Nomenclature of breeds of fowl, classification of fowls, selection of breed for poultry. Housing and equipment - General principles of building poultry sheds. Deep litter system and cages system.							6	CO1		
2	Unit II : Brooding and rearing - Selection and care of hatching Eggs. Methods of brooding. Management of Growers, Layers and Broilers - Lighting of chicks, growers, and layers; Summer and winter management. Debeaking methods, Schedule of vaccination.							6	CO2		
3	Unit III Poultry Nutrition - Feed additives - Names, allowance and usage of food additives - Modern Feed additives for poultry. Feed making machines- Feed for Broiler and Layer.							6	CO3		
4	UNIT IV: Short account on cause, symptoms, prevention, control and treatment of viral, bacterial, fungal and parasitical diseases. Disease and Safety control in farms.							6	CO4		
5	UNIT V: Nutritive value of egg and Meat, factors affecting egg size, Abnormal Eggs, storage and preservation of surplus eggs. Economics of Poultry industry.							6	CO5		
Total							30				
Course Outcomes											
On completion of this course, students will;											51

CO1	Distinguish the different breeds of fowl in Industry and Construct and design the poultry shed and equipment's needed for rearing. 2.	PO1
CO2	Choose the Breeds for Poultry.	PO1, PO2, PO3
CO3	Understand the feeding schedule and production of feeds with machinery equipment.	PO3, PO4, PO5
CO4	Identify and assess the damages caused by the diseases and manage the situation with control measures.	PO2, PO3, PO5, PO6, PO8
CO5	Analyse the marketing demands for poultry products and meet out the demands	PO3, PO4, PO5, PO6, PO7, PO8
Text Books		
1	Banerjee, G.C., 1992, A textbook of animal husbandry, Oxford and IBM Publishing Co., New Delhi.	
2.	2. Gnanamani, M.R., 2010, Modern Aspects of Commercial Poultry Keeping, Deepam Publications, Madurai.	
3.		
References Books (Latest editions, and the style as given below must be strictly adhered to)		
1	Sunil Kumar Das, 1994, Poultry production, CBC Publishers and Distribution, Delhi.	
2.	2. Shukula, G.S. and Upadhyay, V.B., 1997, Economic Zoology, Rakesh Rastogi Publication, Meerut.	
3	3. Indian Poultry Industry year book 1975-76. By Sakuntbak B. Gupta, C-35, New Bactak Road, New Delhi.	
Web Resources		
1.	https://unacademy.com/content/cbse-class-12/study-material/biology/poultry-farm-management/	
2.	https://www.geeksforgeeks.org/poultry-farming/	
3.	https://www.academia.edu/43806750/INTRODUCTION_TO_POULTRY_FARMING	
4.	https://www.biologydiscussion.com/farming/poultry-farming-meaning-poultry-housing-and-brooding/24296	
5.		
Methods of Evaluation		
Internal Evaluation	Continuous Internal Assessment Test	25 Marks
	Assignments	
	Seminars	
External Evaluation	End Semester Examination	75 Marks
	Total	100 Marks
Methods of Assessment		
Recall (K1)	Simple definitions, MCQ, Recall steps, Concept definitions	
Understand/	MCQ, True/False, Short essays, Concept explanations, Short summary or overview	
Comprehension	Resa Women's UNiversity, Kodaikanal – 624 101	

end (K2)	
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		S	S	S	S			S
CO 3		S	S	S	S	S		S
CO 4		S	M			M		
CO 5				S	S	S		S

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

SEMESTER – V

Course Code CC9	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
U23ZOT507	ANIMAL PHYSIOLOGY	Core	Y	-	-	-	4	5	25	75	100
Learning Objectives											
CO1	To familiarize students with the principles and basic facts of Animal Physiology										
CO2	To give students an insight about the molecular and cellular basis of physiological functions in animals.										
CO3	To give an idea about the regulation of organ system functions in a whole animal using a conceptual model of feedback to explain homeostasis.										
CO4	To make the students aware about how the structure-function relationships and its synchronization with the molecular signals.										
UNIT	Details							No. of Hours	Course Objectives		
I	Nutrition & Respiration Nutrition: Digestion and absorption of carbohydrates proteins and lipids. Minerals & Vitamins–their deficiency. Hormonal control of digestion. Respiration: Types of Respiratory organs in animals, Respiratory organ of Man, Respiratory pigments-structure of Hemoglobin, Transportation of gases – Boher Effect-Regulation of respiration-bronchitis, asthma -Physiological effects of smoking							12	CO1		
II	Circulation & Excretion Blood- composition and functions, Mechanism of clotting. Types of Hearts – Heartbeat and its regulation -pace maker – Cardiac cycle – ECG - Pulse and blood pressure. Nephron structure & mechanism of urine formation, Regulation of acid base balance, Excretory products, Osmoregulation in fishes.							12	CO2		

III	Muscle & Nerve Physiology Types of muscles – Ultrastructure of striated muscle, Muscle contraction & properties, Neurons–structure & types – Impulse propagation, synaptic transmission, neurotransmitters - Reflex action, Nerve disorders – epilepsy, Alzheimer’s disease, Parkinson’s disease.	12	CO3
IV	Sense Organs: Structure of eye, physiology of vision, visual elements and pigments, photo chemistry of vision - Eye defects – myopia, hyperopia, presbyopia, astigmatism, cataract - Structure of ear and mechanism of hearing - Hearing impairments – deafness, labyrinthine disease - Olfactory, gustatory and tactile sense organs	12	CO4
V	Reproductive Physiology Endocrine glands in man - Hormones, action and disorders - Feed-back mechanism, Outlines of mechanism of hormonal activity. Puberty, adolescence, pregnancy, parturition, lactation and birth control.	12	CO5
Total		60	
Course Outcomes			
Course Outcomes	On completion of this course, students will;		
CO1	Be able to explain how the various organ systems are coordinated and controlled.	PO1	
CO2	Be able to list the functions of various organs in relation to physiological process.	PO1, PO2	
CO3	be able to develop the idea of multi-level controlling and feedback mechanism in relation to various physiological functions.	PO4, PO6	
CO4	Be able to understand the basic physiological process related to adaptation, metabolism and major requirements.	PO4, PO5, PO6	
CO5	be able to correlate and understand human physiology.	PO3, PO8	
Text Books (Latest Editions)			
1.	Agarwal R A., Anil K Srivastava., Kaushal Kumar.,1978. Animal Physiology and Biochemistry, S. Chand & Co. Ltd., New Delhi Publishing., 377 pp.		
2.	Ambika Shanmugam, 2001. Fundamentals of Biochemistry for Medical students, Karthik Offset Printers, Chennai, 590pp		

3.	Berry A.K.1998. A text book of Animal Physiology and Biochemistry. Emkay Publications, New Delhi, 320 pp.
4.	Parameswaran, Ananta krishnan and Ananta Subramanian, 1975. Outlines of Animal Physiology, S. Viswanathan (Printers & Publishers) Pvt. Ltd., 329 p p.
5.	Verma P.S., Tyagi B.S & Agarwal V.K., 2010. Animal Physiology, S. Chand & Co. Ltd., New Delhi Publishing., 417 pp.

Web Resources		
1.	https://microbenotes.com/category/biochemistry/	
2.	https://www.stem.org.uk/resources/collection/3931/animal-physiology	
3.	https://animalphys4e.sinauer.com	
4.	https://nptel.ac.in/courses/102/104/102104042/	
5.	https://biochem.oregonstate.edu	
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	

References Books	
1.	Guyton, A.C. and Hall, J.B., 2011. Text Book of Medical Physiology, 9th Edition, W.B. Sanders Company, Prism Books (Pvt.) Ltd., Bangalore., 1064 pp.
2	Ganong, W.F., 2019. Review of Medical Physiology, McGraw Hill, New Delhi., 340 pp.
3	Hill, W.R., Wyse, G.A and Anderson, M. 2016. Animal Physiology (4thedn). Sinauer Associates is an imprint of Oxford University Press; USA, 828 pp.
4	Hoar, W.S. 1983. General and Comparative Physiology. Prentice Hall of India, New Delhi, 928 pp.
5	Prosser C.L., 1985. Comparative Animal Physiology, Satish Book Enterprise, Agra - 282 003, 966 pp.
6	Sarada Subrahmanyam, Madhavan Kutty, K., & Singh H.D., 2018. Text Book of Human Physiology, S. Chand & Co, New Delhi.
7	Singh, H.R and Kumar, N. 2017. Animal physiology and biochemistry, Vishal publishing company, Jalandhar, 864 pp.
8	Sreekumar, S. 2010. Basic physiology, PHI learning private ltd., New Delhi.210 pp
9	Tortora G.J. & Derrickson B., 2016. Principles of Anatomy and Physiology, John Sons, Inc. 1232 pp.
10	Wood, D.W., 1968. Principles of Animal Physiology, Edward Arnold Ltd, London., 342 pp.

