B. Sc. Zoology

Syllabus

AFFILIATED COLLEGES

Program Code: 22F

2021 – 2022 onwards

BHARATHIAR UNIVERSITY

(A State University, Accredited with "A" Grade by NAAC,
Ranked 13th among Indian Universities by MHRD-NIRF,
World Ranking: Times -801-1000,Shanghai -901-1000, URAP - 982)

Coimbatore - 641 046, Tamil Nadu, India

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)	
The **B. Sc. Zoology** program describe accomplishments that graduates are expected to attain within five to seven years after graduation	
PEO1	Enhanced the professional skills by means of continuous education and development.
PEO2	Ability to impart complex technical knowledge relating to Zoology in a clear and concise manner in writing and oral skills.
PEO3	Capable of using computers and appropriate software for analysis and employing modern tools in biological observations.
PEO4	Graduate will recognize the need and apply their knowledge in general and various discipline areas.
PEO5	Pursue lifelong learning and constant improvement of their knowledge and skills in the diverse field with the highest professional and ethical standards.
PEO6	Skill to function on multidiscipline environment to meet desired needs within realistic constraints such as environmental, social, ethical, health, safety, and sustainability.
PEO7	Understand the local, National and global issues related to the development and to be considerate of the impact of the issues.
PEO8	Exhibit the ability to communicate effectively and to function successfully as a team member and leader.
PEO9	Ability to explore and assess research work on the field of emergencies and diversity particularly in the field of the Public Health aspects.
PEO10	Capacity to obtain, analyses, and communicate in order to formulate strategies for mitigation in future scenarios with the ability to clearly present and discuss their conclusions and the knowledge behind them.

PROGRAM SPECIFIC OUTCOMES (PSOs)	
After the successful completion of B.Sc., Zoology program, the students are expected to:	
PSO1	To provide Knowledge of various animals from primitive to highly evolved forms.
PSO2	To understand prospective of various branches of Zoology and analyze the interaction between animals with their ecosystems.
PSO3	Understanding the morphology and functional characteristic at cellular and sub-cellular (molecular) level.
PSO4	To equip students with laboratory skills as well as field based studies to make a successful career in Zoology.
PSO5	To highlight biodiversity and its need, make aware about methods of conservation and sustainability.
PSO6	Understand the applications of Zoology in daily life, Medicine, Apiculture, Aquaculture, Industrial Microbiology and Agriculture.
PSO7	Gain knowledge about problem solving methods, effective communication skills and prepare them to enter into higher studies and find employment in different sectors.
PSO8	To ensure quality performance, achieve excellence in education and research in the field of Zoology.

PROGRAM OUTCOMES (POs)	
On successful completion of the B. Sc. Zoology program:	
PO1	Students are able to study animals of diverse phyla, their distribution and their association with the surroundings.
PO2	Students gain information and skill in the fundamentals of animal sciences, understands the multifarious connections along with different living organisms.
PO3	Students achieve knowledge of internal structure of cell, its functions in control of various metabolic functions of organisms. Correlates the physiological, Biochemical processes of animals and relationship of organ systems.
PO4	Students will be able to compare and distinguish the characteristics of animals that discriminate them from other forms of life.
PO5	Understands the complex evolutionary processes and behavior pattern of different animals.
PO6	Understanding of environmental conservation processes, pollution control methods and its importance. Students also gain knowledge and awareness about biodiversityas well as the importance of protection of endangered species.
PO7	Achieve knowledge in applied fields like Sericulture, Poultry forming and Apiculture alongside Statistical and Laboratory techniques.
PO8	Understands about various concepts and importance of Biotechnology, Bioinformatics, Genetics, Genetic engineering in industry and day today human life.
PO9	Apply ethical principles and assign to professional ethics and responsibilities in delivering his duties.
PO10	Understanding of Zoology to one's own life and apply the knowledge judicially and remain constantly employable.

BHARATHIAR UNIVERSITY: COIMBATORE 641 046
B. Sc., ZOOLOGY CURRICULUM
(For the students admitted during the academic year 2021 – 22 onwards)

Part	Course Code	TITLE OF THE COURSE	Credits	HOURS		MAXIMUM MARKS		
				Theory	Practical	CIA	CEE	Total
	FIRST SEMESTER							
I	11T	Language I	4	6	-	50	50	100
II	12E	English I	4	6	-	50	50	100
III	13A	Core Course I: Animal Diversity – Non Chordata	4	6	-	50	50	100
III		Core Practical I	-	-	4	-	-	-
III	1AH	Allied A Course I: **Chemistry/Botany/ Biochemistry**	3	4		30	45	75
III		Allied Practical	-	-	2	-	-	-
IV	1FA	Environmental Studies	2	2	-	-	50	50
		Total	**17**	-	-	-	-	**425**
	SECOND SEMESTER							
I	2IT	Language II	4	6	-	50	50	100
II	22E	English II	4	6	-	50	50	100
III	23A	Core Course II: Animal Diversity – Chordata	4	6	-	50	50	100
III	23P	Core Practical I	4	-	4	50	50	100
III	2AH	Allied A Course II: **Chemistry/Botany/ Biochemistry**	3	4	-	30	45	75
III	2PH	Allied Practical	2	-	2	25	25	50
IV	2FB	Value Education – Human Rights	2	2	-	-	50	50
		Total	**23**	-	-	-	-	**575**
	THIRD SEMESTER							
I	3IT	Part I-Language III	4	6	-	50	50	100
II	32E	Part II-English III	4	6	-	50	50	100
III	33A	Core Course III: Comparative Anatomy of Vertebrates.	4	5	-	50	50	100
III		Core Practical II	-	-	2	-	-	-
III	3AJ	Allied B Course I: **Botany/Chemistry/ Biochemistry**	3	4	-	30	45	75
III		Allied Practical	-	-	2	-	-	-
IV	3ZA	Skill Based I: Sericulture	3	3	-	30	45	75
IV	3FC	Non Major Elective I * Yoga.	2	2	-	-	50	50
		Total	**20**	-	-	-	-	**500**

	FOURTH SEMESTER							
I	41T	Part I-Language IV	4	6	-	50	50	100
II	42E	Part II-English IV	4	6	-	50	50	100
III	43A	Core Course IV: Ecology, Evolution and Zoogeography	4	5	-	50	50	100
III	43P	Core Practical II	4	-	2	50	50	100
III	4AJ	Allied B Course II: **Botany/Chemistry/ Biochemistry**	3	4	-	30	45	75
III	4PJ	Allied Practical	2	-	2	25	25	50
IV	4ZB	Skill Based II: Biostatistics and Computer Applications	3	3	-	30	45	75
IV	4FE	Non Major Elective II * General Awareness.	2	2	-	-	50	50
		Total	**26**	-	-	-	-	**650**
	FIFTH SEMESTER							
III	53A	Core Course V: Cell Biology and Biochemistry	4	5	-	50	50	100
III	53B	Core Course VI: Microbiology	4	5	-	50	50	100
III	53C	Core Course VII: Genetics and Immunology	4	5	-	50	50	100
III		Core Practical III	-	-	2	-	-	-
III		Core Practical IV	-	-	2	-	-	-
III		Elective Course I: A/B/C#	3	3	-	30	45	75
III		Elective Course II: A/B/C#	3	3	-	30	45	75
III		Elective Course III: Practical#	-	-	2	-	-	-
IV	5ZC	Skill Based Course III: Biophysics and Instrumentation.	3	3	-	30	45	75
		TOTAL	**21**	-	-	-	-	**525**
	SIXTH SEMESTER							
III	63A	Core Course VIII: Animal Physiology.	4	5	-	50	50	100
III	63B	Core Course IX: Developmental Biology.	4	5	-	50	50	100
III	63C	Core Course X: Biotechnology.	4	5	-	50	50	100
III	63P	Core Practical III	4	-	2	50	50	100
III	63Q	Core Practical IV	4	-	2	50	50	100
III		Elective Course I: A/B/C#	3	3	-	30	45	75
III		Elective Course II: A/B/C#	3	3	-	30	45	75
III	63R	Elective Course III: Practical#	2	-	2	25	25	50

IV	6ZP	Skill Based Course IV: Practical	3	-	2	30	45	75
V	67A	Extension activities**	2	1	-	-	-	50
		TOTAL	**33**	**-**	**-**	**-**	**-**	**825**
		GRAND TOTAL	**140**					**3500**
		ONLINE COURSES						
		1.	**SWAYAM**					
		2.	**MOOC'S**					

***** Non Major Elective I: Basic Tamil I / Advanced Tamil I / Yoga / Women studies and Non major Elective II: Basic Tamil II / Advanced Tamil II / General Awareness.

***** It is compulsory that those who opt for any languages other than Tamil, they should choose Basic Tamil (Who don't studied Tamil) or Advanced Tamil (For those who studied Tamil up to HSC).

** Only internal marks.

ELECTIVE COURSES

List of Elective Courses (Colleges can choose one course from Elective I & II, Elective III will be the practical of Elective II)			
ELECTIVE COURSES	**SUBJECT CODE**		**TITLE OF THE COURSE**
Elective Course I	A	5EA	Human Genetics and Counseling – Course I.
		6EA	Human Genetics and Counseling – Course II.
	B	5EB	Pest and Their Control – Course I.
		6EB	Pest and Their Control – Course II.
	C	5EC	Wild life Management and Conservation – Course I.
		6EC	Wild life Management and Conservation – Course II.
Elective Course II	A	5ED	Pathology and Clinical Laboratory Technology – Course I.
		6ED	Pathology and Clinical Laboratory Technology – Course II.
	B	5EE	Poultry Science & Management – Course I.
		6EE	Poultry Science & Management – Course II.
	C	5EF	Apiculture – Course I.
		6EF	Apiculture – Course II.
Elective Course III	A	63R	Pathology and Clinical Laboratory Technique – Practical.
	B	63R	Poultry Science and Management – Practical.
	C	63R	Apiculture – Practical.

#VALUE ADDED COURSE (OPTIONAL)

S. No	PAPAERS	TOTAL MARKS
1.	Medical Emergence Management.	100
2.	Vermitechnology	100
3.	Economics of Conservation	100
4.	Intellectual Property Rights	100

First Semester

Course code	13A	ANIMAL DIVERSITY - NONCHORDATA	L	T	P	C
Core/Elective/ SBS		Core Course - I	4	0	0	4
Pre-requisite		Basic Knowledge of Non-Chordata	Syllabus Version		2021 – 2022	

Course Objectives:

1. To identify the phyla of invertebrate animals and recognize their distinguishing features.
2. To understand the taxonomy, relationship and evolution of animals.
3. To understand the role of invertebrates in biological communities, ecological interactions, and conservation problems.
4. To appraise the diversity of animals in a phylogenetic context.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the diversity and general taxonomic rules on animal distribution	K2
2	The learner will be able to identify the animal at basic level and get an idea of adaptation and importance of Non-chordata.	K2
3	Imparts theoretical knowledge about distribution of invertebrate fauna in different zoogeographical realms.	K3
4	Get knowledge about anatomical features of non-chordate, important parasites and economically important organisms.	K3
5	Analyze the importance of its conservation, sustainable economic utilization and its potentials in technological prospects.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	CLASSIFICATION AND PROTISTA	17 hours

Concept of five kingdom classification of life.
Introduction to Protista and Animal kingdom – Systems of Classification and Nomenclature - levels of organization - Types of symmetry. General characters of Protista and Classification with examples.
Type study: Paramecium.
General Topics: Parasitic Protozoa, Life cycle of Plasmodium, Locomotion and Nutrition in Protozoa.

Unit:2	PORIFERA AND COELENTERATA	17 Hours

Characters and classification (up to class) of Porifera and Coelenterate with examples.
Salient features of *Ctenophora*.
Type study: *Leucosolenia*, *Obelia* Colony.
General Topics: Canal system in sponge, Polymorphism in Coelenterate, Diversity (Types) of corals and structure of coral polyp, Coral reefs.

Unit:3	PLATYHELMINTHES, ASCHELMENTHIES AND ANNELIDA	18 Hours

Characters and classification (up to class) of Platyhelminthes, Aschelmenthies and Annelida with examples. **Type study:** *Taenia*, *Ascaris*, *Megascolex*.

General Topics: Coelom, Coelomoducts and Metamerism, Parasitic adaptations in Helminthes and Annelids, Filter feeding in Polychaetes.

Unit:4	ARTHROPODA	18 Hours
Characters and classification (up to class) of Arthropoda with examples. Brief descriptions of *Limulus* (living fossil), Sacculina (Parasitic castration), Copepods, Scorpion, Spider, *Peripatus* (Affinities), Millipeds and Centipeds. **Type study:** Cockroach and Prawn, **General Topics:** Crustacean larvae, Missing links and Economic importance of insects.		
Unit:5	**MOLLUSCA, ECHINODERMATA AND HEMICHORDATA.**	**18 Hours**
Characters and classification (up to class) of Mollusca and Echinodermata with examples. Characters of Hemichordates. Brief descriptions of Fresh water Mussel, *Chiton*, *Sepia*, Starfish, Sea cucumber and Balanoglossus **Type study:** Pila, Starfish (External Features and Water Vascular system) **General Topics:** Larval forms of Mollusca, Torsion and De-torsion in Mollusca, Economically important Mollusca, Echinoderm larva, Evolutionary affinities of Hemichordate.		
Unit:6	**CONTEMPORARY ISSUES**	**2 Hours**
Expert lectures, Online Seminars - Webinars and Field Visits.		
	Total Lecture Hours	**90 Hours**

Text Book(s)

1	Arumugam N. (2002). *Invertebrate Zoology*, Saras publication, Nagercoil, Tamilnadu.
2	Kotpal RL. (2012). *Modern Text Book of Zoology – Invertebrata*, Rostagi, publication, Meerut.
3	Nair NC, Leelavathy S, SoundaraPandian N, Murugan T and Arumugam N. (2010). *A Text Book of Invertebrates*, Saras Publication, Nagercoil, Tamilnadu.

Reference Books

1	Barnes RD. (1980). *Invertebrate Zoology*, 6th edition. Holt Saunders International Edition, Philadelphia.
2	Ekambaranatha Ayyar and. Ananthakrishnan TN. (1994). *Manual of Zoology Vol – I, Part I and IIS, Viswanathan* Pvt. Ltd. Chennai.
3	Hyman LH. (1940).*The Invertebrates (6 vols)*, McGraw-Hill Companies Inc. New York.
4	Jordan EL and Verma PS (2015). *Invertebrate Zoology*, S. Chand and Co, New Delhi.
5	Kotpal RL, Agarwal SK and Khetarpal RP. (1990). *Invertebrates*, Rastogi Publications, Meerut.
6	Margulis L, Schwartz KV and Dolan M. (1994). *The Illustrated Five Kingdoms: A Guide To The Diversity Of Life On Earth*, HarperCollins College Publishers, New York.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://swayam.gov.in/nd2_cec19_bt05/preview
2	http://agritech.tnau.ac.in/sericulture/seri_dept%20of%20seri_training.html
Course Designed By: Dr. A. RAJA RAJESWARI, Asst.Prof, Sri Vasavi College, Erode.	

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	L	S	S	M	L	L	M	M
CO2	S	S	M	S	S	L	L	M	M	M
CO3	S	S	M	S	S	L	L	M	S	M
CO4	S	S	M	S	S	L	L	S	S	S
CO5	S	S	L	S	S	S	M	L	S	M

*S-Strong; M-Medium; L-Low

Second Semester

Course code	23A	ANIMAL DIVERSITY - CHORDATA	L	T	P	C
Core/Elective/ SBS		Core Course - II	4	0	0	4
Pre-requisite		Basic knowledge of Chordata	Syllabus Version		2021 – 2022	

Course Objectives:

1. To understand the taxonomy and relationship and evolution of animals.
2. To identify the class of vertebrate animals and recognize their distinguishing features.
3. To appraise the diversity of animals in a phylogenetic context.
4. To understand how different body designs solve biological problems related to physiological and environmental challenges.
5. To develop an appreciation for the role of vertebrates in biological communities, ecological interactions, and conservation problems.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the diversity of chordates and their classification.	K2
2	Analyze the significant adaptive features in Fishes, Amphibians, Reptiles, Aves and Mammals.	K4
3	Understand physiological and anatomical peculiarities, adaptations necessary to survive in diverse adaptive zones.	K2
4	Familiarize with gradual development of habit and habitats of various animals and physiological system of chordata.	K4
5	Know the transitional stages and their importance in evolution.	K2

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	FISHES	17 Hours

General characters and classification of Chordata (up to class) with examples. Brief descriptions of *Amphioxus*, *Ascidia*, Hag fish, *Scolidon*, Mullet, *Anabas*, Cat fish, Sea horse.

General topics: Affinities of Prochordates, Accessory respiratory organs in Teleost, Types of Fins and function, Comparison of Teleost and Elasmobranches, Evolutionary significance of Dipnoi, Migration of Fishes.

Unit:2	AMPHIBIA	17 Hours

Classification and characters of Amphibia (up to order with examples). Habitat, classification, examples and brief descriptions of Frog, Toad, Salamander, Ambystoma, Tree frog.

General topics: Origin of Amphibia, Metamorphosis of Frog, Limbless amphibians, Parental care in amphibian, Paedomorphosis.

Unit:3	REPTILIA	18 Hours

Classification and characters of Reptilians (up to order with examples). Habitat, classification, examples and descriptions of *Calotes*, *Sphenodon*, Varanus, Chameleon, Snakes, Chelonia and Crocodilia

General topics: Identification of Poisonous and non-poisonous snakes – Poison apparatus and types ofpoison.

Unit:4	AVES	18 Hours

Classification and characters of Aves (up to order with examples). Habitat, classification, examples and brief descriptions of Pigeon, Horn bills, Kingfisher, Heron, Parrot, Wood pecker, Finches and Sunbird.

General topics: Flightless Birds, Flight Adaptations in Birds, Feet and Beak modifications, Wetland birds, Sound production in Birds.

Unit:5	**MAMMALS**	**18 Hours**
Classification and characters of Mammals (up to order with examples). Habitat, classification, examples and brief descriptions of Kangaroo, Bat, Rabbit, *Panthera*, *Hyena*, Monkey, Apes, Deer, Elephant and *Rhinoceros.* **General topics:** Diversity of Marsupials, Affinities of Echidna, Dentition in Mammals, Aquatic mammals and adaptation, Odd and even toed ungulates, Insectivorous mammals, Adaptive radiation in Mammals, Estrous cycle in mammals. .		
Unit:6	**CONTEMPORARY ISSUES**	**2 Hours**
Expert lectures, Online Seminars - Webinars and Field Visits.		
	Total Lecture Hours	**90 Hours**

Text Book(s)

1	Arumugam N. (2019). *Animal Diversity - Volume - 2 - Chordata*, Saras Publication, Nagercoil, Tamilnadu.
2	Kotpal RL. (2019). *Mordern Text Book of Zoology Vertebrates*, 4th edition, Rastogi Publications, Meerut.
3	Thangamani A, Prasannakumar S, Narayanan LM, Arumugam N. (2006). *A Text Book of Chordates*, Saras Publication, Nagercoil, Tamilnadu.
4	Verma PS. (2013). *Chordate Zoology*, S. Chand Publishers, New Delhi

Reference Books

1	Barrington EJW. (1967). *Invertebrate Structure and Functions*, English Language Book Society.
2	Ekambaranatha Ayyar and Ananthakrishnan TN. (1995). *Manual of Zoology Vol – II*, S. Viswanathan Pvt. Ltd., Chennai.
3	Kotpal RL. (2007). *Modern Text Book of Zoology Vertebrates*, 4th edition, Rastogi Publications, Meerut.
4	Pough Harvey F, Christine M, Janis and John B. Heiser. (2002). *Vertebrate Life*, Pearson Education Inc. New Delhi.
5	Young JZ. (1950). *Life of Vertebrates*, Clarendon Press, Oxford, UK.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://knowledgeuniverseonline.com/ntse/Biology/Phylum-Chordata.php
2	https://www.onlinebiologynotes.com/phylum-chordata-characteristics/
Course Designed By: Dr. A. RAJA RAJESWARI, Asst.Prof, Sri Vasavi College, Erode.	