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		
CO 4				S	S	M		
CO 5			S					S

S-Strong (3)

M-Medium (2)

L-Low (1)

Course Code CC15	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
U23ZOT 508	MICROBIOLOGY	Core	Y	-	-	-	4	5	25	75	100
Learning Objectives											
CO1	To become familiar with the foundation concepts of history of Microbiology										
CO2	To understand the structure and functions of a typical prokaryotic cell										
CO3	To gain the knowledge of microscopy and staining concepts										
CO4	To understand and implement disposal and safety measures										
UNIT	Details							No. of Hours	Course Objectives		
I	Introduction to microbiology History, scope of microbiology. Contribution of Leeuwenhoek, Jenner, Pasteur, Koch, Fleming, Iwanowsky, Waksman, Luria, M. J. Thirumalachar, Subba Rao, Sambhu Nath De. Systematic position: 5 kingdom classification of Whittaker and 3 kingdom classification of Carl Woese. Comparison of Bacteria, Archaea, Eukarya (tabular and diagrammatic). Controlling microbes.							12	CO1		
II	Microscopy							12	CO2		

	<p>i) Principles of microscopy</p> <p>ii) Compound microscope (Monocular and Binocular microscopes) – construction and function of parts, ray diagram of path of light, objectives, oculars, condensers, sources of illumination and uses.</p> <p>iii) Dark field, Phase contrast and Fluorescence microscopes, Confocal microscopes, Atomic Force Microscope - principle, construction, ray diagram and applications</p> <p>iv) Electron microscopy – TEM and SEM – principle, construction, ray diagram and uses.</p>		
III	<p>Introductory Mycology</p> <p>i) General characteristics and outline classification of fungi, Morphology of some common fungi - Mucor, Rhizopus, Aspergillus, Penicillium and Fusarium.</p> <p>ii) Yeasts: General characteristics and outline classification of yeasts</p> <p>iii) General characteristics of Lichens and Mycorrhiza.</p> <p>vi) Micosporum.</p>	12	CO3
IV	<p>Introductory Bacteriology</p> <p>Classification of bacteria. Anoxygenic photosynthetic bacteria: general characteristics of purple bacteria and green bacteria. Oxygenic photosynthetic bacteria: General characteristics of Cyanobacteria – external and internal features, physiology and ecology. Magnetotactic bacteria (MTB)- General characteristics, Magnetosomes, Enrichment and isolation of Magnetotactic bacteria. Types of staining.</p>	12	CO4
V	<p>Introductory Virology</p> <p>Virus Structure and Classification. Virus Entry and Viral Pathogenesis. Positive-strand</p> <p>RNA viruses: Picornaviruses, Flaviviruses, Togaviruses, Coronaviruses. Negative-strand and double-strand RNA viruses: Paramyxoviruses, Rhabdoviruses, Filoviruses, Bunyaviruses, Orthomyxoviruses and Reoviruses.</p> <p>DNA viruses: Parvoviruses, Polyomaviruses, Papillomaviruses, Adenoviruses and Baculoviruses, Herpes viruses and Poxviruses.</p>	12	CO5

	Total	60
Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	To understand history, relevance of microbiology and classification of bacteria	PO1
CO2	To understand the working of various microscopes and their application	PO1, PO2
CO3	To gain knowledge of various (physical and chemical) methods of control of microorganisms and safety measures to be followed while handling microbes	PO4, PO6
CO4	To understand the structure of bacterial cells, its organelles, physiology and behaviour.	PO4, PO5, PO6
CO5	To learn different methods of staining bacteria and demonstrate proficiency in handling aseptic bacteriological specimen.	PO3, PO8

Text Books (Latest Editions)

Aneja K.R., Experiments in Microbiology, plant pathology, Tissue culture and Mushroom Cultivation, New Age International, New Delhi.

Atlas R.M., Microbiology – fundamentals and applications, Macmillan Publishing Company, New York.

Ravindra Nath, Fundamentals of Biology Courses for Biotechnology, - Vol.1, Special Bangalore University edition, Kalayani Publishers.

Greenwood D, Richard CD, John S and Peuther F (1992). Medical Microbiology, 16th edition. ELBS, Churchill living stone.

References Books

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

Alexopoulos C.J. and Mims C.W., Introductory Mycology, New Age International, New Delhi.

Thomas M. Bell, 1965. An Introduction to General Virology, William Heinemann Medical books, London.

Stanier R.Y., Ingraham J.L., General Microbiology, Prentice Hall of India Private Limited, New Delhi.

Salle A.J., Fundamental Principles of Bacteriology, Tata McGraw – Hill Publishing Company Limited, New Delhi.

Pelczar .J. Chan E.C.S. and Krieg N.R., Microbiology, McGraw Hill Book Company, New York.

Benson Harold J, Microbiological Applications, WCB McGraw – Hill, New York.

Mother Teresa Woman's University, Kodaikanal - 624 101
Brock T.D. and Madigan M.T., Biology of Microorganisms, Prentice Hall of India Private Limited.

Collins CH, Patricia M, and Lyne JM (1995). Collins and Lynes Microbiological Methods 7th edition. Grange, Butter Worth, Oxford.

Cappucino JG and Sherman N (1996). Microbiology, A Laboratory Manual 4th edition. Benjamin Cumings Inc. California.

Pelczar MJ, Chan ECS and Krieg NR (1993). Microbiology 5th edition, Tata McGraw Hill.

Madigan MT, Martinko JM and Parker J (2012). Brock Biology of Microorganism, 11th edition Prentice Hall International Inc. London.

Web Resources		
1.	https://vlab.amrita.edu/?sub=3&brch=73	
2.	https://learn.chm.msu.edu/vibl/	
3.	https://mvi-au.vlabs.ac.in/	
4.	https://virtuallab.tlc.ontariotechu.ca/intro.php	
5.	https://www.merlot.org/merlot/viewMaterial.htm?id=79694	
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		
CO 4				S	S	M		
CO 5			S					S

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

Course Code	U23ZOT50 9	BIOCHEMISTRY AND IMMUNOLOGY	L	T	P	C
CORE	11		5	-	-	4
Cognitive Level	K2:Understand K3:Apply					
Learning objective	<ul style="list-style-type: none"> ➤ To know the structure and properties of biomolecules. ➤ To understand the role of carbohydrates, Protein and lipids ➤ To study the different metabolic cycles ➤ To provide the knowledge of auto immune diseases ➤ Acquire the knowledge to understand the science of immunology for the new invention of vaccine for some deadly diseases. 					
Unit I	Introduction to Biomolecules:					
Biomolecules - Introduction and bonding –Strong and weak bonds– pH and buffers. Acid-Base balance, Buffer Electrolytes, isotopes, isomerism. Biologically important chemical bonds and their importance.						
Unit II	Carbohydrates					
Carbohydrates – Classification structure, Biological importance, carbohydrate metabolism – Glycolysis, TCA, Cycle, Glycogenesis, glycogenolysis gluconeogenesis, HMP Shunt pathway						
Unit III	Amino acids and Lipids					
Structure and properties of Amino acids – Zwitterions. Protein classification. Properties and importance's – Level of Organization. Classification, properties and biological importance, Enzymes- Classification and mechanism of action, Factors affecting enzyme action, enzyme inhibition						
Unit IV	Introduction of Immunology					
History and scope of immunology Immunity – Types of Immunity – Innate and acquired, passive and active. Lymphoid organs – primary and secondary (Thymus, Bone Marrow, Bursa of fabricius, spleen, tonsil, lymph node, Payer's patches).						
Unit V	Immunology – Structure and Function:					
Immunoglobulin structure and function, biological properties of Ig classes. Interaction of antigen and antibody, complement activation. Immunopathology: - Major histocompatibility complex and its significance. HLA. Hypersensitivity - Types of hypersensitivity. AIDS and immunity. Type of receptors PRR Pans						
Text Books	<ol style="list-style-type: none"> 1. Ambika Shanmugam, Fundamentals of Biochemistry for Medical students, Published by the Author, Madras. 2012, 2. Rastogi, S.C. Biochemistry, 3rd Edition Tata Mc Graw Hill Edition, New Delhi. 2010. 					
<i>Mother Teresa Women's University, Kharagpur</i>	Rastogi publication, Meerut, 2016.					62