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	S	S	M	M	L	S	S
CO2	M	S	S	S	M	M	S	L	S	S
CO3	M	S	S	M	S	M	S	L	M	M
CO4	S	S	M	S	S	L	M	L	M	M
CO5	S	S	M	S	S	M	L	M	M	M

*S-Strong; M-Medium; L-Low

Course code	23P	ANIMAL DIVERSITY – NONCHORDATA AND CHORDATA	L	T	P	C
Core/Elective/ SBS		Core Practical - I	0	0	4	4
Pre-requisite		Practical knowledge of Non-Chordata and Chordata	Syllabus Version		2021 – 2022	

Course Objectives:

1. Learn and be familiar with the Laboratory techniques by means of using digital different methodologies.
2. Examine and understand the external and internal anatomy of Invertebrate and Chordate.
3. To understand the taxonomic position, body organization and evolutionary relationship of animals.
4. To inculcate the significance of various non chordates and chordates.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Evaluate the biological significance, structure and functions of various animals.	K5
2	Able to enlighten the adaptation and unique characters of animals and their role in the development.	K2
3	Apply knowledge and come to know how to handle different organisms.	K3
4	Analyze and to observe various specimens by using Microscope.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

INSTRUCTION:

The Board of studies does not encourage the dissection of animals and advised to rely of alternative digital methods. Those departments undertaking dissection should compulsorily constitute a dissection monitoring committee as per UGC rules. It is to be ensured that the animals used for dissection is not removed from the wild and is in compliance with UGC regulations time to time. It is the duty of the college/department to adhere strictly to the Wildlife Protection Act and its amendments.

MAJOR PRACTICAL

Prawn / Cockroach / Earthworm/ Fish (Any two) Digestive System and Nervous system.
Micrometry measurement of given Protozoan /Micro arthropod / Any sample.

MINOR PRACTICAL

1. Prawn/ Cockroach/Mosquito (Any two): Mounting of Appendages / Mouth parts Earth worm: Mounting of body setae
2. Fish: Mounting of Scales
3. Motility of Paramecium – Hanging drop method.

SPOTTERS

1.Classify Giving Reasons:
Paramecium, *Obelia*, Liver Fluke, *Ascaris*, *Pila*, Star Fish, *Balanoglossus*, Any Fish, Tree Frog, Snake, King Fisher And Bat.

2.Draw Labeled Sketches:
Trochophore, Any Echinoderm Larvae.

3.Biological Significance:
Paramecium –Conjugation, Malaria Parasite, Gemmules, *Limulus*, Hippocampus, Nautilus. Axolotl Larva.

4.Relate Structure And Function:
Spicules Of Sponges, Scolex Of Tapeworm, *Nereis* Parapodium, Carapace And Plastron, Electric Organ – *Narcine*.

5.Descriptive Notes:
Hydra, Physalia, Rotifer, Sea Cucumber, Chiton, Placoid Scales, Chameleon, Quill Feather.

VISIT AND SUBMISSION OF REPORT
1. Visit to any nearby area of biodiversity significance (Report should be included in record).
2. Photo Album of invertebrates and Vertebrates with identification and classification (Evaluation of report should be based on field effort, diversity of photos, classification and identification. Costly presentation of photos albums should compulsorily be discouraged, as the objective of this is to make students familiar with fauna).

QUESTION PATTERN: 50 MARKS
Major: 15, Minor: 10, Record: 5, Spotter: 15 (5 spotters each carry 3 marks),
Album: 05 marks.

Total Practical Hours **60(Each Semester) x 2 = 120 Hours Per Year**

Text Book(s)

1	Arumugam N, Thangamani A, Prasanna Kumar S, Narayanan LK, Jayasurya.(2013).*Practical Zoology Volume 2 Chordata*, Saras Publication, Nagercoil, Tamilnadu.
2	Jayasurya, Ram Prabhu R, Arumugam N, Nair NC, Leelavathy S, Soundara Pandian N, Murugan T.(2013). *Practical Zoology Volume 1Invertebrate*, Saras Publication, Nagarcoil, TamilNadu.
3	Lay SS. (2004). *A text book of Practical Zoology Invertebrate*, Rastogi Publications, Shivaji Road, Meerut, India
4	Verma PS. (2000). *A Manual of Practical Zoology- Chordates*, S. Chand Publications, New Delhi.

Course Designed By: Dr. A. RAJA RAJESWARI, Asst.Prof, Sri Vasavi College, Erode.

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	L	M	M	S	S
CO2	S	S	M	S	S	L	M	L	S	S
CO3	S	S	L	S	M	L	M	L	S	S
CO4	S	S	L	S	M	L	S	L	S	S

*S-Strong; M-Medium; L-Low

Third Semester

Course code	33A	COMPARATIVE ANATOMY OF VERTEBRATES	L	T	P	C
Core/Elective/ SBS		Core Course - III	4	0	0	4
Pre-requisite		Basic knowledge on Structural Anatomy of Vertebrates	Syllabus Version		2021 – 2022	

Course Objectives:

1. Recognition of the morphological and anatomical structure for the major groups of vertebrates from an evolutionary point of view.
2. Gain understanding of how organism form, function and diversity evolved
3. To understand the structural complexity in advanced taxa.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Familiarize with structural organization, biology, and functioning of each organ and formation of organ systems.	K2
2	Students also gain knowledge about fundamental steps in vertebrate development and understand the increasing complexity of organ systems with advancement of evolution.	K2
3	The students will be able to describe the vertebrate structures and relate morphology, function and evolution.	K3
4	Relate the concepts of homology, analogy, morphogenesis, ontogeny, and phylogeny relative to the anatomical features of vertebrates.	K3
5	Provide a strong basic insight in understanding advanced courses like Physiology and Biochemistry.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	DIGESTIVE AND RESPIRATORY SYSTEM	15 Hours

Comparative account of Digestive system of shark, frog, pigeon and rabbit – Ruminant stomach and function. Gills of fishes – Pharyngeal derivatives – Swim Bladder - Comparative account of Lungs and air ducts in Vertebrates.

Unit:2	NERVOUS SYSTEM	14 Hours

Comparative account on structure of Brain, Cranial and spinal nerves of Shark, Frog and Rabbit. Sense organs of vertebrates.

Unit:3	SKELETAL SYSTEM	15 Hours

Regions of Vertebral column - Structure of typical vertebrae - Types of vertebrae – Ribs and sternum. Comparison of Skull, Pelvic, pectoral girdle and limbs of Shark, Frog and Rabbit. Account of skull of Reptiles. Exoskeleton of Vertebrates (Scales, Feathers, hairs etc.).

Unit:4	CIRCULATION AND MUSCULATURE	15 Hours

Aorta and aortic arches – Comparative account of heart, arterial system and venous system in shark, frog, *Calotes*, pigeon and rabbit. Brief account of appendicular musculature – Electric organs in fish.

Unit:5	**URINOGENITAL SYSTEM**	**14 Hours**
Comparison of Pronephros – Mesonephros and Metanephros with examples. Comparison of Urinogenital system of shark, frog, *Calotes*, pigeon and rabbit.		
Unit:6	**CONTEMPORARY ISSUES**	**2 Hours**
Expert lectures, Online Seminars - Webinars and Field Visits.		
	Total Lecture Hours	**75 Hours**

Text Book(s)

1	Arumugam N. (2019). *Animal Diversity - Volume - 2 - Chordata*, Saras Publication, Nagercoil, Tamilnadu.
2	Kotpal Rl. (2017-2018). *Chordata And Comparative Anatomy*, 1st edition, Rastogi Publications, Meerut.
3	Thangamani A, Prasannakumar S, Narayanan LM, Arumugam N. (2006). *A Text Book of Chordates*, Saras Publication, Nagercoil, Tamilnadu.

Reference Books

1	EkambaranathaAyyar and Ananthakrishnan TN. (1969). *Manual of Zoology Vol – II*, S. Viswanathan Pvt. Ltd. Chennai.
2	Kent GC. (2015). *Comparative Anatomy of Vertebrates*, 9th edition, McGraw-Hill, Newyork.
3	Kulshrethra SK. (2002). *Comparative Anatomy of Vertebrates*, Anmol Publications Pvt. Ltd. New Delhi.
4	Saxena RK and Sumithra Saxena. (2015). *Comparative Anatomy of Vertebrates*, 2nd Revised edition, Viva Books Private Limited, New Delhi.
5	Waterman AJ. (1971). *Chordate Structure and Function*, MacMillan and Co Ltd, New York.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://www.athabascau.ca/syllabi/biol/biol320.php

Course Designed By: Dr. A.RAJA RAJESWARI, Asst.Prof, Sri Vasavi College, Erode.

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	S	S	M	M	L	S	M
CO2	M	S	S	S	S	M	M	L	M	M
CO3	M	S	S	S	S	L	M	M	M	S
CO4	M	S	S	S	S	L	M	L	M	M
CO5	M	S	S	S	S	L	M	S	M	M

*S-Strong; M-Medium; L-Low

Course code	3ZA	SERICULTURE	L	T	P	C
Core/Elective/ SBS		Skill Based Course - I	3	0	0	3
Pre-requisite		Basic knowledge on Silkworms and Rearing Techniques	Syllabus Version		2021 – 2022	

Course Objectives:

1. Introduce the concepts of origin, growth and study of Sericulture as science.
2. To develop a basic skill and knowledge in Sericulture.
3. Enlighten the general aspects of Sericulture industry.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	The learner will be able to practice Sericulture as a passion or profession.	K2
2	Understand the scientific approach of mulberry cultivation and silk worm rearing techniques.	K2
3	Able to identify and follow regulation practices for the disease and pest control of the mulberry plant and silk worm.	K3
4	Learn about the various skills that are necessary for self employment.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	MULBERRY CULTIVATION	9 Hours

Brief outline of History of Sericulture - Scope and opportunities in Sericulture – Types of Silk - Organic Silk - Vanya Silk. Mulberry cultivation: Nursery – Planting – irrigation – Pruning – harvesting.

Unit:2	SILK WORMS	8 Hours

Morphology of Silk worm –Types of Silkworm –Silk glands - Life cycle of Silkworm. Brief out line of non-mulberry sericulture and its potential.

Unit:3	REARING	9 Hours

Silkworm rearing - Outdoor and Indoor rearing - Rearing house - Hatching - Incubation - Feeding Silkworms - Protection and rearing - Rearing Appliances - Mounting and Harvesting.

Unit:4	DISEASES	9 Hours

Hygiene conditions in silk production – Diseases of silk worm-Bacterial and Viral diseases – Prevention – Fungal infection to Cocoon. Disease of Mulberry trees- Protozoan and Bacterial diseases and Prevention.

Unit:5	PROCESSING	8 Hours

Silk fiber formation – Properties of cocoon filament – Pre -reeling process – Cocoon boiling. Reeling technology – Re-reeling technology – raw silk industry – byproducts of Silk industries.

Unit:6	CONTEMPORARY ISSUES	2 Hours

Expert lectures, Online Seminars - Webinars and Field Visits.

	Total Lecture Hours	45 Hours

Text Book(s)

1. Ganga G and Sulochana Chetty J. (2006). *An introduction to Sericulture*, 2nd edition, Oxford and IBH publishing co. pvt. Ltd, New Delhi.
2. Ganga G. (2017). *Comprensive Sericulture*, 2nd edition, Oxford and IBH publishing co. pvt. Ltd, New Delhi.
3. Dandin SB, Jayant Jayaswal and Giridhar K. (2000). *Handbook of Sericulture Technologies*, Central Silk Board, Bangalore.

4	Madan Mohan Rao M. (2019). *An Introduction to Sericulture*, BS publications, BSP books, Hyderabad.
5	Manisha Bhattacharyya. (2019). *Economics of Sericulture*, Rajesh Publications, Delhi.
6	Shankar Reddy JPAR. (2009). *Sericulture*, Commonwealth Publishers, Delhi.
Reference Books	
1	*Diseases and Pests of Mulberry and Their Control*. (1991) Pub. By Director Central Silk Board and Training Institute, Mysore.
2	Hrccrama Reddy G. (1988). *Silkworm Breeding*, Oxford and IBH Publishing Co. Pvt. Ltd, New Delhi.
3	Pradan S. (1983). *Agricultural Entomology and Pest Control*, Published by ICAR, New Delhi
4	Sarkar DC. (1988). *Ericulture in India*, Central Silk Board, Government of India, Bangalore.
5	Tanaka Y. (1964). *Sericology*, Central Silk Board Publication, Bangalore.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://swayam.gov.in/nd2_cec19_bt05/preview
2	http://agritech.tnau.ac.in/sericulture/seri_dept%20of%20seri_training.html
Course Designed By: Dr. A. RAJA RAJESWARI, Asst.Prof, Sri Vasavi College, Erode.	

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	M	S	M	S	M	M	S	L	S	S
CO2	M	S	M	M	M	M	S	L	S	S
CO3	S	S	L	M	M	M	S	L	S	S
CO4	S	S	M	L	M	M	S	L	S	S

*S-Strong; M-Medium; L-Low

Fourth Semester

Course code	43A	ECOLOGY, EVOLUTION AND ZOOGEOGRAPHY	L	T	P	C
Core/Elective/ SBS		Core Course - IV	4	0	0	4
Pre-requisite		Knowledge on Ecosystem Structure and Functions, Animal Relationship, Environmental Pollution, Evolution and Zoogeographical Regions.	Syllabus Version		2021-2022	

Course Objectives:

1. To develop awareness about the environment and the interaction of various components.
2. Learn about the adaptations and its significance in relation to evolution.
3. To make the students aware of how organic evolution occurred and how the various life forms come into existence.
4. To make the students aware of the historical periods during the evolution of earth and status of fauna during the particular age.
5. Know about the various zoogeographical regions and their climatic and faunal peculiarities.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	The students will be able to present an overview of diversity of life forms in an ecosystem.	K2
2	The learner can correlate choice of habitat for organisms to abiotic factors, aspects of energy transfer and will be able to explain the necessity for and adaptations, providing examples.	K3
3	To describe the history and development of evolutionary thought, list and describe the evidence for evolution and its required corollaries and mechanisms by which evolution occurs.	K2
4	Able to explain the history of life on earth, climatic and faunal peculiarities.	K2
5	Understand the Zoogeographical regions, distribution, climate change and gain knowledge about evolution of human.	K2

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	ECOLOGICAL CONCEPTS	15 Hours

Ecosystem structure and function. Limiting factors. Biogeochemical cycles: Carbon, Nitrogen, water and Phosphorous. Concept of Species, Population dynamics and Growth curves. Food web Pyramids and Tropic levels. Animal relationships: - Mutualism, commensalism, parasitism, competition, predation.

Unit:2	ECOSYSYEMS	14 Hours

Habitat ecology: Freshwater, Estuarine and Terrestrial ecosystems (Detailed study). Ecotone and edge effect. Air, Water, Noise and Thermal Pollution. E-Waste – definition and management. Fundamentals of Machine Learning.

Unit:3	THEORIES OF EVOLUTION	14 Hours

Theories of Organic evolution. Fossils – types and formation. Evidences of evolution Convergent and Divergent evolution. Natural selection – Isolation Speciation.

Unit:4	GEOLOGICAL TIME SCALE	15 Hours
Hardy -Weinberg Equilibrium and Genetic drift. Colouration - Mimicry types and Significance. Geological time scale (Pre-Cambrian Eon; Up to periods for Paleozoic and Mesozoic era; up to Epoch for Cenozoic era).		
Unit:5	**ZOOGEOGRAPHY**	**15 Hours**
Zoogeographical regions – Palaearctic, Nearctic, Neotropical, Oriental, Australian and Ethiopian regions - their Climatic and faunal peculiarities. Wallace line, Discontinuous distribution - Continental Drift. Brief outlines of Human evolution.		
Unit:6	**CONTEMPORARY ISSUES**	**2 Hours**
Expert lectures, Online Seminars - Webinars and Field Visits.		
	Total Lecture Hours	**75 Hours**

Text Book(s)

1. Arumugam N and Meyyan RP. (2014). *Cell Biology, Molecular Biology, Genetics, Evolution and Ecology*, Volume-I, Saras Publication, Nagercoil, Tamilnadu.

2. Gupta PK. (2005). *Cytology, Genetics and Evolution*. Rastogi Publications, Meerut.

3. Verma PS and Agarwal VK. (2006). *Cell Biology, Genetics, Evolution and Ecology*, S. Chand Publishers, New Delhi.

References

1	Arumugam N. (2007). *Organic Evolution*, Saras Publication, Nagercoil, Tamilnadu.
2	Barton NH, Briggs DEG, Eisen JA, Goldstein DB and Patel NH. (2007). *Evolution*, Cold Spring, Harbour Laboratory Press.
3	Benton AH and Werner WE. (1976). *Field Biology and Ecology*, Tata McGraw Hill, New Delhi.
4	Chapman JL and Reiss MJ. (1992). *Ecology: Principles and Applications*, Cambridge University Press, New Delhi
5	Odum EP. (1971). *Fundamentals of Ecology*, 3rd edition,W.B Saunders College Publishing, Philadelphia
6	Sharma PD. (2014). *Elements of Ecology*, Rastogi Publications, Meerut.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://www.classcentral.com/report/swayam-moocs-course-list/
2	https://nptel.ac.in/gate_paper.html
3	https://swayam.gov.in/nd2_cec20_hs31/preview
4	https://www.swayamprabha.gov.in/
5	www.kanchiuniv.ac.in/assets/SWAYAM-BOOKLET.pdf

Course Designed By: Dr. K. SARASWATHI, Asst.Prof, Chikkaiah Naicker College, Erode.

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	M	S	S	S	M	S
CO2	S	S	S	S	M	S	S	S	M	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	M
CO5	M	M	L	M	S	M	L	M	S	S

*S-Strong; M-Medium; L-Low

Course code	4ZB	BIOSTATISTICS AND COMPUTER APPLICATIONS	L	T	P	C
Core/Elective/ SBS		Skill Based Course - II	3	0	0	3
Pre-requisite		Basic knowledge on Statistical tools and Computer Applications	Syllabus Version		2021 – 2022	

Course Objectives:

1. To develop awareness about the application of statistics in Zoology.
2. To train how the biological data are processed and interpretations are made.
3. To give an introduction to computer and data bases.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	The course will give an idea how data should be managed and Processed.	K2
2	Express statistical reasoning skills correctly and contextually.	K4
3	The course will develop the research aptitude of the students.	K3
4	Apply basic statistical concepts commonly used in basic analytical techniques to generate results.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	SAMPLING AND GRAPHS	9 hours

Types of Sampling –Concept of Sampling in Biology. Frequency distribution – Individual, discrete and Continuous series.
Drawing practice: Histogram, O give, Bar, Pie chart.

Unit:2	MEASURES OF CENTRAL TENDENCY	8 hours

Concepts and equations of Mean and Deviation (individual, discrete and continuous series).
Problem Solving: Mean, Median, Mode and Standard Deviation (individual series alone).

Unit:3	CO-RELATION AND REGRESSION	8 hours

Concept and types of Correlation and Regression.
Problem Solving: Co-efficient of Correlation, Regression for X on Y and Y on X.

Unit:4	TEST OF SIGNIFICANCE	9 hours

Concept of Students "t" test and Chi square test.
Problem Solving: "t" test – independent and dependent, Chi square test.

Unit:5	COMPUTER APPLICATIONS	9 hours

Central Processing Unit – Output and Input devices – Storage devices – Software and Hardware – Basic Operation of MS Word, Excel and Power point – Browsers and search engines. Introduction to Biological Databases – Significance of NCBI.

Unit:6	CONTEMPORARY ISSUES	2 hours

Expert lectures, Online Seminars - Webinars and Field Visits.

	Total Lecture Hours	45 hours

Text Book(s)

1. Arumugam N. (2015). *Basic Concepts of Biostatistics,* Saras Publication Nagercoil, Tamilnadu.
2. Ramakrishnan P. (2019). *Biostatistics,* Saras Publication Nagercoil, Tamilnadu.
3. Sundaralingam R, Arumugam N, Kumaresan V, Gopi A and Meena A. (2014). *Bio Statistics, Computer Application and Bioinformatics,* Saras Publication Nagercoil, Tamilnadu.

Reference Books	
1	Banerjee PK. (2007). *Introduction to Biostatistics,* S. Chand Publication, New Delhi.
2	Baxevanis A and Outllette. (2005). *Bioinformatics a Practical Guide To The Analysis of Genes and proteins,* Willy – Intersience, Hoboken, NJ. USA.
3	Kulkarni AP. (2005). *Basics of Biostatistics,* CBS Publishers, Delhi.
4	Satguru prasad. (2018). *Elements of Biostatistics,* 3rd edition, Rastogi publication, Meerut.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.edx.org/learn/biostatistics
2	https://www.classcentral.com/tag/biostatistics
Course Designed By: Dr. P. STALIN, Asst.Prof, Erode Arts and Science College, Erode.	