	<ol style="list-style-type: none"> 4. Ananda narayanan, T. and Jayram Paniker, C.K., Textbook of Microbiology, 6th Ed. 5. Orient Longman Ltd., Chennai. 2010. 6. Kannan, I., Immunology, MJP publishers, Chennai. 2011. 																		
Reference Books	<ol style="list-style-type: none"> 1. Harpers Illustrated Biochemistry, 30th Edition The McGraw- Hill Education, 2011. 2. Immunology & Immunotechnology, Ashim K. Chakravarth, Published in India by oxford university press, Jai Singh Road, New Delhi. 2006. 3. Arora, M.P. Immunology, Ane Books Pvt. Ltd., New Delhi, 2010. 4. Immunology & Immunotechnology, Ashim K. Chakravarth, Published in India by oxford university press, Jai Singh Road, New Delhi. 2006. 																		
E-References	<ol style="list-style-type: none"> 1. https://labscientists.files.wordpress.com/2017/12/microbiology-immunology-1.pdf 2. http://lib.rudn.ru/file/Immunology Microbiology Catalogue eBook.pdf 3. https://www.moscomm.org/pdf/Ananthanarayan%20microbio.pdf 4. https://alraziuni.edu.ye/book1/Laboratories/microbiology%20immunology.pdf 																		
Course outcome	Upon completion of this course, the students will be able to																		
	<table border="1"> <thead> <tr> <th>CO</th> <th>Course Outcomes</th> <th>Knowledge Level</th> </tr> </thead> <tbody> <tr> <td>CO1</td> <td>gain basic knowledge on biomolecules</td> <td>K2</td> </tr> <tr> <td>CO2</td> <td>understand the biological importance and metabolism of carbohydrate</td> <td>K1</td> </tr> <tr> <td>CO3</td> <td>get thorough knowledge on the metabolism and importance of aminoacids</td> <td>K2</td> </tr> <tr> <td>CO4</td> <td>acquire the knowledge of auto immune diseases</td> <td>K2</td> </tr> <tr> <td>CO5</td> <td>attain the knowledge to understand the structure and function of immunoglobulin</td> <td>K3</td> </tr> </tbody> </table>	CO	Course Outcomes	Knowledge Level	CO1	gain basic knowledge on biomolecules	K2	CO2	understand the biological importance and metabolism of carbohydrate	K1	CO3	get thorough knowledge on the metabolism and importance of aminoacids	K2	CO4	acquire the knowledge of auto immune diseases	K2	CO5	attain the knowledge to understand the structure and function of immunoglobulin	K3
CO	Course Outcomes	Knowledge Level																	
CO1	gain basic knowledge on biomolecules	K2																	
CO2	understand the biological importance and metabolism of carbohydrate	K1																	
CO3	get thorough knowledge on the metabolism and importance of aminoacids	K2																	
CO4	acquire the knowledge of auto immune diseases	K2																	
CO5	attain the knowledge to understand the structure and function of immunoglobulin	K3																	

CO	PROGRAMME OUTCOMES (PO)	PROGRAMME SPECIFIC OUTCOMES (PSO)				
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CO1	S	S	S	S	M	M	M	S	M	S	S	M	M
CO2	S	S	S	S	S	S	M	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	M	S	S	S	S
CO5	S	S	S	S	S	S	M	S	M	S	S	S	S

Course Code	U23ZOP503	Practical in Animal Physiology, Microbiology, Biochemistry and Immunology	L	T	P	C
CORE	XII		-	-	5	4

Cognitive Level	
Learning objective	<ul style="list-style-type: none"> ➤ To understand various stages involved in cell division ➤ To observe and learn the structure of Giant chromosomes ➤ To learn about various microbial techniques ➤ To acquire the practical skill on immunological techniques. ➤ To understand mendelian genetics and statistical tool
	<p>ANIMAL PHYSIOLOGY</p> <p>Mounting Estimation and Observations</p> <ul style="list-style-type: none"> • Preparation of human blood smear • ABO blood grouping • Counting of different types of blood cells using haemocytometer - Demonstration of. W.B.C. & R.B.C. count • Differential leukocyte count • Blood Analysis – Hb Estimation (Sahli's Method) • Use of Kymograph unit, • Demonstration of blood pressure in Sphygmomanometer. , Respirometer. • Survey of Digestive enzymes in cockroach. • Estimations of excretory products of fish, bird and mammal and detections of ammonia, urea and uric acid. • Urine Analysis – Detections of Albumins, Sugar and Deposits. • Observations & Study of mantoux test, widal test <p>Microbiology:</p> <ol style="list-style-type: none"> 1. Preparation of media – Natural Broth solid media (Agar) 2. Plating techniques – streak plate, pour plate and spread plate 3. Serial dilution techniques 4. Gram's staining 5. Hanging drop experiment 6. Screening of antimicrobial agent (Kirby Bauer Method) 7. Observation of Instruments: Water bath, laminar air flow, autoclave, Incubator, Hot air oven, Colony counter. 8. Spotters: - Bacteria, Fungi, Algae, Spirogyra, Agaricus, Rhizopus, Bread mould, Protozoa – paramecium, Yeast.

	Immunology <ol style="list-style-type: none"> 1. Observation and study of Lymphoid organs <ol style="list-style-type: none"> i. Bone Marrow, Bursa fabricus ii. Thymus, Lymph node, Spleen 2. Antigen antibody reaction- Any two 3. Observation and study of IgG, IgA and IgM BIOCHEMISTRY <ol style="list-style-type: none"> 1. Qualitative analysis of Carbohydrate, lipid and protein 2. Protein estimation by Lowry methods 3. DNA estimation 4. Separation techniques-Circular paper chromatography <p>A record of lab work should be maintained and submitted at the time of the practical examination. Study tour to the minimum of 1 day duration to be conducted compulsory.</p>	
Text Books	<ol style="list-style-type: none"> 1. Lal, S.S, A Text Book of Practical Zoology: Rastogi, Meerut.2014. 2. Verma, PS.A Manual of Practical Zoology-third volume S Chand Publications, New Delhi. 2010, 3. Rajamanickam, C. Experimental protocols in basic molecular biology, Osho Scientific Publications, Madurai. 2001 	
Reference Books	<ol style="list-style-type: none"> 1. Nigam and A.Ayyagai Lab Manual in Biochemistry, Immunology and Biotechnology. Tata McGraw- Hill Publication, New Delhi, 2007. 2. Zar, J.H. Biostatistical Analysis, Low Price Edition Pearson Education, India, 2008. 	
E-References	<ol style="list-style-type: none"> 1. http:// www.ecoursesonline.iasri.res.in 2. http:// www.onlinelibrary.wiley.com 	
Course out come	Upon completion of this course, the students will be able to	
	CO	Course Outcomes
	CO1	analyze the various stages of cell divisions
		Knowledge Level
		K5
	CO2	understand the various stages of embryo development
		K2
	CO3	learn and interpret the development and evolution process
		K3
	CO4	develop skill in observing, analyzing and calculating various biological data
		K3
	CO5	gain knowledge on Mendelian characters, probability tests and Biostatistical calculation
		K3