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	M	M	L	L	M	M	S	S	S	S
CO2	M	M	L	M	M	M	S	S	M	M
CO3	M	M	M	L	M	M	S	S	M	S
CO4	M	M	L	M	M	M	S	S	M	S

*S-Strong; M-Medium; L-Low

Course code	43P	COMPARATIVE ANATOMY OF VERTEBRATES, ECOLOGY, EVOLUTION AND ZOOGEOGRAPHY	L	T	P	C
Core/Elective/ SBS		Core Practical - II	0	0	2	2
Pre-requisite		Practical knowledge on Ecology, Anatomy and Evolution	Syllabus Version		2021 – 2022	

Course Objectives:
1. To train and be familiar with the Laboratory techniques by means of using multimedia(digital) methodologies.
2. To understand how change in population affect the ecosystem.
3. To inculcate the significance of various species and evolutionary relationship of animals.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Get practical knowledge about the species identification, diversity and their ecological significance	K2
2	Gain knowledge about the various systems of animals.	K2
3	Understand about the water pollution due to anthropogenic activity through various practical estimations.	K2
4	Apply practical knowledge on digital techniques and plankton analysis.	K3
5	Analyze and able to describe specific fauna in relation to practical and field knowledge.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

INSTRUCTION:
The Board of studies does not encourage the dissection of animals and advised to rely of alternative digital methods. Those departments undertaking dissection should compulsorily constitute a dissection monitoring committee as per UGC rules. It is to be ensured that the animals used for dissection is not removed from the wild and is in compliance with UGC regulations time to time. It is the duty of the college/department to adhere strictly to the Wildlife Protection Act and its amendments.

MAJOR PRACTICAL

1. Estimation of Dissolved Oxygen of river, pond, sewage and industrial effluent.
2. Estimation of salinity.
3. Estimation of free Carbon-di-oxide of water samples.
4. Estimation of Carbonate and Bicarbonates.
5.Demonstration of Vertebrate (Frog / Rat) :

Dissection using Multimedia – Digestive, Brain, 5^{th} Cranial, 10^{th} Cranial, Urinogenital System (Wherever possible digital dissections recommended).

MINOR PRACTICAL

1. Estimation of pH of given water Samples.
2. Estimation of Temperature of Given Water Samples.
3.Mounting of Zooplankton (from local water body)
4. Identification of Zoogeographical realms from the world Map and describe the specific fauna.

SPOTTERS

1.Identify the Typical Vertebrae / Skull:
Fish, Frog, *Calotes*, Pigeon, Rat.

2. Identify the Fore/Hind Limb:
Fish, Frog, *Calotes*, Pigeon, Rat.

3. Comment of Animal Relation Ship:
Sacculina on Crab /Hermit Crab and Sea Anemone.

4. Ecological Adaptation:
Chameleon, Balanus, Chaetopterus, Anabas.

5. Comment on the Evolutionary Significance:
Fossil, Limulus, Analogous and Homologous organs.

VISIT AND SUBMISSION OF REPORT
Visit to any Polluted / Pond Ecosystem and submission of a study report with Photos.

QUESTION PATTERN: 50 MARKS
Major: 15, Minor: 10, Record: 5, Spotter: 15 (5 spotters each carry 3 marks),
Report: 5marks.

Total Practical Hours **30(Each Semester) x 2 = 60 Hours Per Year**

Text Book(s)

1	Jaysura and Arumugam N (2013). *Practical Zoology Vol.3*, Saras Publication, Nagarcoil, Tamil Nadu.
2	Lal SS. (2008). *A text book of Practical Zoology*, Rastogi Publications, Shivaji Road, Meerut
3	*"Standard Methods for the Examination of Water and Wastewater"*, (2005) 21th edition, American Public Health Association, Washington. D.C.

Course Designed By: Dr. A. RAJA RAJESWARI, Asst.Prof, Sri Vasavi College, Erode.

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	L	M	L	S	S
CO2	M	M	S	S	S	L	S	L	S	S
CO3	M	M	M	M	M	S	S	L	S	S
CO4	S	S	M	S	M	M	S	L	S	S
CO5	S	S	M	S	S	L	S	L	S	S

*S-Strong; M-Medium; L-Low

Fifth Semester

Course code	53A	CELL BIOLOGY AND BIOCHEMISTRY	L	T	P	C
Core/Elective/ SBS		Core Paper - V	4	0	0	4
Pre-requisite		Basic Knowledge of Cell Organelles and Biochemical Nature	Syllabus Version		2021 – 2022	

Course Objectives:

1. T o understand the cytological techniques, types of microscopes and structure and functions of cell organelles.
2. To learn about cellular components underlying the mitotic division.
3. To explain the co-ordination of several organelles which bring out the cellular function.
4. Know about the structure, classification and mechanism of different pathways and biochemical reactions.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the structures and purposes of basic components of cells, especially bimolecular membranes, and organelles.	K 3
2	Students can understand how the cellular components are used to generate and utilize energy in cells.	K2
3	Able to explain the cellular components underlying mitotic cell division.	K2
4	Gain knowledge of genetic code and process of protein synthesis.	K4
5	Apply their knowledge of cell biology to selected examples of changes or losses in cell function. These can include responses to environmental or physiological changes, or alterations of cell function brought about by mutation.	K 3

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	INTRODUCTORY CYTOLOGY	14 Hours

Cell theory - Prokaryotic and Eukaryotic cells. Cytological techniques: Fixation– Sectioning and Staining. Principles and Resolving power of compound microscope, Fluorescence microscope and Electron microscope. Cell Junctions - Ultra structure and functions of plasma membrane.

Unit:2	CELL ORGANELLES	14 Hours

Nucleus and Nucleolus. DNA structure and function - DNA Replication - Chromatin – Nucleosome. Chromosomes: – Structure, types, giant chromosomes. Ultra structure and functions of Endoplasmic reticulum, Golgi body and Ribosomes

Unit:3	METABOLISM AND CELL CYCLE	15 Hours

Ultra structure and functions of Lysosomes, Centrosomes, Mitochondria. Glycolysis and Kreb's cycle. Electron transport chain and formation of ATP. Cell cycle - Mitosis, Meiosis -regulation. Apotosis and Cancer (brief outlines)

Unit:4	PROTEIN SYNTHESIS	15 Hours

Types and role of RNA- Structure of t-RNA. Ultra structure, function and types of ribosome. Properties of Genetic code - Detailed study of Protein synthesis – Polysome – differences in Eukaryotes – Short outline of post transcriptional modifications.

Unit:5	BIOCHEMISTRY	15 Hours

Structure and Classification of Carbohydrates, Protein and lipids. Enzymes: - mechanism of action – classification and factors influencing enzyme action. Glycogenesis – Glycogenolysis, Gluconeogenesis and HMP shunt. Beta oxidation of fats.

Unit:6	**CONTEMPORARY ISSUES**	**2 Hours**
Expert lectures, Online Seminars - Webinars and Field Visits.		
	Total Lecture Hours	**75 Hours**

Text Book(s)

1	Arumugam N. (2014). *Cell Biology and Molecular Biology*, Saras Publications, Nagercoil, Tamilnadu.
2	Fatima D , Narayanan LM , Meyyan RP, Nallasingam K, Prasannakumar S, Arumugam N. (2010). *Biochemistry*, Saras Publication, Nagercoil, Tamilnadu.
3	Verma PS and Aggarwal VK. (2016). *Cell Biology*, S. Chand Publishers, New Delhi.
4	Satynanarayana U and Chakrapani U. (2019). *Essentials Of Biochemistry*, 3rd edition, Books and Allied Ltd, Delhi.

Reference Books

1	**A**mbika Shanmugam. (2012). *Fundamentals of Biochemistry for Medical Students*, Wolters Kluwer (India) Pvt Ltd, New Delhi.
2	De Robertis EDP and De Robertis EMF. (1987). *Cell and Molecular Biology*, Lippincott Williams and Wilkins, Philadelphia
3	Gupta PK. (2019).*Cell Biology*, 5th Revised edition, Rastogi Publications, Meerut.
4	Jain JL, Jain N and Jain S. (2016). *Fundamentals of Biochemistry*, S. Chand Publications, New Delhi.
5	Pawar CB. (2018). *Cell Biology*, Himalaya Publications, India.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://www.classcentral.com/report/swayam-moocs-course-list/
2	https://www.classcentral.com/course/swayam-cell-biology-13937
3	https://swayam.gov.in/NPTEL
4	https://nptel.ac.in/courses/102/106/102106025/

Course Designed By: Dr. K. SARASWATHI, Asst.Prof, Chikkaiah Naicker College, Erode.

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	M	S	S	S	S	S
CO2	S	S	S	S	M	S	S	S	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S
CO5	S	S	S	S	S	S	S	S	S	S

*S-Strong; M-Medium; L-Low

Course code	53B	MICROBIOLOGY	L	T	P	C
Core/Elective/ SBS		Core Course - VI	4	0	0	4
Pre-requisite		Basic Knowledge about Diversity, Structure and Applications of Microbiology	Syllabus Version		2021-2022	

Course Objectives:

1. The course is intended to make aware of the students about the classification, diversity, organization, application and pathogenicity of the microorganisms in the ecosystem.
2. The course will help the students to learn about the various microbial culture techniques and its handling.
3. The course will give an idea that how microbes are used in various industries for generation of various products related to day to day life.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Provides basic knowledge about taxonomy, diversity and general structure of micro-organisms.	K2
2	Familiarize with the culture, sterilization, handling, identification and assessing growth characters of microorganisms.	K3,
3	Understand the general microbial techniques for isolation of pure cultures of bacteria, fungi and algae.	K2
4	Get idea about the microbial spoilage and the potentials in the usage of microbes in agriculture.	K3
5	Familiarize with various aspects of microbial diseases and preventive measures.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

Unit:1	CLASSIFICATION	15 Hours

Characters and basic classification of Kingdom Monera and Fungi. Systematic position of Virus – classification - Structure of bacteriophage and HIV. Viroids and Prions. Ultra-structure of *E. coli*.- - bacterial cell wall. General structure of fungi.

Unit:2	BACTERIAL CULTURE	15 Hours

Bacterial growth and growth curve – factors influencing bacterial growth. Types of Culture medium – Culture of Bacteria – Sterilization - Medium – techniques. Maintenance – Characteristics of colonies – staining of bacteria – Bio-fermenters and it role in mass culture.

Unit:3	FOOD AND AGRICULTURE	15 Hours

Control of Microbes. Preservation of Milk. Food Spoilage: Botulism – Staphylococcal –Salmonellosis. Culture of Yeast and economic importance. Microbial Nitrogen fixation - Rhizobium – Azotobacter – Azospirillum - BGA Bio-fertilizer – VAM fungi – Mycorrhiza.

Unit:4	INDUSTRIAL MICROBIOLOGY	14 Hours

Role of microbes in Industry –Stages – types and methods of Fermentation. Products of fermentation industry – Ethanol - Citric acid - enzymes Antibiotics –food and dairy products. Basics concepts of Probiotics.

Unit:5	**MEDICAL MICROBIOLOGY**	**14 Hours**
Causative organism, transmission and preventive measures of Cholera, Typhoid, Tuberculosis, Leprosy, Syphilis, AIDS, Chicken pox, Hepatitis-B, Polio, Rabies, Swine flu, Dengue, Chikungunya and Covid-19.		
Unit:6	**CONTEMPORARY ISSUES**	**2 Hours**
Expert lectures, Online Seminars - Webinars and Field Visits.		
	Total Lecture Hours	**75 Hours**

Text Book(s)

1	Dubey RC and Maheshwari DK. (2013). *A Textbook of Microbiology*, S. Chand Publishers, New Delhi.
2	Mani A, Selvaraj AM, Narayanan LM, Arumugam A. (2017). *Microbiology*, Saras Publication, Nagercoil, Tamilnadu.

Reference Books

1	Atlas RM. (1995). *Principles of Microbiology*, 1st edition, Mosby-Yearbook, Inc, Missouri.
2	Power CH and Daginawla HF. (2001).*General Microbiology*, Himalaya Publishing House, New Delhi.
3	Pelczar MJ, Chan EC, Pelczar MF. (1981). *Elements of Microbiology*, McGraw-Hill International Book Company.
4	Ryan KJ, Ray CG, editors. (2018). *Sherris Medical Microbiology*, 7th edition, McGraw-Hill Education, Singapore.
5	Willey JM, Sherwood L, Woolverton CJ. (2017). *Prescott's Microbiology*, McGraw-Hill, Singapore.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://nptel.ac.in/courses/102/103/102103015/
2	https://nptel.ac.in/courses/102/103/102103015/
3	https://nptel.ac.in/courses/102/103/102103015/

Course Designed By: S. SUDHA, Asst.Prof, LRG Govt. Arts College for Women, Tirupur

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	L	S	L	S
CO2	M	S	M	S	S	M	L	S	M	M
CO3	M	S	M	S	S	S	M	M	L	S
CO4	M	S	S	S	M	S	M	M	M	S
CO5	S	S	S	S	S	S	M	S	M	S

*S-Strong; M-Medium; L-Low

Course code	53C	GENETICS AND IMMUNOLOGY	L	T	P	C
Core/Elective/ SBS		Core Course - VII	4	0	0	4
Pre-requisite		Basic Knowledge of Genetics, Recombination and Concepts of Immune System	Syllabus Version		2021-2022	

Course Objectives:

1. To learn the basic principles of inheritance at the molecular, cellular and organism levels.
2. To understand causal relationships between molecule/cell level phenomena and organism-level patterns of heredity.
3. To learn the mechanism of Mutation and will able to understand how mutations bring changes in an organism.
4. To give an insight to the cellular components involved in the immunity.
5. To give an awareness of the mechanism, types and concepts regarding immune response.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Students will be able to describe and apply the principles of Mendelian genetics.	K3
2	Capable to describe the flow of genetic information from DNA to RNA to protein.	K2
3	Make clear how genes are regulated. The students will be able to explain how mutations occur and its role in adaptation and how speciation occurs.	K3
4	Able to develop an idea about the cellular and molecular basis of immune response.	K3
5	Understand the principles of self-tolerance and autoimmunity and will be able to relate the potentials of immunology in relation to biotechnology and applied sciences.	K2

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	FUNDAMENTALS OF GENETICS	14 Hours

Importance of Drosophila in genetics – Culture methods - sex identification – common mutations. Mendelian Laws of Inheritance and Non Mendelian inheritance (Incomplete dominance – Co-dominance – Polygenic inheritance – Epistasis –Lethal genes). Crossing over – Linkage in drosophila.

Unit:2	RECOMBINATION AND GENETICAL DISORDERS	15 Hours

Recombination in bacteria: – Transformation – Conjugation – F factor -Sexduction – Transduction –Generalised and Specialised - Plasmids. Chromosome variation (Ploidy) - Euploidy – Aneuploidy – Gene Balancing – Gynandromorphs – Barr bodies – Chromosomal aberrations- Non disjunction - Klinefelter, Turner and Down syndrome.

Unit:3	MUTATION	14 Hours

Gene Mutations – Types of Mutations – Physical and Chemical mutagens – DNA repair. Sickle cell anemia – Alkaptonuria – Phenyl ketonuria – albinism. Operon concept- Lac and trp operons (outlines).

Unit:4	CELLS OF IMMUNE SYSTEM	15 Hours

Cells of immune system - Types of Immunity – Innate and acquired - Antigens - Structure, function and types of antibodies. B and T cell, Epitopes, Haptens, Adjuvants. - Antigen-antibody reactions - T-Cell and B-Cell activation - Monoclonal antibodies.

Unit:5	BASIC CONCEPTS OF IMMUNE SYSTEM	15 Hours

Basic concepts of Major Histocompatibility Complex. - Basic properties and functions of Cytokines, Interferons and complement proteins - Humoral and Cell mediated immunity. Types of Hypersensitivity. Concepts of autoimmunity and immunodeficiency - Vaccines.

Unit:6	CONTEMPORARY ISSUES	2 Hours
Expert lectures, Online Seminars - Webinars and Field Visits.		
	Total Lecture Hours	75 Hours

Text Book(s)

1	Verma PS and Agarwal VK. (2010). *Genetics*, S. Chand Publishers, 9th edition, New Delhi.
2	Meyyan RP. (2017). *Fundamentals of Genetics*, Saras Publication , 5th edition, Nagercoil, Tamilnadu.
	Ramesh SR. (2017). *Immunology*, McGraw Hill Education India Private Limited. New York.

Reference Books

1	Gardner EJ. (2006). *Principles of Genetics*, 8th edition. John Wiley and Sons, Inc. London, UK.
2	Primrose SB and Twyman R. (2013). *Principles of Gene Manipulation and Genomics*, John Wiley and Sons; Inc. London, UK.
3	Delves PJ, Martin SJ, Burton DR, Roitt IM. (2017). *EssentialImmunology*,13th edition, John Wiley and Sons; Inc. London, UK.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://swayam.gov.in/nd2_cec20_ma13/preview
2	https://swayam.gov.in/nd2_cec20_bt05/preview

Course Designed By:
Dr. PAWLIN VASANTHI JOSEPH, Assoc.Prof, Nirmala College for Women, Coimbatore.

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	S	S	M	L	L	L	S	L	S
CO3	L	M	S	M	M	L	L	S	L	S
CO3	L	M	M	L	M	L	L	S	L	S
CO4	L	M	S	L	L	L	L	S	L	S
CO5	L	M	S	L	L	L	L	S	M	S

*S-Strong; M-Medium; L-Low

Course code	5ZC	BIOPHYSICS AND INSTRUMENTATION	L	T	P	C
Core/Elective/ SBS		Skill Based Course - III	3	0	0	3
Pre-requisite		Basic Knowledge of Bio-molecular Interaction and Principles of Instrumentation	Syllabus Version		2021-2022	

Course Objectives:

1. To develop skill in understanding and handling molecular science and instrumentation.
2. To make the students capable of understanding the under lying principles of various reaction and biological interactions.
3. To understand the principles and applications of various laboratory instruments.

Expected Course Outcomes

On the successful completion of the course, student will be able to:

1	Able to know the basics about the molecular bonds and interactions	K2
2	The learner will be trained in preparing solutions and handling instruments at basic level.	K3
3	The students will be capable of interpreting and understanding the basis of bioenergetics in living system.	K2
4	Gain the knowledge in the area of enzyme and its action.	K2
5	Understand and apply skills in biological tools and techniques.	K3

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

Unit:1	BIMOLECULAR INTERACTIONS	9 Hours

Valence of carbon - Polar and non polar molecules – Covalent, ionic and Co-ordinate bonds. Hydrogen bonding - weak interactions, ester linkage, electrostatic, Disulphide and peptide bonds - Vander Waals forces. Isomerism and optical activity.

Unit:2	SOLUTIONS	8 Hours

Hydrophiles and Hydrophobes - Acid-Base concept, Molarity, Molality and Normality, Ampholyte, pH and pKa value - Redox potential – Principles of diffusion and Osmosis – Hypo, Hyper and isotonic solutions.

Unit:3	THERMODYNAMICS	9 Hours

First and Second laws of thermodynamics, Biological applications of enthalpy, free energy, activation energy, unavailable energy and entropy, Thermodynamics of passive and active transport.

Unit:4	SIGNALING AND KINETICS	9 Hours

Enzyme action: Michaelis-Menton equation - Vmax - Km - Line Weaver Burk plot. Action potential – refractory period – synaptic potential. Excitation and conduction of heart beat. Radio-labeling and Tracer techniques.

Unit:5	INSTRUMENTATION PRINCIPLES	8 Hours

Principles and Applications of pH meter – Centrifugation – Chromatography – Electrophoresis - Colorimeter and Spectrophotometer – ECG – interpretation of Electrocardiograph.

Unit:6	CONTEMPORARY ISSUES	2 Hours

Expert lectures, Online Seminars - Webinars and Field Visits.