Elective I

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	Externa	Total
U23ZO E51A	Animal Behaviour	SEC	Y	-	-	-	3	3	25	75	100
Learning Objectives											
CO1	To learn the origin and development of animal behaviour and to understand the influence of genetics, environment on animal behaviours.										
CO2	To understand the biological properties of animal behavior, with an evolutionary and ecological emphasis.										
CO3	To Compare innate and learned behavior and differentiate between various mating system.										
CO4	To impart the knowledge about visual and auditory communication; courtship, mate choice, and mating systems; social behavior and social systems; and animal personality.										
CO5	To discuss how movement and migration behaviors are a result of natural selection.										
UNIT	Details							No. of Hours	Course Objectives		
1	Unit I: Genetics and Behaviour : Genetic material, Genes and chromosomes, Genetic variation, Single and Polygenic inheritance of behaviour, Heritability of behaviour, Natural selection and behaviour, Frequency distribution of phenotypes, Darwinian fitness, Evolution of adaptive strategies.							9	CO1		
2	Unit II: Evolution and Social Behaviour : Sexual selection, Altruism, Sexual strategy and social organisation, Animal perception, Neural control of behaviour, Sensory processes and perception, Visual adaptations to unfavourable environments.							9	CO2		
3	Unit III: Animal and the Environment: Coordination and Orientation, Homeostasis and Behaviour, Physiology and Behaviour in changing environments, Animal Learning, Conditioning and Learning, Biological aspects of learning, And Cognitive aspects of learning.							9	CO3		
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4	<p>Unit IV: Understanding Complex Behaviour : Instinct and learning, Displacement activities, Ritualization and Communication, Decision making behaviour in Animals, Complex behaviour of honey bees, Evolutionary optimality, Mechanism of Decision making.</p> <p>The mentality of Animals: Languages and mental representation, non-verbal communication in human, mental images, Intelligence, tool use and culture, Animal awareness and Emotion.</p>	9	CO4
5	<p>Unit V: Chronobiology : Organization of circadian system in multicellular animals; Concept of central and peripheral clock system; Circadian pacemaker system in invertebrates with particular reference to <i>Drosophila</i>; Photoreception and photo-transduction; The physiological clock and measurement of day length; Molecular bases of seasonality; The relevance of biological clocks for human welfare - Clock function (dysfunction); Human health and diseases - Chronopharmacology, chronomedicine, chronotherapy.</p>	9	CO5
Total		45	
Course Outcomes	On completion of this course, students will;		
CO1	Recall and record genetic basis and evolutionary history of behaviour.	PO1	
CO2	Classify movement and migration behaviors and explain environmental influence upon behaviour.	PO1, PO2, PO3	
CO3	Analyze and identify innate, learned and cognitive behavior and differentiate between various mating systems.	PO3, PO4, PO5	
CO4	Assess complexity involved in behavioural traits and evaluate hormones and their role in aggression and reproduction	PO2, PO3, PO5, PO6, PO8	
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CO5	Discuss the rhythmicity of behavioural expressions and the scientific concepts in behavior and behavioral ecology.	PO3, PO4, PO5, PO6, PO7, PO8
Text Books		
1	David McFarland, 1985. Animal Behaviour, Longman Scientific & Technical, UK. 576pp.	
2	Harjindra Singh, 1990. A Text Book of Animal Behaviour, Anomol Publication, 293pp.	
3	Hoshang S. Gundevia and Hare Govind Singh, 1996. Animal Behaviour, S. Chand & Co, 280pp.	
4	Shukla, J. P 2010, Fundamentals of Animal Behaviour, Atlantic, 587pp	
5	Vinod Kumar, 2002. Biological Rhythms. Narosa Publishing House, Delhi.	
References Books (Latest editions, and the style as given below must be strictly adhered to)		
1	Michael D. Breed and Janice Moore, 2012. Animal Behaviour, Academic Press, USA, 359pp.	
2.	Aubrey Manning and Martin Stamp Dawkins, 2012. An Introduction to Animal Behaviour, 6th Edition, Cambridge University Press, UK. 458pp	
3	Davis E. Davis, 1970. Integral Animal Behaviour, Mac Millan Company, London, 118pp.	
4	Jay, C. Dunlap, Jennifer, J. Loros, Patricia J. De Coursey (ed). 2004. Chronobiology Biological time Keeping, Sinauer Associates Inc, Publishers, Sunderland, MA	
Web Resources		
1.	https://www.ncbs.res.in/content/animal-behaviour	
2.	https://bit.ly/3i6wUxR	
3.	https://www.behaviour.univie.ac.at/	
4.	https://www.ru.nl/bsi/	
Methods of Evaluation		
Internal Evaluation	Continuous Internal Assessment Test	25 Marks
	Assignments	
	Seminars	
External Evaluation	End Semester Examination	75 Marks
	Total	100 Marks
Methods of Assessment		
Recall (K1)	Simple definitions, MCQ, Recall steps, Concept definitions	
Understanding/Comprehend	MCQ, True/False, Short essays, Concept explanations, Short summary or overview	
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(K2)	
Application (K3)	Suggest idea/concept with examples, Suggest formulae, Solve problems, Observe, Explain
Analyse (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		S	S	S	S			S
CO 3		S	S	S	S	S		S
CO 4		S	M			M		
CO 5				S	S	S		S

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

Course Code	U23ZOE51B	CANCER BIOLOGY	L	T	P	C
Elective	I		3	-	-	3
Learning objective	<ul style="list-style-type: none"> ➤ To distinguish normal cell and cancer cell. ➤ To understand the various methods of diagnosis of cancer ➤ To obtain the knowledge of staging the cancer cells ➤ To know about different types of cancer ➤ To obtain the knowledge about treatments for cancer. 					
UNIT – I	Cancer Cell:					
Properties of normal cell and cancer cell, benign tumor and malignant tumor. Type of cancer common symptoms, causative factors Definition of primary and secondary cancer.						
UNIT – II	Diagnosis of cancer:					
Classification and diagnosis of cancer by tissue type - Solid tumor, Histopathological diagnosis. Immunohistochemistry Hematological malignancies, morphological diagnosis Biopsy its types. Clinical examinations.						
UNIT – III	Cancer classification:					
TNM classification Purpose types of staging. TNM System, Stage grouping. Factors affecting the stage and staging system.						
UNIT – IV	Sporadic cancers:					
Sporadic cancers, hereditary cancers, examples of cancer susceptibility syndromes, Immune suppression related malignancies, transplantation related malignancies.						
UNIT –V	Cancer treatments-					
Surgery and its types, Radiation, Chemotherapy, Biological therapy, Hormone therapy, transplantation. Targeted therapy, Gene therapy and other treatment methods						
Text Books	<ol style="list-style-type: none"> 1. Renganathan, T.S.. A text book of Human Anatomy. VI edn. S. Chand and Company Ltd., New Delhi. 2002 2. Robert A. Weinberg.(Author), Roberts A Weinberg (Author).The Biology of cancer, 2nd Edition 2nd Edition,2005 					

Reference Books	<ol style="list-style-type: none"> 1. Vander, A.J. Sherman, J.H. and Luciano, D.S.. Human Physiology: The mechanism of body functions, VI edn. Mc Graw-Hill Publications, New York. 1994 2. Lewis J.Kleinsmith. Principles of cancer Biology, Ie first Edition English, Paperback, 2001 3. Robert G.Mc kinnell Ralph E. Parchment Alan O.Perantoni .The Biological Basis of Cance.r Second edition English, Soft Cover,1998 4. Hesteth Dr Robin HeskethIntroduction to Cancer Biology English, Paperback,2000 		
E-References	<ol style="list-style-type: none"> 1. http://csbl.bmb.uga.edu/mirrors/JLU/DragonStar2017/download/introduction-to-cancer-biology.pdf 2. https://sphweb.bumc.bu.edu/otlt/MPH-Modules/PH/PH709_Cancer/A10-Cancer.pdf 		
Course out come	Upon completion of this course, the students will be able to		
	CO	Course Outcomes	Knowledge Level
	CO1	Differentiate between normal cell and cancer cell.	K3
	CO2	understand the classification and diagnosis of cancer by tissue type	K2
	CO3	gain the knowledge of classification of cancer	K1
	CO4	understand the sporadic cancers, hereditary cancers and examples of cancer susceptibility syndromes	K2
	CO5	acquire the knowledge of cancer treatments like radiation, chemotherapy, biological therapy, hormone therapy and transplantation	K2

Mapping of COs with POs & PSOs:

CO	PROGRAMME OUTCOMES (PO)								PROGRAMME SPECIFIC OUTCOMES (PSO)				
	1	2	3	4	5	6	7	8	1	2	3	4	5
Mother Teresa Women's University, Kodaikanal - 624 1017								8	1	2	3	4	5

CO1	S	S	S	M	S	M	S	S	M	S	S	S	M
CO2	S	S	S	S	S	M	S	S	M	S	S	M	S
CO3	S	S	S	S	S	M	S	S	S	S	S	S	S
CO4	S	M	S	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	M	S	S	S	S	S	S	M	S

Strongly Correlating (S) - 3 marks
Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark
No Correlation (N) - 0 marks

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	Externa	Total
U23ZO E52A	Elective 2-BIOPHYSICS AND BIOSTATISTICS	SEC	Y	-	-	-	3	3	25	75	100

Learning Objectives

- To understand the concepts of diffusion, osmosis, centrifugal force, surface tension.
- To understand the techniques for the separation of biomolecules.
- To understand radiology, sonography, Laser techniques for biological and medical application.
- To know to calculate standard deviation, correlation coefficient, chi-square analysis and student 't' test using the formula.