	Total Lecture Hours	45 Hours

	Text Book(s)
1	Arumugam N and Kumaresan V. (2017). *Bio Physics and Bioinstrumentation*, Saras Publication, Nagercoil, Tamilnadu.
2	Bajpai PK. (2008.) *Biological Instrumentation and Methodology*, S. Chand and Co. Ltd. New Delhi.
Reference Books	
1	Arumugam N and Kumaresan V. (2015). *Principles and Techniques in Biophysics*, Saras Publication, Nagercoil, Tamilnadu.
2	Jain JL, Jain N and Jain S. (2009). *Fundamentals of Biochemistry*, S. Chand Publications, New Delhi.
3	Setlow RB and pollard EL. (1962). *Molecular Biophysics*, Pergamon Press.
4	Mohan P Arora (2015). *Bio-Physics*, Himalaya Publishing House, Nagpur.
5	Veerakumari L. (2010). *Bioinstrumentation*, MJP-Publishers, Chennai.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/102/105/102105034/
2	https://nptel.ac.in/courses/102/103/102103083/
Course Designed By: S. SUDHA, Asst.Prof, LRG Govt. Arts College for Women, Tirupur	

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	L	M	L	L	L	S	S	S
CO2	S	S	M	S	M	L	L	S	S	S
CO3	S	S	M	S	M	M	M	M	S	S
CO4	S	S	S	S	M	M	M	M	S	S
CO5	S	S	S	M	S	M	M	S	S	S

*S-Strong; M-Medium; L-Low

Sixth Semester

Course code	63A	ANIMAL PHYSIOLOGY	L	T	P	C
Core/Elective/ SBS		Core Course - VIII	4	0	0	4
Pre-requisite		Basic Knowledge of various Physiological Aspects	Syllabus Version		2021-2022	

Course Objectives:

1. To familiarize students with the principles and basic facts of Animal Physiology.
2. To give students an insight about the molecular and cellular basis of physiological functions in animals.
3. To give an idea about the regulation of organ system functions in a whole animal using a conceptual model of feedback to explain homeostasis.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Associate the transport of gases and its influence on metabolism of major food constituents.	K2
2	Explain the mechanism of circulation and excretion among different vertebrates.	K2
3	Present the structure of a muscle and a nerve and infer its functions.	K3
4	Relate the structure and mechanism of sense organs in animals.	K3
5	Categorize the impact of hormones in the reproductive mechanism of the male and female organism.	K4

K1 – Remember; **K2** – Understand; **K3** – Apply; **K4** – Analyze; **K5** – Evaluate; **K6** – Create

Unit:1	NUTRITION AND RESPIRATION	15 Hours

Nutrition: Digestion and absorption of carbohydrates proteins and lipids. Mineral and Vitamins – its deficiency. Hormonal control of digestion. Respiratory pigments- structure of hemoglobin, Transport of O2 and CO2- Bohr's effect – Regulation of respiration – Carbon monoxide poisoning, Bronchitis, Asthma – Physiological effects of smoking.

Unit:2	CIRCULATION AND EXCRETION	15 Hours

Blood- composition and functions of blood plasma and formed elements, Mechanism of blood clotting, Types of Hearts – Heartbeat and pace maker – Cardiac cycle – ECG – Pulse and blood pressure. Nephron structure and mechanism of urine formation, Excretory products, Osmoregulation in fishes.

Unit:3	MUSCLE AND NERVE PHYSIOLOGY	14 Hours

Brief account of types of muscles – Ultra structure of striated muscle, Muscle contraction and properties. Neurons – structure and types – Impulse propagation, synaptic transmission, Neuro transmitters – Reflex action, Nerve disorders – Epilepsy, Alzheimer's disease, Parkinson's disease.

Unit:4	SENSE ORGANS	15 Hours

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.

Unit:5	REPRODUCTIVE PHYSIOLOGY	14 Hours
Puberty, adolescence, pregnancy, parturition, lactation and birth control. Endocrine glands in man – Hormones, action and disorders – Feed-back mechanism, Outlines of mechanism of hormonal activity.		
Unit:6	**CONTEMPORARY ISSUES**	**2 Hours**
Expert lectures, Online Seminars – Webinars and Field Visits.		
	Total Lecture Hours	**75 Hours**

Text Book(s)

1	Arumugam N and Mariakuttikan A (2014). *Animal Physiology*, Saras Publication, Nagercoil, Tamilnadu.
2	Veerbala Rastogi. (2007). *Animal Physiology*, Kedar Natha Ram Nath Publishers, Meerut.

Reference Books

1	Lehninger AL, Michael Cox, Nelson DL. (2017). *Biochemistry*, 7th edition, Macmillan, New York.
2	Reddy PB. (2015). *Text Book of Animal Physiology*, IMRF Publishing house, AndraPradesh, India.
3	Verma PS and Agarwal (2000). *Animal Physiology*, S. Chand and Company Ltd, New Delhi

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://www.classcentral.com/course/swayam-animal-physiology

Course Designed By:
Dr. ROSILINE MARY, Asst.Prof, Nirmala College For Women, Coimbatore.

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	L	S	M	M	L	L	M	M	S
CO2	M	M	S	M	S	L	L	M	S	S
CO3	L	M	S	M	M	L	L	M	S	S
CO4	L	M	S	S	M	L	M	M	S	S
CO5	M	M	S	S	M	L	L	M	S	S

*S-Strong; M-Medium; L-Low

Course code	63B	DEVELOPMENTAL BIOLOGY	L	T	P	C
Core/Elective/ SBS		Core Course - IX	4	0	0	4
Pre-requisite		Basic Knowledge of Embryology and Techniques in Developmental Biology	Syllabus Version	2021-2022		

Course Objectives:

1. To make aware of the students about the theories, concepts and basics of Developmental Biology.
2. To provide students the idea of sex cells, fertilization, cleavage, differentiation and development of organs.
3. To understand the mechanisms which lead to cell determination.

Expected Course Outcomes:

1	Understand the concepts of basic developmental biology and needs of Artificial intelligence.	K2
2	Able to know about pattern, plans and morphogenetic techniques of developing egg.	K3
3	Gain knowledge about the development of organs in different animals.	K3
4	Know and apply the techniques involved in embryology field.	K3
5	Familiar with reproductive technology and embryo transfer technology.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	GAMETES AND FERTILIZATION	15 Hours

Basic concepts of developmental biology – theories - Structure human Spermatozoa - Structure of mammalian egg - Egg membranes Patterns of egg - Spermatogenesis – Oogenesis. Fertilization – mechanism and significance – Parthenogenesis.

Unit:2	BLASTULATION AND GASTRULATION	14 Hours

Cleavage - Planes and Patterns of cleavage - Factors controlling cleavage - Fate map – Use of Artificial Intelligence in mapping. Blastulation – Morphogenetic movements - gastrulation Frog and Chick.

Unit:3	ORGANOGENESIS	14 Hours

Development of Brain, Eye and Heart in frog. Development of Nervous system in chick and Foetal membranes in Chick and Mammals.

Unit:4	APPLIED EMBRYOLOGY	15 Hours

Organizer concept –Structure – mechanism of induction and competence. Nuclear transplantation - Teratogenesis – Regeneration: types - events and factors. Transgenic mice - Retroviral method – Microinjection method - Embryonic stem cell method. Methods to culture embryo.

Unit:5	PLACENTATION AND TECHNIQUES	15 Hours

Placentation in Mammals –Estrous - Menstrual cycle and menopause - Pregnancy – trimesters – development. *Erythroblastosis foetalis* -Twins – types. Infertility – causes - Test tube baby and Assisted Reproductive Technology – Embryo transfer – Amniocentesis.

Unit:6	CONTEMPORARY ISSUES	2 Hours

Expert lectures, Online Seminars - Webinars and Field Visits.

	Total Lecture Hours	75 Hours

Text Book(s)

1. Arumugam N. (2014). *A Text Book of Embryology*, 15th edition, Saras publication, Nagercoil, Tamilnadu.
2. Verma PS and Agarwal VK. (2010). *Chordate Embryology*, S. Chand and Company Ltd, New Delhi.

Reference Books	
1	Balinsky BI and Fabian BC. (2012). *An Introduction to Embryology*, 5th edition, CBS College Publishers, Cengage Learning India Pvt. Ltd. New Delhi.
2	Madhavan KS. (2017). *Developmental Biology,* Arjun publishing house, India.
3	Rastogi. (2014).*Chordate Embryology*, Kedar Nath Ram Nath, Meerut.
4	Sastry KV and Shukla V. *Developmental Biology*, 2nd edition, Rastogi publication, Meerut.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://swayam.gov.in/nd1_noc20_bt35/preview
2	https://www.mooc-list.com/course/developmental-biology-saylororg?
Course Designed By: **Dr. ROSILINE MARY, Asst.Prof, Nirmala College For Women, Coimbatore.**	

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	M	M	S	M	L	L	M	S	S	M
CO2	L	M	S	M	L	L	S	S	S	M
CO3	L	M	S	L	L	L	S	M	M	M
CO4	L	M	S	L	L	L	S	M	M	M
CO5	M	M	S	M	L	L	S	S	S	M

*S-Strong; M-Medium; L-Low

Course code	63C	BIOTECHNOLOGY	L	T	P	C
Core/Elective/ SBS		Core Course - X	4	0	0	4
Pre-requisite		Basic Knowledge about Principles and Techniques in Biotechnology	Syllabus Version		2021-2022	

Course Objectives:

1. Give a firm foundation in the fundamentals of modern Molecular techniques.
2. The course will give an insight to the mechanism of Gene Expression and Regulation.
3. The course will give idea about various protocols followed in Biotechnology in relation to Animal science.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Give an idea about the various techniques used in modern biotechnology.	K2
2	The course will give an insight into the current applications of biotechnology and advances in the different areas like medical, microbial, environmental, bioremediation, agricultural, animal and forensics.	K2
3	Able to understand how microbes are used to engineer various genes.	K3
4	Explain the general principles of generating genetically modified organisms and modern artificial methods in biotechnology.	K3
5	Appreciate the importance of Biotechnology in enzyme production, cryopreservation and biosensors.	K3

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	RECOMBINANT DNA TECHNOLOGY	15 Hours

Restriction endonuclease – sequence recognition. DNA Ligase. Identification and isolation of gene of interest - Cloning vectors and recombination. Screening of recombinant DNA. Application of recombinant DNA technology. Commercial production of Insulin. Human Genome Project.

Unit:2	MOLECULAR TECHNIQUES	14 Hours

Methods to isolate DNA – PCR types, Principle and applications. Electrophoresis – types and Principle. Blotting – types – applications. DNA finger printing and its applications –RAPD – FISH- RFLP. DNA probes and diagnosis-Introduction to Genome editing.

Unit:3	ANIMAL TISSUE CULTURE	15 Hours

Applications – Primary culture. Steps involved in mammalian cell culture- He la and WI38 cell lines – Maintenance of cell lines – Techniques and Application of organ culture. Animal cloning – Dolly.

Unit:4	APPLICATIONS	15 Hours

Genetically modified Animals- Single cell Protein from microbes – Biofuels – Solid waste management – Liquid Waste Management – Biogas production - Biopesticides. Production of bacterial, fungal, algal and yeast biomass – Mushroom Culture.

Unit:5	ENZYME BIOTECHNOLOGY	14 Hours

Enzyme Biotechnology: Microbial production and application of enzymes – Ribozymes- Artificial enzymes, Immobilization of enzymes- methods and its application. Biosensors, Cryobiology – Methods of Cryo-preservation.

Unit:6	CONTEMPORARY ISSUES	2 Hours

Expert lectures, Online Seminars - Webinars and Field Visits.

	Total Lecture Hours	75 Hours

Text Book(s)	
1	Dubey RC. (2012). *A Text Books of Biotechnology*, S. Chand and Company, New Delhi.
2	Kumaresan V. (2015). *Biotechnology* Saras Publication, Nagercoil, Tamilnadu.
3	Verma PS and Agarwal VK. (2017). *Genetic Engineering*, 9th edition, S. Chand Publishers, New Delhi.
Reference Books	
1	Brown TA. (1995). *Gene cloning*, Chapman and Hall, Publication, London.
2	Gupta PK. (20170. *Molecular Biology and Biotechnology*, Rastogi publication, Meerut.
2	Mohan P Arora. (2003). *Biotechnology*, 1st edition, Edited by Chander Kanta, Published by Himalaya Publishing House.
3	Primrose SB, Twyman R. (2013). *Principles Of Gene Manipulation And Genomics*, John Wiley and Sons, India.
4	Seema S Sambrani. (2017). *A Text Book of Plant and Animal Tissue Culture*, 2nnd edition, Vision publications, Pune, India.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://swayam.gov.in/nd2_cec20_bt07/preview
2	https://swayam.gov.in/nd1_noc19_bt20/preview
Course Designed By: **Dr. PAWLIN VASANTHI JOSEPH, Assoc.Prof, Nirmala College for Women, Coimbatore.**	

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	L	M	M	L	L	L	L	S	S	S
CO2	L	M	M	L	L	L	L	S	S	S
CO3	L	M	M	L	L	L	L	S	S	S
CO4	L	S	M	L	L	L	M	M	S	S
CO5	L	M	M	L	L	L	L	L	S	S

*S-Strong; M-Medium; L-Low

Course code	63P	CELL BIOLOGY AND BIOCHEMISTRY ANIMAL PHYSIOLOGY AND DEVELOPMENTAL BIOLOGY	L	T	P	C
Core/Elective/ SBS		Core Practical - III	0	0	2	2
Pre-requisite		Practical Knowledge in the field of Cell biology, Physiology adaptations and Developmental Stages of Cells	Syllabus Version		2021 – 2022	

Course Objectives:

1. To observe and identify different cell types and structures using different microscopic techniques.
2. To get awareness of physiological processes of cell and physiological activities of aquatic organisms.
3. To learn the developmental stages of organisms by permanent microscopic slides.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Apply concepts and knowledge of the general terminology, cell structure and function.	K3
2	Utilize some of the useful techniques in the field of cell biology (Hematology and staining) and understand the basic concepts behind these techniques.	K2
3	Assess and able to examine various practical techniques in physiological field.	K3
4	Demonstrate an understanding the scientific methods of physiological adaptations of animal.	K2
5	Able to discriminate the developmental stages of cells of various living organisms.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

MAJOR PRACTICAL

1. Squash Preparation of Onion root tip – stages of Mitosis.
2. Estimation of RBC and WBC in human Blood (Not for colleges offering CLT).
3. Oxygen consumption of fresh water fish.
4. Identification of given biochemical sample:
   Monosacchride, Polysacchride, Aminoacid, Protien, Lipid.
5. Analysis of excretory products- Ammonia, urea and uric acid.

MINOR PRACTICAL

1. Study of Opercula movement of a fish at 10 degree increase and Q10.
2. Activity of salivary amylase (Qualitative analysis).
3. Preparation of Haemin crystals.
4. Estimation of Haemoglobin.

SPOTTERS

1. Giant Chromosome (Demonstration of Polytene chromosome preparation).
2. Meiosis sub stages in Prophase I. (Demonstration suggested with Pollen of any Liliacea).
3. Kymograph (Demonstration of Muscle twitch with PowerPoint).
4. T.S of Pituitary, Thyroid, Adrenal, Ovary and testis.
5. Sperm of Man.
6. Egg of Frog.
7. Blastula of Frog.
8. Gastrula of Frog.
9. Development of Chick 18, 24, 48, 72hr.
   Placenta of Sheep and Rabbit.

QUESTION PATTERN: 50 MARKS **Major: 20, Minor: 10, Record: 5, Spotter: 15 (5 spotters each carry 3 marks).**	
Total Practical Hours	**30(Each Semester) x 2 = 60 Hours Per Year**
Text Book(s)	
1	Jayasurya, Arumugam N, Dulsy Fatima. (2013). *Practical Zoology Vol 3*, Saras Publication, Nagercoil, Tamilnadu.
2	Dr. Renu Gupta, Dr. Seema Makhija, Dr. Ravi Toteja. (2018).*Cell Biology: Practical Manual*, Prestige Publishers, New Delhi.
3	Trigunayat MM. (2019). *A Manual of Practical Zoology: Biodiversity, Cell biology, Genetics and Developmental Biology part 1*, Scientific publishers, India.
Course Designed By: Dr. A. RAJA RAJESWARI, Asst.Prof, Sri Vasavi College, Erode.	

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	M	M	S	S	M	L	S	S	S	S
CO2	M	M	S	M	M	L	S	M	S	S
CO3	M	M	S	S	M	L	S	L	S	S
CO4	M	S	S	S	M	L	S	L	S	S
CO5	M	M	M	S	S	L	S	L	M	M

*S-Strong; M-Medium; L-Low

Course code	63Q	MICROBIOLOGY, GENETICS, IMMUNOLOGY AND BIOTECHNOLOGY	L	T	P	C
Core/Elective/ SBS		Core Practical - IV	0	0	2	2
Pre-requisite		Practical Knowledge of various techniques in Microbiology, Genetics and Biotechnology	Syllabus Version		2021 – 2022	

Course Objectives:

1. To impart hands-on training in basic microbiological techniques.
2. To understand the concepts and obtain practical knowledge in genetics and biotechnology through experiments.
3. To familiarize students with various immunological techniques.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Familiar with practical skills in the use of tools, technologies and methods common to microbiology and biotechnology.	K3
2	Able to test the microbiological quality of samples from different sources and differentiate between Gram-positive and Gram-negative bacteria.	K4
3	Gain knowledge about basic immunological principles involved in clinical and applied science.	K2
4	Trained in basic enzyme and immunological assays and be taught to present the results both qualitatively and quantitatively.	K4 K2
5	Understand different sterilization procedures, mounting techniques and media preparation when handling advanced Biotechnological equipments.	

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

MAJOR PRACTICAL

1. Isolation of DNA from any fruit/tissue.
2. Preparation of Culture Media : Liquid and Solid
3. Enumeration of microbes in soil
4. Gram staining Technique.
5. Thin layer chromatography of any Biological sample (Optional).
6. Estimation of activity of Protease and Amylase.

MINOR PRACTICAL

1. Quality of Milk – MBR test.
2. Mounting of given fungi.
3. Antigen – Antibody reaction: ABO blood group.
4. Sterilization of the Culture Medium in Autoclave / pressure cooker.
5. Estimation of sugar in given wine sample.
6. Determination of Motility of Microbe:
   Hanging drop technique (Do not use curd as *Lactobacillus* is not motile).

SPOTTERS

Genetics:

Genetic importance - Drosophila male and female, Giant Chromosome.

Microbiology:

Autoclave/Pressure Cooker, Electrophoresis unit, Culture media-Plate, Slant and Broth.

Immunology:

Thymus gland, WIDAL kit, VDRL kit, Antibiotic sensitivity test.

Biotechnology:

Spirullina, Yeast, Penicillin, Azolla, Mushroom seeds, Bio-pesticide (BT/Fungi), Biofertiliser (Nitrosomonas/ Rhizobium/Phosphobacter)

VISIT AND SUBMISSION

Visit to an industry or lab of Biotechnology or Microbiological importance. Report should be submitted in the Practical.

QUESTION PATTERN: 50 MARKS

Major: 15, Minor: 10, Record: 5, Spotter: 15 (5 spotters each carry 3 marks), Report: 5 marks.

Total Practical Hours **30(Each Semester) x 2 = 60 Hours Per Year**

Text Book(s)

1	Das S. (2020). *Microbiology Practical Manual*, CBS Publication, Delhi.
2	Janarthanan S. (2018). *Practical Biotechnology: Methods and Protocols*, Kindle Edition, Publication Universities Press (India) Private Limited.
3	Senthilkumar Balakrishnan, Karthik Kaliaperumal and Senbagam Duraisamy. (2017). *Practical Immunology a Laboratory Manual*, Lap Lambert Academic publishing, Germany.
4	Trigunayat MM. (2019). *A Manual of Practical Zoology: Biodiversity, Cell biology, Genetics and Developmental Biology part 1*, Scientific publishers, India.

Course Designed By: Dr. A. RAJA RAJESWARI, Asst.Prof, Sri Vasavi College, Erode.

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	M	S	M	L	L	S	S	S	S
CO2	M	M	L	M	L	L	S	S	S	S
CO3	L	M	M	L	L	L	S	S	S	S
CO4	L	M	M	L	L	L	S	S	S	S
CO5	L	M	M	M	M	L	S	S	S	S

*S-Strong; M-Medium; L-Low

Course code	6ZP	SERICULTURE, BIOSTATISTICS, COMPUTER APPLICATIONS, BIOPHYSICS AND INSTRUMENTATION	L	T	P	C
Core/Elective/ SBS		SKILL BASED COURSE - IV	0	0	2	2
Pre-requisite		Practical Knowledge in Sericulture, Statistical tools and Principles of Instrumentation	Syllabus Version		2021 – 2022	

Course Objectives:
1. To understand the working principles of the instruments in biological instruments.
2.To inculcate the practical knowledge on moriculture and sericulture,
3. To discuss about the basic principles of physics in biology.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Relate knowledge on Silkworm rearing and evaluate the quality of cocoon and silk.	K3
2	Apply the concepts of computer science related with the statistical analysis.	K3
3	Familiarize with the applications of statistics and able apply in the different fields of biology.	K4
4	Understand the basic operations of MS Office in computer applications	K2
5	Gain knowledge and understands the working principles of the instruments in biology.	K3

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

MAJOR PRACTICAL

1. Preparation of Chromate solution at various 5 concentration, measure the OD to verify Beer Lambert law.
2. Prepare isotonic, hypotonic and hypertonic solution and put a drop of blood and observe under the microscope.
3. Measure the length of given leaf samples or any other of choice (minimum 20 samples) and calculation of Mean, Median, Mode and Standard Deviation.
4. Given are two groups of samples A and B. A contain 10 leaves (or any other of choice) of a locality and B from other species or locality. Measure the length and check do the samples differ significantly using students"t".

MINOR PRACTICAL

1. Preparation of Buffer (acetate/ phosphate/ citrate/ borate) of given pH.

2. Identification, sorting and percentage calculation of different types of cocoons.

3. Based on the given values calculate the Correlation coefficient.

4. Based on the given values calculate the regression equation based on a variable.

SPOTTERS

Mulberry leaf, Silk worm moth, Different instars of larvae, Cocoon, Fungal Parasite of Silk Worm.

Light microscope, pH Meter, Centrifuge, Chromatograph, Colorimeter.

VISIT AND SUBMISSION

Visit to an industry or lab of Biotechnology or Microbiological importance. Report should be submitted in the Practical.

QUESTION PATTERN: 45 MARKS

Major: 15, Minor: 10, Record: 5, Spotter: 10 (5 spotters each carry 2 marks), Report: 5 marks.

Total Practical Hours **30 Hours Per Year(Practical for end semester only)**

Text Book(s)

1	Arumugam N, Prasanna kumar S, Narayanan LM, Kumaresan V, Meyyan RP, Mariakuttikan A, Dulsy fatima, Nallasingam K, Jayasurya. *Practical Zoology Volume 3*, Saras publication, Nagercoil, Tamil Nadu.
2	Ganga G. (2020). *An introduction to Sericulture*,2nd edition, Oxford and IBH publishing, Delhi.
3	Rana SVS. (2009). *Biotechniques-Theory and Practice*, 2nd edition. Rastogi Publication, Meerut.
4	Subramanian MA. (2005). *Biophysics -Principles and Techniques*, 1st edition.- MJP Publishes, Chennai.
5	Veer Bala Rastogi. (2009). *Fundamentals of Biostatistics*, 2nd edition. Ane Books, Pvt. Ltd. New Delhi.

Course Designed By: Dr. A. RAJA RAJESWARI, Asst.Prof, Sri Vasavi College, Erode.

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	M	L	S	M	S	S
CO2	L	L	L	L	M	L	S	S	S	S
CO3	L	M	M	M	L	L	S	S	S	S
CO4	L	L	L	L	L	M	S	S	S	S
CO5	L	M	M	L	L	L	S	M	S	M

*S-Strong; M-Medium; L-Low

Elective Courses

Course code	5EA	HUMAN GENETICS AND COUNSELING - I	L	T	P	C
Core/Elective/ SBS		Elective I - A	3	0	0	3
Pre-requisite		Basic Knowledge of Chromosomes, Inheritance and Syndromes	Syllabus Version		2021 – 2022	

Course Objectives:

1. The objective of this course is to give a firm foundation on the fundamentals of human chromosomes and their nomenclature and banding methods.
2. The give an idea about various aspects of human genetics, heredity and genetic diseases.
3. Students to gain the knowledge of pedigree analysis and to identify the complications to the basic patterns.
4. To make the students aware of the chromosomal syndromes.
5. To train the students to seek the possibilities of identifying Human genetics as a Profession.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	The course will give an idea about the various genetic disorders.	K2
2	Students get the knowledge to apply the real life situations.	K3
3	Give an idea to employ the scientific method to generate new knowledge and to solve problems, regarding human heredity.	K4
4	Able to explain the genetic disorders and prompt them to undertake genetics as subject of research in higher studies.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	CHROMOSOMES	8 Hours

Human chromosome – International system of Nomenclature - Chromosome number, Idiogram, Banding methods (Q, C, G and R banding).

Unit:2	INHERITANCE	9 Hours

Monogenic traits, Autosomal inheritance, Dominant, Recessive, Sex-linked inheritance, Sex-limited and sex-influenced traits, mitochondrial inheritance, MIM number, consanguinity and its effects,

Unit:3	PEDIGREE	8 Hours

Pedigree, gathering family history, pedigree symbols, construction of pedigrees, presentation of molecular genetic data in pedigrees, - Complications to the basic pedigree patterns.

Unit:4	SYNDROMES	9 Hours

Human chromosomal disorders (Syndromes) Disorders of chromosome structure and disorders of chromosome number-Trisomy 18, Down's syndrome, Trosomy 13, Cri-du chat syndrome, Parder-ville syndrome, Jacob's syndrome Robertson Syndrome, Cystic fibrosis, Muscular dystrophy, Thalassemia, Major Fragile x Syndrome.

Unit:5	METABOLIC ERRORS	9 Hours

Non-Mendelian Inheritance-Mitochondrial disorder, Sex mosaicism - uniparaentalDisomy and Genomic Imprinting. In-born errors of metabolism: Alkaptoneuria – Galactosemia - Gaucher's disease - Glucose-6-phosphate dehydrogenase deficiency -Tay-Sach's disease, Niemann Pick disease.

Unit:6	CONTEMPORARY ISSUES	2 Hours

Expert lectures, Online Seminars - Webinars and Field Visits.

	Total Lecture Hours	45 Hours

Text Book(s)	
1	Meyyan RP. (2014). *Fundamentals of Genetics*, Saras Publication, Nagercoil, Tamil Nadu.
2	Verma PS and Agarwal VK. (2010). *Genetics*, S. Chand Publishers, New Delhi
Reference Books	
1	Bhatnagar SM, Kothari Lopa ML. (1999). *Essentials of Human Genetics*, 4th edition- (Reprint 2004) – Orient Longman (P) Ltd., India.
2	Gangane SD. (2017). *Human Genetics*, Publisher-Reed Elsevier India Pvt. Ltd, India.
3	Gardner EJ. (2015). *Principles of genetics*, 7th edition, John Wiley Sons, Inc., London, UK.
4	Strickberger MW. (1976). *Genetics*, Published by Macmillian Publishing Co., Inc., NewYork.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	www.classcentral.com › Subjects › Science › Biology
2	nptel.ac.in › courses › noc20 › SEM1 › noc20-bt06
3	swayam.gov.in › explorer
4	swayam.gov.in › nd1_noc20_bt06 › preview
Course Designed By: Dr. K. SARASWATHI, Asst.Prof, Chikkaiah Naicker College, Erode.	

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	S	S	M	M	S	S	S	S
CO2	S	S	S	S	M	M	S	S	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	M

*S-Strong; M-Medium; L-Low

Course code	6EA	HUMAN GENETICS AND COUNSELING - II	L	T	P	C
Core/Elective/ SBS		Elective I - A	3	0	0	3
Pre-requisite		Basic Knowledge of Diseases, Diagnosis and Behavioral Genetics	Syllabus Version		2021 – 2022	

Course Objectives:

1. The give an idea about various aspects of human genetics, heredity and genetic disease and various methods of prenatal diagnosis.
2. To make the students aware of the human genome project promises and achievements.
3. To make the students understand the central and unifying position of genetics in biological services and to create awareness for a better community.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	The students will be able to get the knowledge of physiology and genetics of blood groups.	K2
2	Knowledge of research principles and methods applicable in the discipline of genetic testing approach taken for specific genetic disorders.	K2
3	Gain knowledge of the role of genetics as the underlying cause of various disorders of the human body.	K3
4	The course will give an idea about genes related to behavior and behavioral disorders.	K4
5	To train the students to seek the possibilities of identifying Human genetics and counseling as a Profession.	K3

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	BLOOD GROUP	8 Hours

Blood groups (major types) - Blood transfusion – *Erythroblastosis foetalis*. Physiology and genetics of blood groups. Population genetics: Hardy-Weinberg principle and its application in human population.

Unit:2	DIAGNOSIS	9 Hours

Prenatal diagnosis: Chorionic villi sampling, foetoscopy, ultrascopy, amniocentesis - peripheral blood leucocyte culture. Dermatoglyphics: Terminology, methods of observation and printing, dermatoglyphic features of syndrome.

Unit:3	BRAIN DISEASES	9 Hours

Degenerative brain diseases: Stroke - Alzheimer's disease - Parkinson disease. Chromosomal position effect and gene variegation - epigenetic control of gene activity. Molecular medicines in cancer therapy. Microarray as a tool for detection of human genetic disorders

Unit:4	BEHAVIOURAL GENETICS	9 Hours

Genes related to behaviour - Genetic and environmental manipulations, learning and memory. Dementia – Schizophrenia - Mood disorders - Anxiety disorders - childhood personality disorders - antisocial personality - criminal behavior.

Unit:5	HUMAN GENOME PROJECT	8 Hours

Human Genome Project – History - Sequencing of Human Genome - Promises and Achievements - Ethical, Legal and Social issues. Other Genome Projects initiated as a direct consequence of HGP completion, Human Genome Diversity Project.

Unit:6	CONTEMPORARY ISSUES	2 Hours

Expert lectures, Online Seminars - Webinars and Field Visits.

	Total Lecture Hours	45 Hours

Text Book(s)	
1	Mandal S. (2002). *Fundamentals of Human Genetics*,2nd edition, New Central Book Agency (P) Limited, Kolkatta.
2	Meyyan RP. (2014). *Fundamentals of Genetics,* Saras Publication, Nagercoil, Tamilnadu.
3	Verma PS and Agarwal VK. (2010). *Genetics*, S. Chand Publishers, New Delhi.
Reference Books	
1	Gangane SD. (2017). *Human Genetics, Publisher*-Reed Elsevier India Pvt. Ltd, India.
2	Gardner EJ. (2015). *Principles of genetics*, 7th edition, John Wiley Sons, Inc., London, UK.
3	Strickberger MW. (1976).*Genetics,* Published by Macmillian Publishing Co., Inc. NewYork.
4	Rickie Lewis. (2011). *Human Genetics – Concept and Application*, 2nd edition, McGraw-Hill Education Publisher, Europe.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	www.classcentral.com › Subjects › Science › Biology
2	nptel.ac.in › courses › noc20 › SEM1 › noc20-bt06
3	swayam.gov.in › explorer
4	swayam.gov.in › nd1_noc20_bt06 › preview
Course Designed By: Dr. K. SARASWATHI, Asst.Prof, Chikkaiah Naicker College, Erode.	

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	S	S	M	M	S	S	M	S
CO2	S	S	S	S	M	M	S	S	M	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	L
CO5	S	S	S	S	S	S	S	S	S	L

*S-Strong; M-Medium; L-Low

Course code	5EB	PEST AND THEIR CONTROL - I	L	T	P	C
Core/Elective/ SBS		Elective I - B	3	0	0	3
Pre-requisite		Basic Knowledge in Identification of Pests and Control Measures	Syllabus Version		2021 – 2022	

Course Objectives:

1. To make the learner aware of various pest, pest outbreak and its control methods.
2. Learn to manage pest and diseases in diverse environment.
3. To study the different theories related to the ecology of the insects.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the basic classification and identify the insects using taxonomic keys.	K2
2	Able to explain the external morphology of insects and their modifications and adaptations suitable to the eco-system.	K2
3	Acquired the knowledge about various methods and tools adopted for pest control strategies.	K4
4	Gain knowledge about the various biological agents, entomopathogenic organisms and the importance of IPM in pest management.	K5

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	INTRODUCTION,CLASSIFICATION AND IMPORTANCE	8 Hours

Introduction, definition and causes for insect assuming pest status. Classification of pest - Types of damage caused by pests. Importance of pest control, Pest surveillance and forecasting and pest outbreak.

Unit:2	GENERAL CHARACTERS, BIONOMICS AND CONTROL MEASURES	9 Hours

Paddy pest:

1. *Tryporyza incertulus* (Lepidoptera) 2. *Orseolia oryzae* (Diptera)
3. *Hieroglyphu sbanian* (Orthoptera) 4. *Dicladispa armigera* (Coleoptera)

Wheat pest:

1. *Anaphothrips sudanensis* (Thysonoptera) 2.*Odentodermis obesis* (Isoptera)
3. *Mythimana separate* (Lepidoptera).

Unit:3	GENERAL CHARACTERS, BIONOMICS AND CONTROL MEASURES	9 Hours

Sugarcane pest:

1. Chilo infuscatellus (Lepidoptera) 2. *Pyrilla perpusilla* (Hemiptera)
3. Aleurolovus barodensis (Hemiptera) 4. *Scirphophaga nivella* (Lepidoptera)

Cotton pest:

1. Pectinophora gossypiella (Lepidoptera) 2. *Aphid gossypii*(Hemiptera)
3.Earias vitella (Lepidoptera) 4. *Dysder cuscingulatus* (Hemiptera).

Unit:4	GENERAL CHARACTERS, BIONOMICS AND CONTROL MEASURES	9 Hours

Cereals:

1. *Chilopartellus* (Lepidoptera) 2. *Antherigona soccata* (Diptera).

Pulses:

1. *Helicoverpa armigera* (Lepidoptera) 2. *Melanogromyza* obtuse (Diptera)

Vegetables:

1. *Leucinodes orbonalis* (Lepidoptera) 2. *Pieris brassicae* (Lepidoptera)

Fruits:

1. *Papilio demolues* (Lepidoptera) 2. *Daccus cucurbitae* (Diptera).

Unit:5	GENERAL CHARACTERS, BIONOMICS AND CONTROL MEASURES	8 Hours
Stored Grain pest: 1. *Tribolium castraneum* (Coleoptera) 2. *Sitophilus oryzae* (Coleoptera). **House Hold pest:** 1. Bed bug 2.House fly 3. Human louse 4. Cockroach 5. Mosquitoes.		
Unit:6	**CONTEMPORARY ISSUES**	**2 Hours**
Expert lectures, Online Seminars - Webinars and Field Visits.		
	Total Lecture Hours	**45 Hours**

Text Book(s)

1	Ashok Kumar and Prem Mohan Nigam. (2000). *Economic and Applied Entomology*, Emkay Publication, New Delhi.
2	Jawaid Ahsan and Subhas Prasad Sinha. (2000). *A Handbook on Economic Zoology*, S. Chand and co., Ltd., New Delhi.
3	Nalina Sundari MS. (2006). *Entomology*, M.J.P Publications, Chennai
4	Ravindranathan KR. (2013). *A Text Book of Economic Zoology*, 1st edition, Wisdom Press, New Delhi.
5	Vasantharaj David and Kumaraswami K. (1988). *Elements of Economic Entomology*, Popular Book Depot, Chennai.

Reference Books

1	Imms AD. (1972). *Text book of Entomology*, Vol. I and II Ed. By Richard and Owen.ELBS
2	Jawaid Ahsan and Subhas Prasad sinha. (2000). *A Handbook on Economic Zoology*, S. Chand and co., Ltd., New Delhi.
3	Nair KK, Anandhakrishnan TN and David BV. (1992). *General and Applied Entomology*, Tata Mc.Graw Hill Publication, Delhi.
4	Rajendra Singh. (2007). *Elements of Entomology*, Rastogi publicatios, Meerut.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://ucanr.edu/blogs/blogcore/postdetail.cfm?postnum=5007
2	https://www.pestcontrolcourses.com/pest-control-training-courses-online/

Course Designed By: Dr. A. RAJA RAJESWARI, Asst.Prof, Sri Vasavi College, Erode.

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	M	S	M	M	M	M
CO3	S	M	M	S	S	M	M	L	L	L
CO3	S	M	M	S	S	S	S	L	S	M
CO4	S	S	M	M	M	S	S	L	S	S

*S-Strong; M-Medium; L-Low

Course code	6EB	PEST AND THEIR CONTROL - II	L	T	P	C
Core/Elective/ SBS		Elective I - B	3	0	0	3
Pre-requisite		Basic Knowledge of Principles and Methods of Pest Control and Insecticide Technologies	Syllabus Version		2021 – 2022	

Course Objectives:

1. To make the learner aware of various pest, pest outbreak and its control methods.
2. Learn to manage pest and diseases in diverse environment.
3. To study the different theories related to the ecology of the insects.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Gain knowledge and apply various techniques in the field to control the pest.	K2
2	Familiarized with classification of insecticides, pesticide residue and environmental pollution due to toxic insecticides.	K2
3	Acquired the knowledge about various methods and tools adopted for pest control strategies.	K4
4	Aware about the various techniques and the importance of IPM in pest management.	K5
5	Realize the interaction between plants and insects.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	PRINCIPLES AND METHODS OF PEST CONTROL	9 Hours

:
Using techniques such as Mechanical, Biological, Ecological and Cultural. Genetic Techniques – Sterile Male Techniques, Quarantine and legislative measures.

Unit:2	CLASSIFICATION OF INSECTICIDES	9 Hours

Based on Mode entry and Mode of action:
Chemical nature - Inorganic, Organic compounds- DDT, Endosulfan, Fenitrothion, Malathion, Monocrotophous, Oxime Carbamates.

Unit:3	INSECTICIDE FORMULATIONS AND APPLICATION TECHNOLOGY	9 Hours

Aerosols, Fumigants, Baits.
Dusting and dusters, sprayers – Manually operated – Hydraulic sprayers, Power operated – Pneumatic sprayer.

Unit:4	INTEGRATED PEST MANAGEMENT	8 Hours

Integrated Pest Management (IPM), Chemosterilants, Sex attractants, Pheromonal control.

Unit:5	OTHER PESTS	8 Hours

Crab, Snail, Peacock, Parrot and Rat
Concept of Host-Pest Interaction.

Unit:6	CONTEMPORARY ISSUES	2 Hours

Expert lectures, Online Seminars - Webinars and Field Visits.

	Total Lecture Hours	45 Hours

Text Book(s)

1. Ashok Kumar and Prem Mohan Nigam. (2000). *Economic and Applied Entomology*, Emkay Publication, New Delhi.
2. Jawaid Ahsan and Subhas Prasad sinha. (2000). *A Handbook on Economic Zoology*, S. Chand and co., Ltd., New Delhi.
3. Nalina Sundari MS. (2006). *Entomology*, MJP-Publications, Chennai

4	Ravindranathan KR. (2013). *A Text Book of Economic Zoology*, 1st edition, Wisdom Press, New Delhi.
5	Vasantharaj David and Kumaraswami K. (1988). *Elements of Economic Entomology*, Popular Book Depot, Chennai.
Reference Books	
1	Imms AD. (1972). *Text book of Entomology*, Vol. I and II Ed. By Richard and Owen. ELBS
2	Jawaid Ahsan and Subhas Prasad sinha. (2000). *A Handbook on Economic Zoology*, S. Chand and co., Ltd., New Delhi.
3	Nair KK, Anandhakrishnan TN and David BV. (1992). *General and Applied Entomology*, Tata Mc.Graw Hill Publication, Delhi.
4	Rajendra Singh. (2007). *Elements of Entomology*, Rastogi publicatios, Meerut.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://ucanr.edu/blogs/blogcore/postdetail.cfm?postnum=5007
2	https://www.pestcontrolcourses.com/pest-control-training-courses-online/
Course Designed By: Dr. A. RAJA RAJESWARI, Asst.Prof, Sri Vasavi College, Erode.	

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	S	S	M	S	M	M	M	M
CO3	S	M	M	S	S	M	M	L	L	L
CO3	S	M	M	S	S	S	S	L	S	M
CO4	S	S	M	M	M	S	S	L	S	S
CO5	S	S	M	S	S	S	M	L	S	S

*S-Strong; M-Medium; L-Low

Course code	5EC	WILDLIFE MANAGEMENT AND CONSERVATION - I	L	T	P	C
Core/Elective/ SBS		Elective I - C	3	0	0	3
Pre-requisite		Basic Knowledge in Wildlife Conservation and its Importance	Syllabus Version		2021-2022	

Course Objectives:

1. The course is framed to give introduction to Wildlife management and Conservation.
2. To make student aware of the various areas of wildlife and Job opportunities.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	The course will give an idea about the wildlife Management techniques	K2
2	The course train the students to assess various conservation strategies	K3
3	Gain knowledge about terminology and identification of birds and butterflies.	K3
4	Understand the importance of fauna in different reserves.	K2

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	INTRODUCTION TO WILDLIFE	9 Hours

Scope and opportunities of Wildlife Sciences – Major types of forest types of India - Protected areas – Sanctuaries - National Parks – Tiger reserves – Biosphere Reserves and their role.