UNIT	Details	No. of Hours	Course Objectives
I	Unit I: Biophysical Principles: Physical laws in living system: diffusion–Factors affecting diffusion- types of diffusion – Fick’s law – Biological significance of diffusion–Osmosis–Osmotic pressure (endocytosis, pinocytosis, phagocytosis, exocytosis plasmolysis and haemolysis) Principles of viscosity–Brownian movement–surface tension–turgor pressure–Centrifugation: Principle–types–applications.	9	CO1
2	Unit II: Applications of Biophysics: Principle and applications of colorimeter – electrophoresis –principle, instrumentation – applications of gel electrophoresis. Radioactivity: Types of radioactive decay – Radioactive isotopes – Autoradiography – biological impacts – Geiger-Muller counter: Principle – working procedure – advantages and disadvantages. Medical and biological uses of X-rays, Ultrasound and Laser	9	CO2
3	Unit III: Collection and Classification of Data: Introduction to biostatistics: Definition – characteristics, importance and applications of biostatistics. Collection of data: Primary – secondary data. Statistical population and sampling in biological studies. Types of Classification: Qualitative – quantitative. Variables: discrete – continuous. Frequency	9	CO3

	distributions.		
4	Unit IV: Presentation of Data: Tabulation: Types – Components – advantages. Diagrammatic and graphical representations of data: Bar diagrams (Simple, multiple, subdivided and percentage) – Pie diagram – Frequency diagram: histograms – frequency polygon – frequency curve – line graphs	9	CO4
5	Unit V: Descriptive & Inferential Statistics: Measure of central tendency: Arithmetic mean – median– mode. Measures of dispersion: Standard deviation – Standard error– Coefficient of variance. Test of significance: Chi-square test for goodness of fit – Student ‘t’ test.	9	CO5
Total		45	
Course Outcomes	On completion of this course, students will;		
CO1	Understand and recall the basic biophysical concepts, statistical data and formula.	PO1	
CO2	Apply suitable physical techniques and statistical methods to solve biological problems.	PO1, PO2, PO3	
CO3	Identify and relate the bio analytical techniques and statistical principles for the application of biological experiments.	PO3, PO4, PO5	
CO4	Select suitable biophysical techniques to study the biological process and statistical approach to assess the experimental results.	PO2, PO3, PO5, PO6, PO8	
CO5	Integrate the bio analytical techniques and statistical methods to validate research investigations	PO3, PO4, PO5, PO6, PO7, PO8	
Text Books			
1	Das,D.,1996.BiophysicsandBiophysicalChemistryforMedicalandBiology students, Academic,Calcutta. 302pp.		
2	Subramanian,M.A.,2016.Biophysics–PrinciplesandTechniques,MJP,Chennai. 324pp.		
3	Gurumani,N.,2005.AnintroductiontoBiostatistics,MJP,Chennai, 250pp.		

4	Palanichamy,S and M. Shanmugavelu,1991. Principles of Biostatistics. Palani Paramount.India. 350pp	
5	Roy, R.N. 1996. A Text Book of Biophysics, New Central Book Agency Ltd, Calcutta. 992pp	
References Books (Latest editions, and the style as given below must be strictly adhered to)		
1	Antonisamy, B., Solomon Christopher and P. Prasanna Samuel, 2011. Biostatistics: Principles and practices. MacGraw Hill Education Pvt .Ltd. New Delhi. 349pp.	
2.	BettyKarasek,2015.Advancedconceptsofbiophysics,CallistroReference, 198pp.	
3	Daniel,W.W.,2000.Biostatistics:Afoundationforanalysisinthehealthsciences, 7 th Ed.JohnWiley&SonsLtd.NewYork. 328pp.	
4	EdwardK.Yeagers,2018.BasicBiophysicsforBiology,CRCPress,USA.195pp	
5	Gurumani, N., 2006. Research methodology for biological sciences, MJP, Chennai. 753pp.	
6	Harvey Motulsky, 2015. Essentials of Biostatistics. A non mathematical approach.OxfordUniversityPress.NewYork. 208pp.	
7	MichaelC.,WhitlockandDolphSchluter,2009.Theanalysisofbiologicaldata, 2 nd Ed.MacMillanPublishers,NewYork,USA.818pp	
8	Narayanan, R., 2010. Essentials of biophysics, II Ed., New age International publishers,Chennai. 546pp	
Web Resources:		
1.	https://bit.ly/2XGFuML	
2.	http://www.life.uiuc.edu/molbio/geldigest/electro.html	
3.	http://users.stat.ufl.edu/~winner/sta6934/st4170_int.pdf	
4.	http://www.biostathandbook.com/analysissteps.html	
	https://bit.ly/3nXUIrD	
	https://onlinecourses.nptel.ac.in/noc19_bt19	
Methods of Evaluation		
Internal Evaluation	Continuous Internal Assessment Test	25 Marks
	Assignments	
	Seminars	
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	
Author	Teresa Women's UNiversity, Kodaikanal – 624 101	
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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

U23ZOE52B - WILDLIFE CONSERVATION AND MANAGEMENT

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
U23ZOE52B	WILDLIFE CONSERVATION AND MANAGEMENT	SEC	Y	-	-	-	3	3	25	75	100
Learning Objectives											
<ul style="list-style-type: none"> ➤ To understand and discuss the importance of wildlife, its values, modern concepts in wildlife management, and relevant conservation policies. ➤ To assess and instill strong foundations on wildlife policies and be familiar with a variety of laws and regulations. ➤ To analyze and design appropriate approaches to turn conflict into tolerance and coexistence, with an emphasis on the human dimensions of human-wildlife interactions. ➤ To evaluate and integrate all the related areas like Fundamentals in Ecology, Forestry, Natural Resource Conservation approaches and develops the role PVA models for protection of endangered species. ➤ To explain the advanced scientific basis for wildlife management and discuss National and International Efforts for successful wildlife conservation. 											
UNIT	Details							No. of Hours	Course Objectives		
I	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.							9	CO1		
2	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							9	CO2		

	species.		
3	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.	9	CO3
4	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.	9	CO4
5	Unit V: Management of Wildlife: Distribution, status. Habitat utilization pattern, threats to survival of Slender Loris, Musk deer, Great Indian Bustard, Olive Ridley turtle. Wild life Trade & legislation, Assessment, documentation, Prevention of trade, Wild life laws and ethics.	9	CO5
	Total	45	

Course Outcomes	On completion of this course, students will;		
CO1	To understand and recall the importance of wildlife, extinction and Conservation Approaches of wildlife.	PO1	
CO2	To integrate and assess the National, international approaches for biodiversity conservation.	PO1, PO2, PO3	
CO3	To analyze and differentiate threats to wildlife, various action plans, conservation strategies on wildlife of India to turn conflict into tolerance and coexistence.	PO3, PO4, PO5	
CO4	To explain the role PVA models, Wildlife conservation approaches, and limitations.	PO2, PO3, PO5, PO6, PO8	
CO5	To construct and simulate National and International strategies for Conservation, Wild life laws and ethics	PO3, PO4, PO5, PO6, PO7, PO8	

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 Management of Wild life : Distribution, status. Habitat utilization pattern, threats to survival of Slender Loris, Musk deer, Great Indian Bustard, Olive Ridley turtle. Wild life Trade & legislation, Assessment, documentation, Prevention of trade, Wild life laws and ethics.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.
8	Woodroffe R, Thirgood, S. and Rabinowitz A. 2005.People and Wildlife, Conflict or Co existence? Cambridge University.
9	Sinha, P.C. 1998. Wildlife and Forest Conservation, Anmol Publishing Pvt. Ltd., New Delhi
10	Singh, S.K, 2005. Text Book of Wildlife Management. IBDC, Lucknow
References Books (Latest editions, and the style as given below must be strictly adhered to)	
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.
7	Sharma, B.D, 1999. Indian Wildlife Resources Ecology and Development, Daya Publishing House, Delhi.
8	Stephen, H.B. and V.B. Saharia,1995. Wildlife research and management. Asian and American Approaches, Oxford University Press, Delhi.
9	Negi, S.S. 1993. Biodiversity and its conservation in India, Indus Publishing Co., New Delhi.
10	Moulton, M. P. & J. Sanderson, 1997. Wildlife Issues in a Changing World. St. Lucie Press.
Mother Teresa Women's UNiversity, Kodaikanal – 624 101	

Web Resources:		
1.	https://bit.ly/39oPj44	
2.	https://bit.ly/3IHdEYJ	
3.	https://bit.ly/3CwBCfY	
4.	https://bit.ly/3EDYr3a	
5.	https://bit.ly/3tVtG4U	
Methods of Evaluation		
Internal Evaluation	Continuous Internal Assessment Test	25 Marks
	Assignments	
	Seminars	
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	

SEMESTER - VI

Course Code U23ZOT610	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
Core 13	BIOTECHNOLOGY	Core	Y	-	-	-	4	6	25	75	100
Learning Objectives											
CO1	To know the concepts of biotechnology and familiarize with the tools and techniques of Biotechnology										
CO2	To acquire knowledge on tissue culture and learn the fundamentals of patenting of biological products.										
CO3	To be familiar with microbial degradation of bioremediation and biomining process.										
CO4	To elucidate the production of transgenic animals and their importance.										
UNIT	Details							No. of Hours	Course Objectives		
I	Scope and Importance of biotechnology in India. Animal cell and Tissue culture: Animal cell culture media. physical, chemical functions of different constituents of culture medium, Role of carbondioxide, growth factors, glutamine in culture medium.							12	CO1		
II	Types of cell culture: Primary and established culture, Organ culture Disaggregation of tissue cell separation, Cryopreservation.							12	CO2		
III	Transgenic Animal AND PLANTS Technology: Transgenesis: Concept, transgenes, transgenic animal models - knock out mice, sheep; Applications of transgenesis : Molecular farming, Transgenic fishes, transgenic live stocks, and animals as bioreactors. Somatic cell hyperidization							12	CO3		
IV	Environmental Biotechnology: Biodiversity and its conservation, Applications of biotechnology in agriculture and environment. Biodegradation, Bioremediation, Biosensors and Bio fuels.							12	CO4		
Bio-fertilizers, Microbes as bio-fertilizers. Bio plastics									82		