Unit:2	WILDLIFE CONSERVATION	9 Hours

IUCN Red Data list – CITES – Endangered Mammals of India and Conversation – Project Tiger and Project Elephant. Conservation of Indian rhino, lion and Thar. Importance of Zoo in Conservation

Unit:3	ORNITHOLOGY	9 Hours

Terms used in description of Birds Plumage and parts – Types of Bills – Types of feet – Identification of birds in the field based on tail, bill, crest, leg and colour.

Unit:4	INDIAN BUTTERFLIES	8 Hours

Butterflies and Moths – Identification of types of Swallowtails: Club tails – Roses - Bird wings – Mime –Mormon – Raven - Helen - peacock – Jay – Blue bottles – Sword tails – Zebra. Whites, sulfurs and orange-tips.

Unit:5	IMPORTANT RESERVES	8 Hours

History, Location, Habitats, Fauna and importance of Mudumalai Tiger Reserve – Sathyamangalam Tiger Reserve – Kalakkad Mundanthurai Tiger Reserve – Anamalai Tiger Reserve – Gulf of Mannar.

Unit:6	CONTEMPORARY ISSUES	2 Hours

Expert lectures, online seminars – webinars, field visits

	Total Lecture Hours	45 Hours

Text Book(s)	
1	Balakrishnan M. (2016). *Wild Life Ecology and Conservation,* Scientific publishers, Jodhpur, India.
2	Caughley G and Sinclair AR. (2006). *Wildlife Ecology and Management,* Blackwell Science, United Science.
3	Ranga MM. (2002). *Wild Life Management and Conservation,* Agro-Bios publications, Jodhpur, India.
4	Reena Mathur. (2018). *Wild Life Conservation and Management,* Rastogi publication, Meerut.
5	Sale JB and Berkmueller K. (1998). *Manual of Wildlife Techniques for India,* Establishment of the Wildlife Institute, India. Field document 11.
Reference Books	
1	Ali S, Ripley SD. (1983). *Handbook of The Birds of India and Pakistan,* Compact edition. Oxford University Press and BNHS, Mumbai.
2	Divan S and Rosencranz A. (2001). *Environmental Law and Policy in India: Cases, Materials and Statutes,* New Delhi: Oxford University Press.
3	Kehimkar ID. (2008). *Book of Indian Butterflies,* Oxford University Press.
4	Prater SH and Barruel P. (1997). *The Book of Indian Animals,* Bombay: Bombay Natural History Society.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.worldwildlife.org/teaching-resources
2	https://www.nwf.org/Educational-Resources/Wildlife-Guide
3	https://swayam.gov.in/nd1_noc20_bt38/preview
4	https://swayam.gov.in/nd1_noc19_bt32/preview
Course Designed By: Dr. SANIL R., Associate Professor, Government Arts College, Ooty	

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	S	M	S	M	L	S	S
CO3	S	S	L	S	M	S	L	L	S	S
CO3	S	S	M	S	S	S	L	L	S	S
CO4	S	S	L	S	M	S	L	L	S	S

*S-Strong; M-Medium; L-Low

Course code	6EC	WILDLIFE MANAGEMENT AND CONSERVATION - II	L	T	P	C
Core/Elective/ SBS		Elective I - C	3	0	0	3
Pre-requisite		Basic Knowledge about Wildlife Techniques, Census and Animal Behavior	Syllabus Version		2021-2022	

Course Objectives:

1. The course is framed to train the students about various wildlife techniques.

2. To train the students to find job opportunities as biologists in Reserves.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	The course will give an idea about the wildlife Management techniques	K2
2	The course trains the students to conduct wildlife related surveys and analyses the wildlife related threats.	K3
3	Gain knowledge about different behavior of wild animals.	K2
4	Get aware about the management of forest and importance of conservation of wild animals.	K3
5	Familiarized with diversity act and eco- tourism as a career development.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	WILDLIFE TECHNIQUES.	8 Hours

Peadometer – Field Compass – GPS – Introduction to GIS – Camera traps – Quadrates - Line transects – Presence/Absence Survey.

Unit:2	WILDLIFE CENSUS.	9 Hours

Planning census – sample counts – Block counts – Roadside counts – Dung count – Pugmark and waterhole census – Identifying animals based on indirect signs – Capture recapture techniques – tiger, co-predator monitoring census methods (WII) – usage of M-stripes.

Unit:3	ANIMAL BEHAVIOUR	9 Hours

Foraging behaviour - group foraging - Breeding seasons - factors - courtship, polyandry, polygamy - promiscuity - brood parasites –Aggression – Competition – Social spacing – Territory –Social behaviour of elephants and lion.

Unit:4	WILDLIFE CONSERVATION	9 Hours

Joint Forest Management - Tribes and forestry programmes - Watershed management – Deforestation – impacts – Afforestation – Habitat fragmentation – corridors – Human Animal Conflicts – Mitigation of Conflicts

Unit:5	WPA AND ECOTOURISM	8 Hours

Brief outlines of WPA 1972 and amendments - Biological diversity Act 2002 - Forest right Act 2008. Ecotourism – Potentials of eco-tourism as Career of a Zoology graduate.

Unit:6	CONTEMPORARY ISSUES	2 Hours

Expert lectures, online seminars – webinars, field visits

	Total Lecture Hours	45 Hours

Text Book(s)	
1	Balakrishnan M. (2016). *Wild Life Ecology and Conservation,* Scientific publishers, Jodhpur, India.
2	Caughley G and Sinclair AR. (2006). *Wildlife Ecology and Management*, Blackwell Science, United Science.
3	Ranga MM. (2002). *Wild Life Management and Conservation,* Agro-Bios publications, Jodhpur, India.
4	Reena Mathur. (2018). *Wild Life Conservation and Management*, Rastogi publication, Meerut.
5	Sale JB and Berkmueller K. (1998).*Manual of Wildlife Techniques for India*, Establishment of the Wildlife Institute, India. Field document 11.
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1	Ali S, Ripley SD. (1983).*Handbook of The Birds of India and Pakistan*, Compact edition. Oxford University Press and BNHS, Mumbai.
2	Divan S and Rosencranz A. (2001). *Environmental Law and Policy in India: Cases, Materials and Statutes,* New Delhi: Oxford University Press.
3	Kehimkar ID. (2008). *Book of Indian Butterflies*, Oxford University Press.
4	Prater SH and Barruel P. (1997). *The Book of Indian Animals*,Bombay: Bombay Natural History Society.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.worldwildlife.org/teaching-resources
2	https://www.nwf.org/Educational-Resources/Wildlife-Guide
3	https://swayam.gov.in/nd1_noc20_bt38/preview
4	https://swayam.gov.in/nd1_noc19_bt32/preview
Course Designed By: Dr. SANIL R., Associate Professor, Government Arts College, Ooty	

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	S	M	S	M	L	S	S
CO3	S	S	L	S	M	S	M	L	S	S
CO3	S	S	M	S	S	S	M	L	S	S
CO4	S	S	M	S	S	S	M	L	S	S
CO5	M	M	L	M	M	S	L	L	S	S

*S-Strong; M-Medium; L-Low

Course code	5ED	PATHOLOGY AND CLINICAL LABORATORY – I	L	T	P	C
Core/Elective/ SBS		Elective II - A	3	0	0	3
Pre-requisite		Basic Knowledge about Clinical Laboratory Principles and Techniques	Syllabus Version		2021 – 2022	

Course Objectives:

1. To evaluate laboratory and pathologic testing and to learn the pathogenesis of a variety of common and uncommon diseases.
2. To develop knowledge of basic pathologic processes and skills to interpret laboratory data as well as make clinic pathologic correlations.
3. To provide experience in laboratory direction and encourage residents to assume a leadership role in the education of other physicians and allied health professionals.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the pathologic basis of disease for which a particular test is performed.	K2
2	Greater knowledge related to specimen collection, handling methodologies, and the skills of individuals performing those tests.	K2
3	Gain knowledge to Practice the technical and mechanical aspects of laboratory pathology and effectively manage a laboratory.	K3
4	Familiarize with the following blood bank and serology testing, hematologic tests, microscopic examination, Gram-stained techniques etc.,	K4
5	Able to identify and understand the limitations of such studies in order to select proper tests suited to a particular diagnostic problem.	K3

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	BASIC LABORATORY PRINCIPLES	9 Hours

Organization of clinical laboratory - Safety measures - Chemical, fire and Electrical - Lab Technician Duties and Responsibilities - Professionalism and Ethics in laboratory workers, Modern Laboratory set up - Clinic borne infection and personnel hygiene.

Unit:2	BASIC LABORATORY EQUIPMENTS	8 Hours

Light Microscope – Incubator - Hot Air Oven – Autoclave - Laminar Air flow Chamber - Water Bath-Centrifuge –Haemocytometer -Albuminometer – Urinometer- Haemoglobinometer - Microtome - Glassware –Description of Glassware, its use, handling and care.

Unit:3	PREPARATION OF REAGENTS	9 Hours

Buffer and pH - Preparation of Normal, Per cent and Molar solutions - Physiological saline, Clinical Laboratory records- -Quality control: Accuracy, Precision, and Reference values, use of chemicals and their interactions, danger signs, production techniques, and disposal methods.

Unit:4	BASIC CLINICAL CHEMISTRY	9 Hours

Collection of blood – Anticoagulants - Separation of Serum and Plasma - Blood cell count and differential count – Estimation of Haemoglobin (Sahlis and Cyanmethemoglobin) - Clotting time - bleetting time – ESR – PCV – Blood smear and for observation parasites.

Unit:5	AUTOMATION IN CLINICAL LABORATORY	8 Hours

Semi and Fluid Auto Analyzer – ELISA – Use of PCR – Haemotology Analyser – Cell counter – HPLC Analysis for Haemoglobin Fraction

Unit:6	CONTEMPORARY ISSUES	2 Hours
Expert lectures, Online Seminars - Webinars and Field Visits.		
	Total Lecture Hours	45 Hours

Text Book(s)

1	Mukherjee KL. (2010). *Medical Laboratory Technology*, Volume 1, 2 and 3. Tata McGraw- Hill Education, India.
2	Sachdev KN. (1999). *Clinical Pathology and Clinical Bacteriology*, Jaypee Brothers Publishers, New Delhi.
3	Talib VH, Khurana SR. (2009). *Handbook of Medical Laboratory Technology*, CBS Publishers, Delhi.
4	Varley H. (2008). *Practical Clinical Biochemistry*, CBS Publishers, Delhi.

Reference Books

1	Pagana KD, Pagana TJ. *Mosby's Manual of Diagnostic and Laboratory Tests-E-Book*, Elsevier Health Sciences.
2	Vandana Puri, Praeen Kr Gupta. (2020). *Complex Review of Pathology and Hematology for NBE*, 6th edition, CBS Publishers, Delhi.
3	Ajmani PS. (2017). *Handbook of Clinical Laboratory Techniques*, AITBS Publisher, India.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://www.emagister.in/distance_learning_pathology_courses-tdist-236.htm

Course Designed By: Dr. A. RAJA RAJESWARI, Asst.Prof, Sri Vasavi College, Erode.

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	M	M	S	M	S	M	S	S
CO2	M	L	L	M	S	M	S	M	S	S
CO3	L	S	S	L	M	L	S	L	S	S
CO4	L	S	S	L	M	M	S	L	S	S
CO5	L	M	S	L	M	M	L	L	S	S

*S-Strong; M-Medium; L-Low

Course code	6ED	PATHOLOGY AND CLINICAL LABORATORY - II	L	T	P	C
Core/Elective/ SBS		Elective II - A	3	0	0	3
Pre-requisite		Basic Knowledge to Practice and Manage a Clinical laboratory	Syllabus Version		2021 – 2022	

Course Objectives:

1. To evaluate laboratory and pathologic testing and to learn the pathogenesis of a variety of common and uncommon diseases.
2. To develop knowledge of basic pathologic processes and skills to interpret laboratory data as well as make clinic pathologic correlations
3. To provide experience in laboratory direction and encourage residents to assume a leadership role in the education of other physicians and allied health professionals

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Greater knowledge related to specimen collection, handling methodologies, and the skills of individuals performing those tests.	K2
2	Able to prepare culture and histopathological techniques to analyze different samples.	K3
3	Familiarize with the blood bank and serology testing, hematologic tests, microscopic examination, Gram-stained techniques etc.,	K4
4	Able to identify and understand the limitations of such studies in order to select proper tests suited to a particular diagnostic problem.	K3
5	Gain knowledge to Practice the technical and mechanical aspects of laboratory pathology and effectively manage a laboratory.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	FUNCTION TESTS	8 Hours

Renal function tests, Liver function tests, Arterial blood gas analysis.

Unit:2	BODY FLUIDS	9 Hours

Urine: Collection and preservation - Composition – volume – appearance and odors - Specific gravity - Microscopic examination. Measurement of glucose and protein. Faecal examination: Microscopic – Occult blood – Helminthes Parasites. Semen analysis: count and motility.

Unit:3	MICROBIOLOGY AND CYTOLOGY	9 Hours

Wet Preparations of microbes - Staining preparations: Simple – Differential - Special staining methods Bacterial Identification and Antibiotic susceptibility testing. FNAC – smear and fixation – PAP Staining – Biopsy for cancer.

Unit:4	HISTOPATHOLOGY	8 Hours

Microtome: Fixating – dehydration – clearing – infiltration - embedding – Block preparation – Sectioning – Mounting – Staining. Principle of double (H and E stain) – PASM Staining.

Unit:5	BLOOD TRANSFUSION	9 Hours

Screening of donor compatibility testing, safety, procurement of supplies. Screening donor's blood for infectious agents -HIV, HCV, HBV, *Trepanoma palladium*, *Plasmodium*, HTLV-Bacterially contaminated Blood. ABO – Rh blood groups - other red cell antigens and antibodies. Coomb's test.

Unit:6	CONTEMPORARY ISSUES	2 Hours

Expert lectures, Online Seminars - Webinars and Field Visits.

	Total Lecture Hours	45 Hours

Text Book(s)	
1	Mukherjee KL. (2010). *Medical Laboratory Technology*, Volume 1, 2 and 3. Tata McGraw- Hill Education, India.
2	Sachdev KN. (1999). *Clinical Pathology and Clinical Bacteriology*, Jaypee Brothers Publishers, New Delhi.
3	Talib VH, Khurana SR. (2009).*Handbook of Medical Laboratory Technology*, CBS Publishers, Delhi.
4	Varley H. (2008). *Practical Clinical Biochemistry*, CBS Publishers, Delhi.
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1	Pagana KD, Pagana TJ. *Mosby's Manual of Diagnostic and Laboratory Tests-E-Book*, Elsevier Health Sciences.
2	Vandana Puri, Praeen Kr Gupta. (2020). *Complex Review of Pathology and Hematology for NBE*, 6th edition, CBS Publishers, Delhi.
3	Ajmani PS. (2017). *Handbook of Clinical Laboratory Techniques*, AITBS Publisher, India.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.emagister.in/distance_learning_pathology_courses-tdist-236.htm
Course Designed By: Dr. A. RAJA RAJESWARI, Asst.Prof, Sri Vasavi College, Erode.	

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	M	M	M	M	S	M	S	M	S	S
CO2	M	L	L	M	S	M	S	M	S	S
CO3	L	S	S	L	M	L	S	L	S	S
CO4	L	S	S	L	M	M	S	L	S	S
CO5	L	M	S	L	M	M	L	L	S	S

*S-Strong; M-Medium; L-Low

Course code	63R	PATHOLOGY AND CLINICAL LABORATORY TECHNOLOGY PRACTICAL	L	T	P	C
Core/Elective/ SBS		Elective III - A	0	0	2	2
Pre-requisite		Practical Knowledge to Analysis, Interpret and Evaluate Laboratory test results	Syllabus Version		2021 – 20212	

Course Objectives:

1. Competent use of laboratory tests and to Interpret laboratory test results.

2. Discuss the differential diagnosis and laboratory evaluation for a patient.

3. Demonstrate Microbiological staining techniques for rapid diagnosis of causative agents and to understand the clinical indications.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Able to select, interpret tests and explain their clinical uses and limitations.	K2
2	Explain and choose appropriate tests for monitoring various disorders.	K3
3	Recognize and assess laboratory tests results of one of their patients.	K4
4	Summarize and interpret the results of Differential count of Blood, WBC and Haemoglobin.	K5

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

MAJOR PRACTICAL

1. Total count of RBC.
2. Total count of WBC.
3. Differential count of Blood
4. Microscopic identification of pus or cast cells and qualitatively checks for the presence of blood in urine.
5. Smear the given bacteria with Gram's staining and interpret the result.

MINOR PRACTICAL

1. Estimation of Haemoglobin by Sahlismethod.
2.Estimation of Bleeding and Clotting time
3. Estimation of specific gravity and Albumin in Urine.
4. Semi-quantitative estimation of glucose in urine.
5. Qualitatively detect the presence of bile salts and Urobilinogen in urine.

SPOTTERS

Malaria parasite, Filarial parasite, Tape Worm, ESR, Autoclave, Microtome, Coomb's test, Spermatozoa, Incubator, Water bath, Centrifuge.

VISIT AND SUBMISSION OF REPORT

Visit to training lab / training to a clinical lab of nearby locality. Report should be submitted in the practical.

QUESTION PATTERN: TOTAL MARKS: 25 MARKS.
Major: 08, Minor: 05, Record: 04, Spotter: 06 (2 spotters each carry 3 marks) Report: 2 marks.

Total Practical Hours **30(Each Semester) x 2 = 60 Hours Per Year**

Text Book(s)	
1	Mondal SK. (2020). *Pathology Practicals*, 1st edition, CBS publisher, Delhi.
2	Yadav. (2015). *Essentials of Practical Pathology for Undergraduates*, Ahuja Publishing House, Delhi.
Course Designed By: Dr. A. RAJA RAJESWARI, Asst.Prof, Sri Vasavi College, Erode.	

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	L	L	S	M	L	L	S	S	S	S
CO2	L	L	S	L	L	M	S	S	S	S
CO3	L	L	S	M	L	M	S	S	S	S
CO4	L	L	S	S	L	M	S	S	S	S

*S-Strong; M-Medium; L-Low

Course code	5EE	POULTRY SCIENCE AND MANAGEMENT – I	L	T	P	C
Core/Elective/ SBS		Elective II - B	3	0	0	3
Pre-requisite		Basic Knowledge to Identify Breeds, Poultry Housing, Brooding and Rearing Techniques	Syllabus Version		2021 – 2022	

Course Objectives:

1. To provide with sufficient information and knowledge to allow them to farm poultry commercial and semi-commercial way.

2. Gain basic knowledge about the production of poultry meat and eggs.

3. To understand about the basic principles of poultry nutrition, reproduction and physiology.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Introduces current standards for the establishment and management of poultry house.	K2
2	Understand the scientific methods of breeding, hatching and various techniques in the poultry field.	K2
3	Skillfully apply the tools, equipment, and protective mechanism for Poultry farming.	K4
4	Apply the formulation to provide of good nutrition, management of form birds and egg production.	K5
5	Learn about the various skills that are necessary for self employment.	K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	HISTORY AND IMPORTANCE OF POULTRY FARMING	9 Hours

History and importance of poultry farming - role of poultry farming in rural development and employment potential - Economic contributions to national productivity - egg production, Table breed production and poultry manure. Anatomy and physiology of poultry birds: Digestive and reproductive system.

Unit:2	BREEDING, HATCHING, INCUBATION AND CULLING	9 Hours

Breeds of poultry birds - scientific methods of breeding - hybrid selection and selecting parents for production - factors for selection - hatching - selecting eggs for hatching. Incubation: natural and artificial incubation - Types of incubators - maintenance of temperature and humidity - sterilization of room during hatching - separation and culling.

Unit:3	POULTRY HOUSING AND EQUIPMENTS	8 Hours

Space requirements - Types of housing - equipment's of feeding and watering - protection from enemies and adverse conditions.

Unit:4	NUTRITION OF POULTRY BIRDS	8 Hours

Feed requirement according to age - feed formulation - classification of feed-stuffs - milling by-products and distillery by-products. Availability of raw materials and their cost - food graders – usage of antibiotics.

Unit:5	BROODING AND REARING	9 Hours
Brooding- types of brooding – natural and artificial brooding – temperature requirement - Rearing of chick, Sexing, characters of good layers and broilers - culling - Debeaking - Caponetts and capons.		
Unit:6	**CONTEMPORARY ISSUES**	**2 Hours**
Expert lectures, Online Seminars - Webinars and Field Visits.		
	Total Lecture Hours	**45 Hours**

Text Book(s)

1	Banarjee GC (2008). *Poultry*, Oxford and IBH Co pvt Ltd.
2	Gnanamani MR (2010). *Modern Aspects of Poultry Keeping*, Deepam publications, Madurai.
3	Jadhav NV and Siddiqui MF. (2010).*Handbook of Poultry Production and Management*, Jaypee Brothers Medical Publishers (P) Ltd, New Delhi.
4	Vegad JL (2015). *Poultry Diseases- A Guide for Farmers and Poultry Professionals*, 2nd edition.CBS Publishers and Distributors, Delhi.

Reference Books

1	Chauhan HVS. (2018). *Poultry Diseases, Diagnosis and Treatmen*, New Age International Publisher, New Delhi.
2	Eiri Board. (2014). *Hand Book of Poultry Farming and Feed Formulations*, Published by Engineers India Research Institute, Delhi.
3	Jagdish Prasad. (2015). *Poultry: Production And Management*, 5th edition, Kalyani publisher, Delhi.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://www.classcentral.com/course/swayam-introduction-to-poultry-farming-14160
2	https://swayam.gov.in/nd2_nou19_ag09/preview

Course Designed By: Dr. A. RAJA RAJESWARI, Asst.Prof, Sri Vasavi College, Erode.

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	M	M	S	M	S	M	S	S
CO2	M	S	M	S	S	M	S	M	S	S
CO3	M	M	L	L	M	L	S	M	S	S
CO4	M	M	M	S	M	L	S	M	S	S
CO5	M	S	M	M	S	M	S	M	S	S

*S-Strong; M-Medium; L-Low

Course code	6EE	POLYTRY SCIENCE AND MANAGEMENT - II	L	T	P	C
Core/Elective/ SBS		Elective II - B	3	0	0	3
Pre-requisite		Basic Knowledge in Management of Broilers, Layers and Marketing of Breeds	Syllabus Version		2021 – 2022	

Course Objectives:

1. To provide with sufficient information and knowledge to allow them to farm poultry commercial and semi-commercial way.
2. To learn specific areas of poultry production including breeding, nutrition, health and product quality and development of entrepreneurial skills in poultry farming

3. To provide an understanding of poultry production in a broad context from farm to fork.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Learn about the various skills that are necessary to manage poultry farms.	K2
2	Skillfully apply the tools, equipment, and protective mechanism for management of layers and broilers in Poultry farming.	K4
3	Apply the methods and techniques in the egg production, preservation and marketing.	K3
4	Able to identify and follow regulation practices for the disease and pest control for birds.	K4
5	Introduces current standards for the establishment and management of poultry house.	K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	MANAGEMENT OF LAYERS	9 Hours

Characteristics of layer chicks - housing, space and lighting requirements - Summer and Winter management - Changes in feeding programme - Care of egg - Hen sampling - Cannibalism.

Unit:2	MANAGEMENT OF BROILERS	9 Hours

Characteristics of the Broiler chicks - Housing of broiler chicks - Optimum Conditions - Feeding and Feed formulations - Sampling.

Unit:3	DISEASE AND HEALTH MANAGEMENT	9 Hours

Diseases caused by viruses: Marek's Disease, Ranikhet Disease, Fowl pox, Gumboro disease, Egg drop syndrome.
Diseases caused by Bactria: Salmonellosis, fowl cholera, Tick fever.
Diseases caused by Fungi: Aspergillosis, Aflotoxicosis.
Diseases caused by Worms and other Parasites.
Antibiotics, Vaccination, Deworming and Insecticide Treatment. Health cover.

Unit:4	MARKETING	8 Hours

Marketing, Grading and Preservation of egg - Packing and Transportation of eggs - Difference between dark and pale yellow yolk and its taste.

Unit:5	IMPORTANCE OF EGG	8 Hours

Different uses of eggs in preparation of bakery products and other edible items - Nutritive values of egg - Relationship between customers, Maintenance of prices.

Unit:6	**CONTEMPORARY ISSUES**	**2 Hours**
Expert lectures, Online Seminars - Webinars and Field Visits.		
	Total Lecture Hours	**45 Hours**

Text Book(s)	
1	Banarjee GC (2008). *Poultry*, Oxford and IBH Co pvt Ltd.
2	Gnanamani MR (2010). *Modern Aspects of Poultry Keeping, Deepam* publications, Madurai.
3	Jadhav NV and Siddiqui MF. (2010). *Handbook of Poultry Production and Management,* Jaypee Brothers Medical Publishers (P) Ltd, New Delhi.
4	Vegad JL (2015). *Poultry Diseases- A Guide for Farmers and Poultry Professionals,* 2nd edition.CBS Publishers and Distributors, Delhi.
Reference Books	
1	Chauhan HVS. (2018). *Poultry Diseases, Diagnosis and Treatmen*, New Age International Publisher, New Delhi.
2	Eiri Board. (2014). *Hand Book of Poultry Farming and Feed Formulations, Published* by Engineers India Research Institute, Delhi.
3	Jadhav NV and Siddiqui MF. (2010). *Handbook of Poultry Production and Management,* Jaypee Brothers Medical Publishers, New Delhi.
4	Jagdish Prasad. (2015). *Poultry: Production And Management,* 5th edition, Kalyani publisher, Delhi.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.classcentral.com/course/swayam-introduction-to-poultry-farming-14160
2	https://swayam.gov.in/nd2_nou19_ag09/preview
Course Designed By: Dr. A. RAJA RAJESWARI, Asst.Prof, Sri Vasavi College, Erode.	

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	M	S	M	M	S	M	S	M	S	S
CO2	M	S	M	S	S	M	S	M	S	S
CO3	M	M	L	L	M	L	S	M	S	S
CO4	M	M	M	S	M	L	S	M	S	S
CO5	M	S	M	M	S	M	S	M	S	S

*S-Strong; M-Medium; L-Low

Course code	63R	POULTRY SCIENCE AND MANAGEMENT - PRACTICAL	L	T	P	C
Core/Elective/ SBS		Elective Course III - B	0	0	2	2
Pre-requisite		Practical Knowledge to Rear and Manage Poultry Breeds	Syllabus Version		2021 – 2022	

Course Objectives:

1. To provide an opportunity to become familiar and acquire a degree of skill in poultry field.

2. To enlighten the evaluation of the productive performance of livestock.

3. To reveal the real nature of animal production and their role in rural development.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Evaluate the importance and value of agricultural products as a feed source in poultry and differentiate the poultry breeds and their characteristics features.	K5
2	Gain practical knowledge in analyzing the abnormalities and grading techniques of eggs.	K2
3	Understand about various techniques debeaking, candling and also be familiar with incubators in breeding that are necessary for manage the poultry farm.	K2
4	Able to follow proper vaccination practice for the diseases and pest control.	K4
5	Field visits make the students to catch up the mills processing, animal feedstuffs and Hatcheries.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

MAJOR PRACTICAL

Nutritive Value of poultry feed sources:

a. Carbohydrate sources - Maize, Rice Polish, Rice Bran, Wheat Bran
b. Vegetable Protein sources - Groundnut Cake, Sesame Cake, Coconut Meal, Cotton Seed, Soybean Meal, Sunflower meal
c. Animal protein sources - Fish Meal, Meat Meal, Silkworm Pupae Meal
d. Mineral sources - Bone meal, Oyster Shell Meal, Lime Stone

Different type of breeds and their characteristics

e. American class: Rhode Island Red
f. Mediterranean class: leghorn, Minorca
g. Asiatic class: Desi birds/Aseel, Kadacknath

Grading of eggs

h. Grade AA
i. Grade A
j. Grade B

Egg abnormalities

k. Tiny eggs
l. Leathery /soft shell eggs
m. Double yoked eggs
n. Blood smeared eggs
o. Dirty egg

MINOR PRACTICAL

1. Vaccination schedules for broilers and layers
2. Debeaking
3. Types of housing
4. Egg candling
5. Cannibalism

SPOTTERS

1. **Comment on the poultry equipments**: Feeding and Watering equipments.
2. **Draw labeled sketch**: Digestive system, Reproductive system (male and female).
3. **Brief description on the medicinal values**: Antibiotics and Vaccines.
4. **Poultry diseases**: Symptoms and preventive methods.
5. **Short notes with diagram**: Brooder and Incubator.

VISIT AND SUBMISSION OF REPORT

Visit to poultry markets/farm /study of specific marketing problems/ in house training in college. Report should be submitted in the practical.

QUESTION PATTERN: TOTAL MARKS: 25 MARKS.
Major: 08, Minor: 05, Record: 04, Spotter: 06 (2 spotters each carry 3 marks) Report: 2 marks.

Total Practical Hours **30(Each Semester) x 2 = 60 Hours Per Year**

Text Book(s)

1	Banarjee GC (2008). *Poultry*, Oxford and IBH Co. pvt Ltd.
2	Gnanamani MR (2010). *Modern Aspects of Poultry Keeping,* Deepam publications, Madurai.
3	Rice EJ and Botosford HE. (1949). *Practical poultry management,* John Wiley, Hansen Inc. New York.
4	Siddiqui SM, Reddy CV and Mathur CR. (1975). *A Practical Manual of Poultry Production,* 1st edition, Kothari Book Depot, India.

Course Designed By: Dr. A. RAJA RAJESWARI, Asst.Prof, Sri Vasavi College, Erode.

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	M	L	S	L	S	S
CO2	M	S	S	M	L	L	S	L	S	S
CO3	M	S	S	M	M	L	S	M	S	S
CO4	M	S	S	M	L	L	S	M	S	S
CO5	M	S	M	S	M	M	S	M	S	S

*S-Strong; M-Medium; L-Low

Course code	5EF	APICULTURE - I	L	T	P	C
Core/Elective/ SBS		Elective II - C	3	0	0	3
Pre-requisite		Basic Introduction about Bees, Beekeeping and Beekeeping Appliances	Syllabus Version		2021 – 2022	

Course Objectives:

1. To increase the knowledge of bees and bee culture.
2. To learn the fundamentals and scientific basis of beekeeping
3. To maintain small apiaries for demonstration, pollination, extraction and popularization of honey and other by-products of Bee keeping.
4. To build and manage a network of garden and independent beekeeping sites.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Introduces current standards for the establishment and management of bees.	K1
2	Familiarize with morphology, food and development of bees.	K2
3	Skillfully apply the tools, equipment and protective gear for beekeeping.	K3
4	Apply the knowledge of good quality of nectar and pollen to planning landscapes and gardens.	K3
5	Gain knowledge about various techniques followed in marketing of Honey.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	INTRODUCTION TO BEES	8 Hours

Scope and Advantages. Kinds of Honey bee –*Apis dorsata* – *Apis florea* – *Apis cerana indica* – *Trigonairidi pennis*. Honey Bee colony: Worker - Queen – Drones. External Morphology of Worker Bee.

Unit:2	LIFE CYCLE AND ANATOMY	9 Hours

Life cycle and Development of Honey Bee. Food of Honey Bee –Nectar – Pollen – Royal Jelly – Honey. Pollen, Nectar and Water foraging – Swarming.

Unit:3	PRIMITIVE BEEKEEPING	9 Hours

Primitive Beekeeping and structure of Hives - Modern Beekeeping and structure of Hives Advantages and disadvantages of these methods.

Unit:4	APIARY APPLIANCES	9 Hours

Appliances used in Apiary: Comb frame – foundation sheet – Dummy division board – Drone and Queen excluder – Swarm trap – Smoker – Uncapping knife –Bee veils – Honey extractor – Bee brush –feeders.

Unit:5	EXTRACTION AND PRESERVATION	8 Hours

Honey extractor – Methods of extraction, Processing, Packing and Storage. Marketing of Honey.

Unit:6	CONTEMPORARY ISSUES	2 Hours

Expert lectures, Online Seminars - Webinars and Field Visits.

	Total Lecture Hours	45 Hours

Text Book(s)

1. Atuar Rahman. (2017). *Apiculture In India*, Indian Council of Agricultural Research, India.
2. Jayashree KV, Tharadevi CS and Arumugam N. (2015).*Apiculture*, Saras Publication, Nagercoil, Tamilnadu.
3. Sammataro D, Avitabile A. (2011). *The beekeeper's Handbook*, Cornell University Press.
4. Sathe TV. (2014). *Fundamental of Beekeeping*, Daya Publishing House, New Delhi.

Reference Books	
1	Graham J M. (1992). *The Hive At The Honey Bee, Dadant* and Sons, Hamilton, IIIinois.
2	Hem Raj. (2020). *Text Book of Apiculture,* S. Vinesh and Co, publishers, Karnataka, India.
3	Mishra RC. (1995). *Honey Bees and Their Management in India,* ICAR Publication, New Delhi.
4	Sanford MT, Bonney RE. (2010). *Storey's Guide to Keeping Honey Bees: Honey Production, Pollination and Bee Health.* Storey Publishing, US.
5	Singh S. (1971). *Beekeeping in India*, ICAR publication.
6	Winston M. (1991). *The biology of the honeybee,* Harvard University Press, Massachusetts, USA.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.beesource.com/forums/showthread.php?320175-Free-online-Beekeeping-course
2	https://www.hortcourses.com/courses/bees-beekeeping-and-honey-790.aspx
Course Designed By: Dr. A. RAJA RAJESWARI, Asst.Prof, Sri Vasavi College, Erode.	

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	M	S	S	M	M	S	S	L	S	S
CO3	M	M	M	S	S	M	S	L	S	S
CO3	M	M	S	M	M	S	S	L	S	S
CO4	M	S	M	S	M	S	S	L	S	S

*S-Strong; M-Medium; L-Low

Course code	6EF	APICULTURE -II	L	T	P	C
Core/Elective/ SBS		Elective II - C	3	0	0	3
Pre-requisite		Basic Knowledge in handling tools for Management of Bees	Syllabus Version		2021 – 2022	

Course Objectives:

1. To learn honey extraction and honey bee health issues.
2. To maintain small apiaries for demonstration, pollination, extraction and popularization of honey and other by-product of bee keeping.
3. To make aware of various methods of beekeeping and the uses of its appliances.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Gain knowledge about the importance of honey and also able to classify the honey.	K1
2	Able to identify and follow regulation practices for the control diseases and control of parasites and enemies.	K3
3	Skillfully apply the tools, equipment, and techniques for management of bee.	K3
4	Be relevant and follow the procedure required for rearing, caring, grafting and stocking techniques.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	HONEY	9 Hours

Types of Honey – Properties of Honey – Nutritional and Medicinal value of Honey. Bee Wax – Properties and uses. Methods to identify original honey.

Unit:2	ENEMIES	8 Hours

Damages and preventive measures for Wasps - Greater and Lesser wax moths - Wax Beetles - Black Ants Birds and Mammals.

Unit:3	STOCKS AND ECONOMICS	9 Hours

Uniting of Stocks - Uses and Principles - Methods of uniting. Artificial feeding methods. Economics of Beekeeping: Preparation of project – Infrastructure cost –recurring – expected income and gain – Methods to obtain loan

Unit:4	QUEEN REARING	9 Hours

Types of Honey – Properties of Honey – Nutritional and Medicinal value of Honey. Bee Wax – Properties and uses. Methods to identify original honey.

Unit:5	DISEASES	8 Hours

Description of Parasite, Symptoms, Transmission, Diagnosis and Control of Brood Disease and adult diseases.

Unit:6	CONTEMPORARY ISSUES	2 Hours

Expert lectures, Online Seminars - Webinars and Field Visits.

	Total Lecture Hours	45 Hours

Text Book(s)

1. Atuar Rahman. (2017). *Apiculture In India*, Indian Council of Agricultural Research, India.
2. Jayashree KV, Tharadevi CS and Arumugam N. (2015).*Apiculture*, Saras Publication Nagercoil, Tamilnadu.
3. Sammataro D, Avitabile A. (2011). *The Beekeeper's Handbook*, Cornell University Press.
4. Sathe TV. (2014). *Fundamental of Beekeeping*, Daya Publishing House, New Delhi.

Reference Books	
1	Graham J M. (1992). *The hive and the honey bee,* Dadant and Sons, Hamilton, IIIinois.
2	Hem Raj. (2020). *Text Book of Apiculture,* S. Vinesh and Co, publishers, Karnataka, India.
3	Mishra RC. (1995). *Honey bees and their management in India,* ICAR Publication, New Delhi
4	Sanford MT, Bonney RE. (2010). *Storey's Guide to Keeping Honey Bees: Honey Production, Pollination and Bee Health.* Storey Publishing, US.
5	Singh S. (1971). *Beekeeping in India,* ICAR publication.
6	Winston M. (1991). *The biology of the honeybee,* Harvard University Press, Massachusetts, USA.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.beesource.com/forums/showthread.php?320175-Free-online-Beekeeping-course
2	https://www.hortcourses.com/courses/bees-beekeeping-and-honey-790.aspx
Course Designed By: Dr.A.RAJA RAJESWARI, Asst.Prof, Sri Vasavi College, Erode.	

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	M	S	S	M	M	S	S	L	S	S
CO3	M	M	M	S	S	M	S	L	S	S
CO3	M	M	S	M	M	S	S	L	S	S
CO4	M	S	M	S	M	S	S	L	S	S

*S-Strong; M-Medium; L-Low

Course code	63R	APICULTURE PRACTICAL	L	T	P	C
Core/Elective/ SBS		Elective Course III - C	0	0	2	2
Pre-requisite		Practical Knowledge about Management of Bees, Extraction and Identifying the Quality of Honey	Syllabus Version		2021 – 2022	

Course Objectives:

1. To increase the knowledge of bees and bee culture.

2. To maintain small apiaries for demonstration, pollination, extraction and popularization of honey and other by-product of beekeeping.

3. To build and manage a network of garden and independent beekeeping sites, make aware of various methods of beekeeping and the uses of its appliances.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Introduces current standards for the establishment and management of bees.	K1
2	Familiarized with various techniques like mounting and extraction of honey.	K3
3	Identify and describe about different hives, appliances and parasites of bees.	K3
4	Gain practical knowledge in identifying the quality of honey.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

MAJOR PRACTICAL

1. Extraction of Honey.

2. Setting up of a Newton Hive (Cardboards and others can be used).

3. Estimation of Glucose in Honey.

4. Mounting of Pro, Meso and Meta thoracic legs of Honeybee.

5. Dissection of Wax glands (Optional).

MINOR PRACTICAL

1. Mounting of Mouthparts.

2. Identifying the quality of Honey.

3. Qualitative identification of Glucose, Fructose and Sucrose in Honey.

SPOTTERS

1. Identification and Description of Whole mount of types of Honeybees.
2. Identification and Description of types of Primitive and Modern Hives.
3. Identification and Description of Appliances Used in Apiary.
4. Identification and Description of Parasites of Honeybee.
5. Identification and Description of Worker, Drone and Queen.

VISIT AND SUBMISSION OF REPORT

Visit to apiculture unit of nearby locality or training or in house apiculture in college. Report should be submitted in the practical.

QUESTION PATTERN: TOTAL MARKS: 25 MARKS.
Major: 08, Minor: 05, Record: 04, Spotter: 06 (2 spotters each carry 3 marks) Report: 2 marks.

Total Practical Hours **30(Each Semester) x 2 = 60 Hours Per Year**

Text Book(s)

1	David Cramp A. (2008). *A Practical Manual Of Beekeeping: How to Keep Bees and Develop Your Full Potential as an Apiarist*, Kindle Edition, Spring Hill Publisher, UK.
2	David Cramp A. (2012). *The Complete Step-by-step Book of Beekeeping: A Practical Guide to Beekeeping, from Setting Up a Colony to Hive Management and Harvesting the Honey*, Lorenz Books. London.
3	Haike Rieks. (2006).*Practical Guide for Organic Bee keepers*, EPOPA publication, Netherlands.

Course Designed By: Dr.A.RAJA RAJESWARI, Asst.Prof, Sri Vasavi College, Erode.