V	Medical Biotechnology - Hybridoma technology and uses; Applications of biotechnology in medicine - production of vaccines - gene therapy, forensic medicine (DNA Finger printing).	12	CO5
Total		60	

Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	To describe the methodologies for handling animal cells based on their diverse characteristics and identify the correct biotechnological tools to obtain the desired products from the cells.	PO1
CO2	To develop and explain the protocols for genetically manipulating cells and produce transgenic animals	PO1, PO2
CO3	To select the apt molecular techniques to evaluate and analyze animal traits and diseases at the genomic level and devise methods for easy taxonomical identification and classification for biodiversity and environmental studies.	PO4, PO6
CO4	To choose the correct methods of transgenesis and to consider their use in improving animal husbandry nationally and globally	PO4, PO5, PO6
CO5	To speculate on the environmental implications of animal biotechnological methods and design responsible, ethical solutions to livestock production and health issues.	PO3, PO8
Text Books (Latest Editions)		
1.	Ramdoss P., 2009. Animal Biotechnology- Recent concepts and developments, MJP publishers.	
2.	Dubey S. K., Bandana Ghosh, 2012. Fish biotechnology, Wisdom Press.	
3.	Sasidhara, R., 2015. Animal biotechnology, MJP publishers.	
4.	Dubey R. C., 2014. A text Book of Biotechnology, S. Chand & Co Ltd, Ram Nagar, New Delhi.	
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5.	Singh B. D., 2015. Biotechnology: Expanding horizon, Kalyani publishers.
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References Books

1.	Veer Bala Rastogi, 2016. Principles of Molecular biology, Medtech, Maine, USA.
2	Michael Crichton, 2014. Essentials of Biotechnology, Medtech, Maine, USA.
3	Godbey W.T., 2014. An Introduction to Biotechnology, Academic press, New York, USA.
4	Primrose S.B., R. M. Twyman and R. W. Old, 2001. Principles of gene manipulation, Wiley- Blackwell, UK.
5	Primrose S. B., 2001. Molecular Biotechnology, Panima Publishing Corporation, New Delhi, India.
6	Ramawat, K.G and Shailey Goyal, 2009. Comprehensive biotechnology, S.Chand company, New Delhi, India.

Web Resources		
1.	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3612824/	
2.	https://www.isaaa.org/resources/publications/pocketk/40/default.asp	
3.	https://www.ncbi.nlm.nih.gov/books/NBK207574/	
4.	https://iopscience.iop.org/article/10.1088/1755-1315/492/1/012035/pdf	
5.	https://go.nature.com/3zAZmO9	
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		
CO 4				S	S	M		
CO 5			S					S

S-Strong (3)

M-Medium (2)

L-Low (1)

Course Code U23ZOT611	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	ENVIRONMENTAL BIOLOGY and EVOLUTION	Core	Y	-	-	-	4	6	25	75	100
Learning Objectives											
CO1	To understand the structure and functions of the ecosystem.										
CO2	To explain the relationship between biotic and abiotic factors in an ecosystem.										
CO3	To know the causes and effects of climate change and habitat loss.										
CO4	To bring awareness about the impact of socio-economic development on the environment and the solutions put forward by the government to reduce environmental damage.										
UNIT	Details							No. of Hours	Course Objectives		
I	Ecosystem: Concept of an ecosystem-Structure and function of an ecosystem- Producers, consumers and decomposers-Energy flow in the ecosystem-Ecological succession-Food chains, food webs and ecological pyramids-Introduction, types, characteristic features, structure and function of the following ecosystem: Forest ecosystem - Grassland ecosystem-Desert ecosystem-Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).							12	CO1		
II	Population And Biological Cycles : Structure and distribution – Growth curves - Groups, natality, Mortality -Density indices, Life study tables - factors affecting population growth -Carrying capacity. Population regulation and human population control. Complete and incomplete biogeochemical cycles - Sedimentary cycle.							12	CO2		

III	Environmental Stresses and Management: Global climatic pattern, global warming, atmospheric ozone, acid and nitrogen deposition. Uptake, biotransformation, elimination and accumulation of toxicants. Factors influencing bioaccumulation from food and trophic transfer. Pesticides and other chemical in agriculture, industry and hygiene and their disposal. Bio indicator and biomarkers of environmental health. Biodegradation and bioremediation of chemicals.	12	CO3
IV	Environmental Pollution: Definition- cause, effects and control measures of: -Air pollution - Water pollution -Soil pollution -Marine pollution - Noise pollution - Thermal pollution -Nuclear hazards.	12	CO4
V	Biodiversity Conservation: Biodiversity crisis – habitat degradation, poaching of wild life. - Socio economic and political causes of loss of biodiversity. - In situ and ex situ conservation of biodiversity - Hot spots of Biodiversity. Green peace movement - Chipko Movement - Role of government agencies: Central and State Pollution Control Boards - Ministry of Environment and Forests- National Biodiversity Authority. Awareness Programme, NGOs, Natural Disaster Management, Legislations for environmental Protection, Bio villages – sustainable utilization and development, Environmental ethics.	12	CO5
Total		60	
Course Outcomes			
Course Outcomes	On completion of this course, students will;		
CO1	Understand the fundamental structure and functions of the ecosystem.	PO1	
CO2	Assess the inter-relationship between organisms and between biotic and abiotic factors in an ecosystem.	PO1, PO2	
CO3	Analyze the factors that cause pollution, climate change, loss of biodiversity and depletion of resources.	PO4, PO6	
CO4	Evaluate the impact of human population growth and socio-economic development on the structure and function of the ecosystem.	PO4, PO5, PO6	
CO5	Design plans to scientifically solve environmental problems using biological tools, technologies and government policies.	PO3, PO8	

Text Books (Latest Editions)		
1.	Matthew R. Fisher, 2018. Environmental Biology. Open Oregon Educational Resources. James Madison University.	
2.	Asthana, D.K. and Meera, A. 2009. A text book of environmental studies, S. Chand, New Delhi.	
3.	Sanyal, K. Kundu, M. and Rana, s. 2009. Ecology and environment, Books and allied, Kolkata.	
4.	Grant, W.E. and Swannack, T.M., 2008, Ecological Modelling, Blackwell.	
References Books (Latest editions, and the style as given below must be strictly adhered to)		
1.	Odum E.P. 1983. Basic Ecology, Saunders, New York	
2.	Wilkinson, D.M., 2007, Fundamental Processes in Ecology: An Earth system Approach, Oxford University Press, UK.	
3.	Saha, T.K. 2010. Ecology and Environmental biology, Books and Allied, Kolkata.	
Web Resources		
1.	https://bit.ly/2VYWOM5	
2.	https://bit.ly/2VZQFiT	
3.	https://bit.ly/3kqdXYA	
4.	https://bit.ly/39rvvgt	
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:

Mother Teresa	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	88
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CO 1	S							
CO 2	M	S						
CO 3				S		S		
CO 4				S	S	M		
CO 5			S					S

S-Strong(3)

M-Medium (2)

L-Low (1)

CORE 15 (PRACTICAL)
PRACTICAL IN BIOTECHNOLOGY, ENVIRONMENTAL BIOLOGY AND EVOLUTION

Course Code	U23ZOP604	PRACTICAL IN BIOTECHNOLOGY, ENVIRONMENTAL BIOLOGY AND EVOLUTION (Practical)	L	T	P	C
Core	15		5	-	-	4
Learning objective	<ul style="list-style-type: none"> ➤ To know the biotechnology techniques. ➤ To understand the physical chemical parameter in water sample. ➤ To understand the adaptaion of animals by experiment ➤ After this, student can determine the water quality 					
	<p>BIOTECHNOLOGY: Observation and study of E. Coli, Bacteriophage, Plasmid - pBR322 Plasmids, DNA finger printing</p> <p>Environmental Biology</p> <ol style="list-style-type: none"> 2. Estimation of dissolved oxygen in tap water and distilled water 3. Estimation of dissolved CO₂ in water samples. 4. Measurement of hardness of water by using detergent on distilled water and tap water 5. Estimation of salinity in water sample 6. Sampling of animal population by using quadrante method 7. Detection of transparency of water by Secchi disc method 8. Animal association- symbiosis, parasitism, predation & commensalisms 9. Analysis and mounting of freshwater and marine planktons 10. Adaptation of aquatic animals based on a study of museumspecimen such as rocky, sandy, muddy and burrowing animals. <p>EVOLUTION</p> <p>Finding out genetic drift in a small population using beads Variation – Finger Prints. Vestigial Organ. Examples of evolutionary significance of peripatus, Limulus and Archaeopteryx. Animals with adaptive colouration. (Stick insect & Chamaeleon).</p>					

	A record of lab work should be maintained and submitted at the time of the practical examination Study tour		
Text Books	<ol style="list-style-type: none"> 1. Lal, S.S , A Text Book of Practical Zoology: Rastogi, Meerut.2014. 2. Verma, PS A Manual of Practical Zoology-third volume, S ChandPublications, New Delhi.2010. 		
Reference Books	<ol style="list-style-type: none"> 1. Janarthanan, S. and Vincent, S. Practical Biotechnology: Methodsand protocols, University.Press, 2007. 2. Yogendra, N. and Srivastava, N.. Environmental Pollution, AshishPublishing House. New Delhi. 2001 		
Course out come	Upon completion of this course, the students will be able to		
	CO	Course Outcomes	Knowledge Level
	CO1	Gain the knowledge about various biotechnology techniques.	K4
	CO2	practice water quality analysis	K2
	CO3	Gain knowledge on animal population methods	K3
	CO4	Gain the knowledge about evolutionary adaptation of animals.	K3
	CO5	Interpret the diagnostic tests with health condition.	K4

Mapping of COs with POs & PSOs

CO	PROGRAMME OUTCOMES (PO)								PROGRAMME SPECIFIC OUTCOMES (PSO)				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO1	M	S	S	S	S	S	S	M	S	S	M	S	M
CO2	S	S	M	S	S	S	S	M	S	M	S	S	S
CO3	S	S	M	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	M	S	S	S	S	S	S	S
CO5	M	S	S	S	S	M	S	M	S	S	S	S	S

Strongly Correlating (S) - 3 marks
 Moderately Correlating (M) - 2 marks Weakly
 Correlating (W) - 1 mark No
 Correlation (N) - 0 marks

Course Code		L	T	P	C
U23ZOE63A	BIOINFORMATICS	3	-	-	3
Learning objective	<ul style="list-style-type: none"> ➤ To gain the knowledge about computer and its devices ➤ To learn about the programming languages and its application ➤ To learn the basic concept of bioinformatics and its application in various fields ➤ To learn the use of nucleic acid and protein data banks ➤ To understand the methods of representation for evolutionary analysis tree 				
Unit I	Introduction to Computer				
History development and types of computers general awareness of computer systems. hard ware and software(CPU and other peripheral devices)					
Unit II	Programming languages				
Machine language assembly languages. Higher level language- introduction, email, world wide web – surfing					
Unit III	Sequence analysis				
need and importance pairwise alignments- dynamic programming - Global and local – Alignment concepts- Database searching tools Entrez, BLAST, FASTA, Multiple alignment cluster construction of phylogenetic trees.					
Unit IV	Use of nucleic acid and protein				
data banks NCBI, EMBI, DDBJ, SWISSPORT,3D structural analysis of biomolecules – molecular visualization tools Rasmol, chemsketen and SPDBV- Protein Docking					
Unit V	Evolutionary analysis :				
Distance clustering methods- Rooted and Un rooted tree representation Bootstrapping strategies, Neutral networks.					
Text Books	<ol style="list-style-type: none"> 1. Introduction of Bioinfomatics –Attwood t and Parry d. Pearson Education Asia. 2012 2. Computer for biologists- A, Fielding. Benjamin/cuming publi.co 2015 				

Reference Books	<ol style="list-style-type: none"> 1. Attwood, T.K. and Parry, D.J – Smith, D.J. Introduction to Bioinformatics, 2005. 2. Baxevanis, A.D. and Quellerie, B.F.F.. Bioinformatics. A practical guide to harbour Laboratory Press, New York. 2010 		
E-references	<ol style="list-style-type: none"> 1. http://www.aun.edu.eg/molecular_biology/Procedure%20Bioinformatics22.232015/Xiong%20%20Essential%20Bioinformatics%20send%20by%20Amira.pdf 2. http://www.ru.ac.bd/wpcontent/uploads/sites/25/2019/03/410_01_Lesk 		
Course out come	Upon completion of this course, the students will be able to		
	CO	Course Outcomes	Knowledge Level
	CO1	able to know the history development and types of computers	K1
	CO2	understand the programming languages	K2
	CO3	apply the knowledge of sequence alignment tools	K3
	CO4	understand the uses of nucleic acid and protein data banks	K2
	CO5	know the applications of evolutionary analysis	K2

CO	PROGRAMME OUTCOMES (PO)								PROGRAMME SPECIFIC OUTCOMES (PSO)				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO1	S	W	S	S	M	S	M	S	S	S	S	S	M
CO2	S	W	S	M	S	S	S	M	M	S	S	S	S
CO3	S	M	S	S	S	S	M	S	S	M	S	S	S
CO4	S	S	S	S	M	M	S	S	M	S	S	S	S
CO5	S	S	S	S	S	M	M	S	S	M	S	S	S

Course Code	U23ZOE63B	INSECT VECTORS AND DISEASES	L	T	P	C
Elective	7		3	-	-	3
Learning objectives	<ul style="list-style-type: none"> • To comprehend the various insect vectors and disease spreading mechanism • To learn the various diseases caused by the insect vector and its control measures 					
<i>Mother Teresa Women's UNiversity, Kodaikanal – 624 101</i>						
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Unit I	Introduction to Insects:
General Features of Insects, Morphological features, Head – Eyes, Types of antennae, Mouth parts - feeding habits	
Unit II	Concept of Vectors:
Concept of Vectors - Brief introduction of Carrier and Vectors (mechanical and biological vector),Reservoirs, Host-vector relationship, Vectorial capacity, Adaptations as vectors, Host Specificity	
Unit III	Insects as Vectors:
Insects as Vectors - Classification of insects up to orders, Dipteran as Disease Vectors - Dipterans as important insect vectors – Mosquitoes, Sand fly, Houseflies	
Unit IV	Study of mosquito:
Study of mosquito-borne diseases – Malaria, Dengue, Chikungunya, Viral encephalitis, Filariasis; Control of mosquitoes Study of sand fly-borne diseases –Visceral Leishmaniasis, Cutaneous Leishmaniasis, Phlebotomus fever; Control of Sand fly Study of house fly as important mechanical vector, Myiasis, Control of house fly.	
Unit V	Siphonaptera:
Siphonaptera as Disease Vectors Fleas as important insect vectors; Host-specificity, Study of Flea-borne diseases Plague, Typhus fever; Control of fleas - Siphunculata as Disease Vectors-Human louse (Head, Body and Pubic louse) as important insect vectors; Study of louse-borne diseases – Typhus fever, Relapsing fever.	
Text Books	<ol style="list-style-type: none"> 1. Imms, A.D. . A General Text Book of Entomology. Chapman & Hall, UK.1977. 2. Chapman, R.F. . The Insects: Structure and Function. IV Edition, Cambridge University Press, UK.1998

Reference Books	<ol style="list-style-type: none"> 1. Pedigo L.P. Entomology and Pest Management. Prentice Hall Publication.2002. 2. Mathews, G. Integrated Vector Management: Controlling Vectors of Malaria and Other Insect Vector Borne Diseases. Wiley-Blackwell-2011 		
E-Reference	https://www.who.int/tdr/diseases-topics/vectors/en/#:~:text=Mosquitoes%20are%20the%20best%20known,%2C%20Chikungunya%2C%20Rift%20Valley%20fever.		
Course outcome	Upon completion of this course, the students will be able to		
	CO	Course Outcomes	Knowledge Level
	CO1	understand the general features of insects	K1
<i>Mother Teresa Women's University, Kodaikanal – 624 101</i>			95

CO2	know the concept of vectors	K2
CO3	classify the insects vectors	K3
CO4	know about mosquito borne diseases	K2
CO5	gain knowledge about Siphonaptera as Disease Vectors	K2

Mapping of COs with POs & PSOs:

CO	PROGRAMME OUTCOMES(PO)								PROGRAMME SPECIFIC OUTCOMES (PSO)				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO1	S	M	S	S	S	S	M	S	M	S	M	S	M
CO2	S	S	S	S	S	S	S	S	S	M	S	S	S
CO3	S	S	M	S	M	M	S	M	S	S	S	M	S
CO4	S	S	S	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	M	S	S	M	S	M	S	S	S	S

Strongly Correlating (S) - 3 marks
 Moderately Correlating (M) - 2 marks Weakly
 Correlating (W) - 1 mark No
 Correlation (N) - 0 marks

U23ZOE64A-AGRICULTURAL ENTOMOLOGY

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	Externa	Total
U23ZOE64A	AGRICULTURAL ENTOMOLOGY	SEC	Y	-	-	-	3	3	25	75	100

Learning Objectives

- Explain the basic concepts of entomology and observe the pest status of agriculture.
- Illustrate and examine the systemic and functional morphology of various group of agricultural insect pests.
- Differentiate and classify the various groups of insect animals and estimate biodiversity.
- To compare and distinguish the general and specific characteristics integrated pest management.
- Infer and integrate the economic importance of insect species.