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	M	S	S	L	S	S
CO3	L	M	L	L	M	M	S	L	S	S
CO3	M	S	L	S	M	S	S	L	S	S
CO4	L	L	L	M	L	M	S	L	S	S

*S-Strong; M-Medium; L-Low

Value Added Course

Value Added Course	MEDICAL EMERGENCY MANAGEMENT	L	T	P	C
	Value Added Course-I				
Pre-requisite	Knowledge to Understand the First Aid Treatment and Management	Syllabus Version	2021-2022		

Course Objectives:

1. To understand the scope and role of First Aid Treatments.
2. To manage the various incidents using First Aid Treatment measures.
3. To describe the various medical emergency situations.
4. To learn handling techniques of First Aid Treatment.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	To understand the significance of First Aid Treatments and utilize the possible measures for life saving in an unconscious casualty.	K2
2	To explain the First Aid management for respiratory, wounds and circulation problems.	K3
3	To list the techniques and equipments for First Aid.	K4
4	To plan the First Aids for emergency in community and natural disorders.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

THEORY **10 x 2 =20 Hours**

Module 1. First Aid and Aider. Precaution and Preparation.

Module 2. Action of Emergency: Protection from infection, dealing casualty and use of medications.

Module 3.Incidents**:** Pandemic diseases (virus and Bacteria).

Module 4. Accidents: Traffic accidents, Fire accidents, Electrical incidents and Water incidents.

Module 5. Medical Situations: Heart attack, Stroke, Hyper and Hypoglycemia, Seizures.

Module 6.Common Diseases: Fever, Allergy, Anaphylactic shock, Headache, Migraine, Sore throat, Earache and toothache, Abdominal pain, Vomiting and Diarrhea.

Module 7. First Aid materials, Dressings, Cold compresses, Removing clothing and headgear.

Module 8. Casualty handling, Principles of bandaging and types (Roller and Tubular), square knots, hand and foot cover.

Module 9. Emergency Action: Cardio Pulmonary Resuscitation for an adult and infant and chest compression.

Module 10. Community Emergency: Fire explosions, Earth quakes, Flood and Famine.

PRACTICALS **5 x 2 = 10 Hours**

1.Blood Pressure checking Sitting, Standing and Lying Position

2. Cardio Pulmonary Resuscitation (CPR)-handling Test

3. RBC and WBC Count

4.Estimation of Bleeding and Clotting time

5.Checking Heart Beat and Pulse Rate.

Reference Books	
1	American college of emergency physicians. (2014). *First Aid Manual,* 5th edition, Dorl Kindersley, Publication, London.
2	Clement. (2012). *Text book on First Aid and Emergency Nursing,* 1st edition, JP brothers, New Delhi.
3	Philip Jevons. (2006). *Emergency care and First Aid for Nurses, A practical Guide,* Churchill Living Stone, London.
4	St. John Ambulance, St. Andrew's Ambulance association and the British red cross society. (2006). *First Aid Manual,* 9th edition, Publication Dorling Kindersley, London.
Course Designed By: Dr. UTHAYAKUMAR, Asst.Prof, Sri Vasavi College, Erode.	

Mapping with Programme Outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	L	M	M	M	L	S	M	M	S	S
CO2	L	M	M	M	L	S	L	M	S	S
CO3	L	M	M	M	L	M	S	S	S	S
CO4	L	M	M	M	L	M	S	S	S	S

*S-Strong; M-Medium; L-Low

Value Added Course	VERMITECHNOLOGY	L	T	P	C
	Value Added Course-II				
Pre-requisite	Basic Knowledge about Rearing Earthworm	Syllabus Version	2021-2022		

Course Objectives:

1. To understand the importance of Earthworms.
2. To impart the basic knowledge on Vermicomposting methods.
3. To familiarize the values of Vermitechnology and its applied aspects of organic farming.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Student gain basic knowledge of Earthworms.	K2
2	Understand the importance of waste degradation by Eco-friendly method.	K3
3	Understand the significance of Vermicomposting methods.	K4
4	Apply knowledge on commercialization of Vermiproducts.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

MODULE **15 x 2 = 30 Hours**

Module 1. Definition, Concept and Need for Vermiculture.

Module 2. Classification of Earthworm Epigeic, Anecic and Endogeic forms.
Module 3. Earthworm: General body structure, colour, Anatomy and Body Setae.
Module 4. Food habits – Digestive system – Excretion.
Module 5. Reproduction and Life cycle of Earthworm.

Module 6. Vermiculture unit setup. Small scale and Large scale vermin composing..
Module 7. Vermiculture environmental-Air, Moisture. Temperature.
Module 8. Vermicomposting materials –Types of vermicomposting and Requirements.
Module 9. Advantages and Maintenance of Vermicomposting.
Module 10. Chemical composition of Vermicompost, Vermi wash, Value addition of Vermicompost.
Module 11. Uses of earthworms in animal feed industry.
Module 12. Bioremediation through Vermitechnology.
Module 13. Role of earthworms in sustainable agriculture - organic farming.
Module 14. Earthworm activities – soil fertility and texture - soil aeration.

Module 15. Recycling of different wastes by vermicomposting.

Text Books

1	Bhatnagar RK and Palta RK. (1996). *Vermiculture and Vermicomposting*, Kalyani Publishers, New Delhi.
2	Gupta PK. (2005). *Vermicomposting for Sustainable Agriculture*, Agro-Bios publication, Jodhpur, ,
3	Ismail SA. (1997). *Vermicology-The biology of Earthworm, Orient* Longman, India.
4	Ranganathan LS.(2006).*Vermicomposting Technology – From Soil Health to Human Health,* Agro-Bios Publications, India
5	Sathe TV. (2004).*Vermiculture and Organic Farming, Daya* Publishing House, India.
6	Seethalakshmy. (2014). *A Text book of Vermitechnology*, 3rd edition, Saras Publications, Nagerkovil, Tamilnadu.

Reference Books	
1	Arun K. Sharma. (2002). *A Hand book of organic forming*, Agrobios, Jothpur, India.
2	Edwards CA and Lofty JR. (1977) "*Biology of Earthworms*", Chapman and Hall Ltd, London.
3	Lee KE. (1985) "*Earthworms*: *Their ecology and Relationship with Soils and Land Use*", Academic Press, Sydney.
4	Satchel JE. (1983). "*Earthworm Ecology*", Chapman Hall, London.
5	Tripathi G. (2003). *Vermisource Technology*, Discovery Publishing House, India.
Course Designed By: S. SUDHA, Asst.Prof, LRG Govt. Arts College for Women, Tirupur	

Mapping with Programme Outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	S	S	S	S	S	L	S	S
CO2	M	M	M	M	S	S	S	L	S	S
CO3	M	S	S	M	M	S	S	L	S	S
CO4	M	M	S	M	M	S	S	L	S	S

*S-Strong; M-Medium; L-Low

Value Added Course	ECONOMICS OF CONSERVATION	L	T	P	C
	Value Added Course-III				
Pre-requisite	Basic Knowledge in Life Sciences	Syllabus Version	2021-2022		

Course Objectives:

1. To create basic awareness about conservation
2. To create awareness to students explore biodiversity for new product development.
3. To create awareness to understand the economics aspects of Biodiversity

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Explore nature in search of new biodiversity products in field of medicine and agriculture.	K3
2	Able to understand the significance and need of conserving resources	K3
3	Gain knowledge about importance of Ecosystem services and marine resources.	K2
4	Familiar and able to isolate, identify the biodiversity products.	K3
5	Aware and create career opportunity in ecotourism.	K5

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

MODULE **15 x 2 = 30 Hours**

Module 1. Concept of Biodiversity
Module 2. Ecosystems and Community structure
Module 3. Spatial and temporal aspects of biodiversity
Module 4. Causes of the global loss of biodiversity
Module 5. Invasive species and their impact on ecosystems and biodiversity
Module 6. Conservation biology: policy and management
Module 7. Ecosystem services and their importance for human societies
Module 8. Biodiversity products
Module 9. Economics of marine resources
Module 10. Biodiversity products from Animals.
Module 11. Biodiversity products from plants.
Module 12.Biotechnology in Biodiversity
Module 13.Isolation, identification and patenting Biodiversity Products
Module 14.Biodiversity as Career
Module 15. Eco-tourism and possibilities.

Reference Books

1	Anderson J and Slater D L. (1981). *Catalogue of Mammals,* Vol. I and II. Cosmo Publications, New Delhi.
2	Hosetti BB, Ramkrishna S. (2016). *Biodiversity* : *Concepts and Conservation*, 1st edition, Aavishkar Publishers, Distributors, Jaipur
3	Prater S H. (1988). *The Book of Indian Animals,* Bombay Natural History Society, Bombay
4	Young J Z. (1950). *The Life of Vertebrates,* Clarendon Press, Oxford.

Course Designed By: Dr. R. SANIL, Associate Professor, Government Arts College, Ooty

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	M	M	M	S	S	S	S	S	M
CO2	M	S	S	S	S	M	M	M	M	M
CO3	M	M	L	L	L	S	L	M	S	S
CO4	M	M	L	M	L	S	L	M	S	S
CO5	M	M	L	L	L	S	L	M	S	S

*S-Strong; M-Medium; L-Low

Value Added Course	INTELLECTUAL PROPERTY RIGHT	L	T	P	C
	Value Added Course-IV				
Pre-requisite	Basic Knowledge to Aware About IPR	Syllabus Version		2021 – 2022	

Course Objectives:

1. To introduce fundamental aspects of Intellectual property Rights to students who are going to play a major role in development and management of innovative projects in industries.
2.To disseminate knowledge on patents, patent regime in India and abroad and registration aspects.
3.To disseminate knowledge on copyrights and its related rights and registration aspects.
4. To disseminate knowledge on Design, Geographical Indication (GI), Plant Variety and Layout Design Protection and their registration aspects.
5. To aware about current trends in IPR and Govt. steps in fostering IPR.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	The students once they complete their academic projects shall get an adequate knowledge on patent and copyright for their innovative research works.	K2
2	During their research career, information in patent documents provides useful insight on novelty of their idea from state-of-the art search. These provide further way for developing their idea or innovations.	K3
3	Pave the way for the students to catch up Intellectual Property(IP) as an career : a. R&D IP Counsel, Patent Examiner, Patent and Trademark agent, Entrepreneur.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

MODULE **15 x 2 = 30 Hours**

Module 1. Introduction and the need for intellectual property right (IPR)
Module2. Kinds of Intellectual Property Rights: Patent, Copyright, Trade Mark, Design, Geographical Indication, Plant Varieties.
Module 3. Layout Design and Genetic Resources.
Module 4. Traditional Knowledge and Trade Secret.
Module 5. IPR in India.
Module 6. Patents - Elements of Patentability: Novelty, Non Obviousness.
Module 7. Patent office and Appellate Board, Registration Procedure, Remedies and Penalties.
Module 8. Nature of Copyright, Registration Procedure, Ownership and license of copyright.
Module 9. Related Rights - Distinction between related rights and copyrights
Module10.Concept and Kinds of Trademarks (brand names, logos, signatures, and symbols).
Module 11. Registration of Trademarks - Rights of holder.
Module 12. Design: Meaning and concept of Novel and Original.
Module 13.Geographical indication: Meaning, Difference between GI and trademarks.
Module 14. Plant variety protection: Meaning Benefit sharing and farmers' rights.
Module 15. Layout Design protection: Meaning, Procedure and Effect of registration.

Text Book(s)

1	Nithyananda KV. (2019). *Intellectual Property Rights: Protection and Management*, India, IN: Cengage Learning India Private Limited.
2	2. Neeraj P and Khusdeep D. (2014). *Intellectual Property Rights*, India, IN: PHI learning Private Limited.

Reference Books	
1	Ahuja V K. (2017). *Law relating to Intellectual Property Rights*, India, IN: Lexis Nexis.
	E-resources:
2	Subramanian N and Sundararaman, M. (2018). *Intellectual Property Rights – An Overview*. Retrieved from http://www.bdu.ac.in/cells/ipr/docs/ipr-eng-ebook.pdf
3	World Intellectual Property Organisation. (2004). *WIPO Intellectual property Handbook*. Retrieved from https://www.wipo.int/edocs/pubdocs/en/intproperty/489/wipo_pub_489.pdf
3	Journal of Intellectual Property Rights (JIPR): NISCAIR
	Related Online Contents
1	Cell for IPR Promotion and Management (http://cipam.gov.in/)
2	World Intellectual Property Organisation (https://www.wipo.int/about-ip/en/)
3	Office of the Controller General of Patents, Designs & Trademarks (http://www.ipindia.nic.in/)
Course Designed By: Dr. A. RENI PRABHA, Assoc.Prof, Chikkaiah Naicker College, Erode	

Mapping with Programme Outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	M	L	L	M	M	M	S	M	S	S
CO2	L	M	L	M	M	M	M	S	S	S
CO3	M	L	L	M	L	M	M	M	S	S

*S-Strong; M-Medium; L-Low

Annexure

B.Sc. ZOOLOGY

SYLLABUS

(With effect from 2020 - 2021 onwards)

Program Code:

DEPARTMENT OF ZOOLOGY
Bharathiar University
(A State University, Accredited with "A "Grade" by NAAC and 13th Rank among Indian Universities by MHRD-NIRF) Coimbatore 641 046, INDIA

GUIDELINES FOR CONDUCTING VALUE ADDED COURSES

Course Structure

1. The request for approval of syllabus by the concerned authorities is mandatory atleast15 days before the date of commencement of the course. The Syllabus (15/30hours), Schedule and the Details of Faculty handling the course approved by the Departmental Committee and forwarded by Head of the Department should be enclosed.
    a. The course offered should not be the same as any course listed in the curriculum of the respective programme/or any other programme offered in University /Colleges.
    b. The value added courses may be also conducted during weekends/ vacation period.
    c. The course can be offered any semester in the PG Programmes.
    d. Industry experts/eminent academicians from other Institutes are also eligible to offer the value added course.
    e. The course can be offered only if there are atleast10 students opting for it.
    f. The students may be allowed to take value added courses offered by other departments after obtaining permission from Head of the Department offering the course.

Duration

2. The duration of value added coursesis15 (30) periods of theory or a maximum of theory and Laboratory courses and the course can have a maximum of three hours per day. For the one (two) credit courses either 15(30) periods of theory or a combination of theory and Laboratory may be offered.
   Where, **2 periods** of laboratory =**1 period** of theory

Evaluation

3. Thevalueaddedcoursesshallcarry100marksandshallbeevaluatedthrough **Internal assessments only**.

    a. Two Assessments shall be conducted preferably one in the middle and the other at the end of the course by the Department concerned.
    b. The duration of assessment is one hour each.
    c. The total marks obtained in the tests shall be reduced to100 marks and rounded to the nearest integer.
    d. The Head of the Department may identify a faculty member as coordinator for the course. A committee consisting of the Head of the Department, staff handling the course (if available), coordinator and a senior Faculty member nominated by the Head of the Department shall monitor the evaluation process. The grades shall be assigned to the students by the above committee based on their relative performance.

e. The coordinator for the course is responsible for maintaining and processing the records with regard to assessment marks and results.

Passing Requirement and Grading

4. Thepassingrequirementforvalueaddedcoursesshallbe50%ofthemarks prescribed for the course**(Internal assessment only)**

a. The grade O, A+, A, B+,B obtained for the one/two credit shall figure in the Mark sheet under the title **"Value Added Courses".** The other grades RA, SA **will not figure in the mark sheet.**
b. The credits earned through value added courses shall not be considered for calculating GPA and CGPA.
c. The credits earned through value added courses shall not be considered for classification of degree.
d. If the course is offered during any semester, it will appear in that semester's mark sheet. However if the course is offered in summer/ winter vacations, the course will be included in the grade sheet of the subsequent semester.

Maximum Number of Courses

5. A student can earn a maximum of 3 credits during the entire programme of study by attending value added courses which would be over and above the required maximum number of credits for the award of the degrees.

Financial Commitment

6. The expenditure to be incurred for the conduct of value added courses should be met from nominal fees collected from the students at a rate fixed by the University. However any additional expenditure may be supported by the funds of the Department.

APPLICATION FOR CONDUCTING VALUE ADDED COURSES

1. Name of the Department:
2. PG programme:
3. **Details of the Value Added Courses:**
   a. Name of the Value Added Courses
   b. Type of Value Added Courses (Theory/ Lab/ Lab integrated Theory/others)
   c. Short Description Enclosure1 enclosed -YES / NO
   d. Syllabus including Reference Enclosure 2 enclosed - YES / NO
4. **Target audience:**
   Semester (indicate if more than one)
   others
5. **Details of Faculty handling the course:**
   a. Name of the Faculty Handling the Value Added course
   b. Details including designation and expertise Enclosure3enclosed-YES / NO
   c. Contact details
      Email ID :
      Phone No :
6. **Tentative Time Table** including dates of internal assessments : Enclosure 4 enclosed - YES / NO
7. Number of students opting for the course:
8. Department Consultative Committee - Minutes : Enclosure 5 enclosed - YES / NO
9. Name and Designation of the Coordinator :

Head of the Department
(with date & seal)

Note:

* **Fees if any**

DETAILS OF COMPLETION OF VALUE ADDED COURSE

Name of the Department :
Name of the Value Added Course offered
Name of the Faculty offered the course
: Academic / Industry
Name of the coordinator :
E- Mail :
Contact :

Details of students attended the course:

S.No	Name of the student	Reg.No.	Programme	Semester	Marks	Grade

(Faculty handling the Course (if available)

(Senior Faculty Nominated by HOD)

(Co-ordinator)

(Head of the Department)
(With Date &Seal)

DISTRIBUTION OF EXTERNAL AND INTERNAL MARKS FOR THEORY PAPERS

Table – 1(A): Distribution of marks for **External (CEE)** and **Internal (CIA)** for University (external) examination and **Continuous Internal Assessment** and passing minimum marks for **Theory Papers.**

Max. Marks	Comprehensive External Examinations (CEE)		Continuous Internal Assessments (CIA)		Overall Passing Minimum (Internal + External)
	Max. Marks	Passing Minimum	Max. Marks	Passing Minimum	
100	50	20	50	15	40
75	45	18	30	09	30

Table – 1(B): Distribution of marks for the **Continuous Internal Assessment** in the **Theory Papers** of **UG programmes**.

S. No	Component	Allotment of Internal Assessment marks for a maximum of	
		50	**30**
1	Tests(Average of two tests)	15	10
2	End semester model test (3 hours)	15	10
3	Assignments/Quiz/ Group Discussion	10	05
4	Seminar	05	-
5	Attendance	05	05

(Each student should attend at least one test)

DISTRIBUTION OF EXTERNAL AND INTERNAL MARKS FOR PRACTICALPAPERS

Table – 2(A): Distribution of marks for **External (CEE)** and **Internal (CIA)** University examinations and **Continuous Internal Assessments** and passing minimum marks for the **Practical Courses.**

Max. Marks	Comprehensive External Examinations (CEE)		Continuous Internal Assessments (CIA)		Overall Passing Minimum (Internal + External)
	Max. Marks	Passing Minimum	Max. Marks	Passing Minimum	
100	50	20	50	15	40
75	45	18	30	09	30
50	25	10	25	7.5	20

Table – 2(B):

Distribution of marks for the **Continuous Internal Assessment** in **UG Practical Courses**.

S. No	Component	Allotment of Internal Assessment marks for a maximum of		
		50	30	25
1	Record	15	10	10
2	Tests: One best test out of two tests.	30	15	10
3	Attendance (Minimum 10 experiments to be completed)	5	5	5

DISTRIBUTION OF MARKS FOR ATTENDANCE

Attendance	Marks
90% and above	5 marks
Between 85% and 90%	4 marks
Between 80% and 85%	3 marks
Between 75% and 80%	2 marks
Between 70% and 75%	1 marks

QUESTION PAPERPATTERN

The following question paper patterns shall be followed for **OBE** pattern syllabi for the candidates admitted from the academic year 2020-21 wherever applicable otherwise provided in syllabi itself.

MAXIMUM 50 MARKS – WHEREVER APPLICABLE			
Section A	Multiple choice questions with four options	10*1=10	10 questions – 2 from each unit
Section B	Short answer questions of either / or type like 1.a (or) b	5*3=15	5 questions – 1 from each unit
Section C	Essay-type questions of either / or type like 1.a (or) b	5*5=25	5 questions – 1 from each unit

MAXIMUM 45 MARKS – WHEREVER APPLICABLE			
Section A	Multiple choice questions with four options	10*1=10	10 questions – 2 from each unit
Section B	Short answer questions of either / or type like 1.a (or) b	5*2=10	5 questions – 1 from each unit
Section C	Essay-type questions of either / or type like 1.a (or) b	5*5=25	5 questions – 1 from each unit

The **General Awareness** paper to have multiple choice questions (with four option) to be evaluated by using **OMR**.

For other courses in Part IV of UG programmes namely, **Environmental Studies, Value Education – Human Rights, Yoga for Human Excellence, Women's Rights and Constitution of India** the question paper pattern should be **5 out of 10.**