UNIT	Details	No. of Hours	Course Objectives
I	Unit I: Outline classification of insects - Causes for insect assuming pest status - Methods of collection, mounting and preservation of insect pests.	9	CO1
2	Unit II: Insect vectors of plant diseases, Insect pests of stored grains their preventive and curative methods, Most common insect pests of the following plants and their control measures: Paddy, Sugarcane, Groundnut, Coconut and Cotton. Locust and its control. Insect pollinators and scavenge	9	CO2
3	Unit III: Apiculture: Introduction, types of honey bees, hive, apiary, selection of bees for apiary, Newton's bee hive, enemies and diseases of honey bees. Sericulture: Introduction, types of silk worms, silk worm races, life history of mulberry silk worm, features of sericulture industry, pests and diseases of silk worm. Lac Culture.	9	CO3
4	Unit IV: IPM, physical, mechanical, chemical and biological control methods, Pesticide application equipment	9	CO4
5	Unit V: Introduction and steps towards IPM, Pheromones, antifeedents, repellents and biopesticide.	9	CO5
Total		45	

Course	Teresa Women's UNiversity, Kodaikanal – 624 101		97
Outcomes	On completion of this course, students will;		
CO1	Examine and identify the systemic and functional	PO1	

	morphology of various group of agricultural insect pests.	
CO2	Differentiate and classify the various groups of insects and estimate the biodiversity.	PO1, PO2, PO3
CO3	Explain the pest status in agriculture and control measures.	PO3, PO4, PO5
CO4	To compare the methods and outcomes of integrated pest management.	PO2, PO3, PO5, PO6, PO8
CO5	List the economic importance of agricultural insect species	PO3, PO4, PO5, PO6, PO7, PO8

Text Books

1	David, Band Ananthkrishnan, T.N. 2006. General and Applied Entomology, Second edition, Tata McGraw hill publishing company Ltd., New Delhi, India.
2	Vasanthraj David, B. and Ramamurthy, VV. 2012. Elements of Economic Entomology, Seventh edition, Namrutha publications, Chennai.
3	Pruthi, H.S. 1969. Textbook on Agricultural Entomology, I.C.A. R. Publication, New Delhi.
4	Awasthi, V.B. 2012. Introduction to General and Applied Entomology, third edition, Scientific publishers.

References Books

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

1	Abishek Shukla, D. 2009. A Hand Book of Economic Entomology, Vedamse Books, New Delhi.
2.	Ministry of Agriculture, Government of India, 1995. Manual on Integrated Pest Management in Rice and Cotton.
3	John William S. 1995. Management of Natural Wealth, Loyola College Publications, Chennai.

Web Resources:

1.	http://www.fao.org
2.	http://flybase.bio.indiana.edu/
3.	http://www.ipm.ucdavis.edu
4.	http://www.ent.iastate.edu/list/
5.	www.entsoc.org

Methods of Evaluation

Internal Evaluation	Continuous Internal Assessment Test	25 Marks
	Assignments	
	Seminars	
External Evaluation	End Semester Examination	75 Marks
	Total	100 Marks

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

U23ZOE64B -BIOINSTRUMENTATION

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	Externa	Total
U23ZOE64B	BIOINSTRUMENTATION	SEC	Y	-	-	-	3	3	25	75	100

Learning Objectives

- To induce interest in the use of various biological instrumentation and employ them for the study of cells, tissues and genetic material.
- To help students to map the use of specific bioinstrumentation for specific biological experiments and infer the results of such experiments.
- To study the working principle of different bioinstrumentation and their applications.
- To enable students to design experiments and justify them with the underlying principles of bioinstrumentation.

UNIT	Details	No. of Hours	Course Objectives
I	Unit I: Good Laboratory Practices : Guide lines, Laboratory symbols; Cleaning and sterilization of labware and reagents; handling and care of laboratory animals; Laminar flow hood: types and use; Concepts of molecular weight, atomic weight, preparation of solutions of a particular molarity and percentage; Buffers: definition and preparation of buffers, pH meter; Safety and ethical issues in laboratory settings	9	CO1
2	Unit II: Microscopy - Light microscope, SEM, TEM, Atomic force microscope; Cryopreservation - principle and procedure; Fluorescence activated cell sorting; X-ray crystallography	9	CO2
3	Unit III: Centrifugation - working principle and types of centrifugation; Spectrophotometry; Mass spectrometry; Chromatography - principle and types of chromatography.	9	CO3
4	Unit IV: Biomedical Instrumentation : ESR measurement, haemoglobin measurement, blood pressure, blood flow, ECG, cardiac pacemakers; X- ray imaging, CT scan and NMR imaging; Ultrasound imaging; medical	9	CO4
<i>Mother</i>	<i>Trends in Women's University, Kodaikanal - 641101</i> Applications of Biosensors - glucose biosensor, alcohol biosensor, artificial retina, environmental biosensors, cantilever-based biosensors, DNA biosensor.		10

5	Unit V: Molecular Techniques : Isolation of DNA, RNA and proteins; Electrophoresis of DNA and proteins; Polymerase chain reaction; ELISA; Immunofluorescence; Fluorescent in situ hybridization; Southern and Western blotting.	9	CO5
Total		45	
Course Outcomes	On completion of this course, students will;		
CO1	To describe and explain the steps in the use of various biological instrumentation those are used in the study of different animal specimens.	PO1	
CO2	To relate the applications of biological techniques and employ them for the study of cells, tissues and genetic material.	PO1, PO2, PO3	
CO3	To correlate and appraise the use of specific bioinstrumentation for specific biological experiments and infer the results of such experiments.	PO3, PO4, PO5	
CO4	To compare the working principle of different bioinstrumentation and to summarize their applications.	PO2, PO3, PO5, PO6, PO8	
CO5	To devise experiments and justify them with the understanding of the underlying principles of bioinstrumentation that are ecofriendly, ethical and have national and global relevance	PO3, PO4, PO5, PO6, PO7, PO8	
Text Books			
1	SabariGhosal and Anupama Sharma Avasthi, 2018. Fundamentals of Bioanalytical Techniques and Instrumentation, 2nd Ed., Phi Learning Pvt. Ltd., New Delhi, India.		
2	Veerakumari L., 2015. Bioinstrumentation, MJP Publishers, Chennai, India.		
3	Prakash Singh Bisen, Anjana Sharma, 2012. Introduction to Instrumentation in Life Sciences, CRC Press, Taylor & Francis Group, New York, USA.		
4	Gupta P.C., 2010. Biological Instrumentation and Methodology (Tools & Techniques), S. Chand & Company Limited, New Delhi, India.		
5	Ghatak K. L., 2010. Techniques and Methods in Biology, Phi Learning Pvt. Ltd., New Delhi, India.		
References Books			
(Latest editions, and the style as given below must be strictly adhered to)			
1	Sue Carson, Heather Miller, Melissa Srougi and Scott Witherow, 2019. Molecular Biology Techniques: A Classroom Laboratory Manual, Academic Press, New York, USA.		
2	Aysha Divan, Janice Royds, 2013. Tools and Techniques in Biomolecular Science, Oxford University Press, UK.		

3	Gordon M.H., Macrae R., 2012. Instrumental Analysis in the Biological Sciences, Blackie & Son Ltd., UK	
4	Leonard Davis, Mark Dibner and James Battey, 2012. Basic Methods in Molecular Biology, Elsevier Science Publishing Co., New York, USA	
5	Wilson, K.M. and Walker, J.M., 2010. Principles and Techniques of Biochemistry and Molecular Biology, Cambridge University Press, UK.	
Web Resources:		
1.	1. https://bit.ly/3i5flym	
2.	1. https://pbiol.rsb.org.uk	
3.	1. https://www.nature.com/subjects/biological-techniques	
4.	https://www.ibiology.org	
Methods of Evaluation		
Internal Evaluation	Continuous Internal Assessment Test	25 Marks
	Assignments	
	Seminars	
External Evaluation	End Semester Examination	75 Marks
	Total	100 Marks
Methods of Assessment		
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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	

