Under Graduate Programme - B.Sc ZOOLOGY

CHOICE BASED CREDIT SYSTEM (CBCS PATTERN)

(FOR THE CANDIDATES ADMITTED FROM 2023 - 2024…. ONWARDS)

SEM	PART	COURSECODE	TITLEOFTHECOURSE	NATURE OF COURSE	IH	CP	EXAMHRS	MARKS		TOTAL
								CIA	ESE	
I	I	23UTAM101/ 23UHIN101/ 23UFRE101	TAMIL/HINDI/FRENCHI	LAN	6	3	3	**25**	**75**	100
	II	23UGEN101 23UAEN101	GENERALENGLISHI ADVANCEDENGLISHI	ENG	6	3	3	**25**	**75**	100
	III	23UZO1C01	CORE: LIFEAND DIVERSITYOFANIMALSI **(*Skill Development*)**	CC	4	4	3	**25**	**75**	100
	III	23UZO1C02	CORE:SERICULTURE (***Entrepreneurship***)	CC	3	4	3	**25**	**75**	100
	III	23UPB1A01	ALLIED BOTANYI	GEN	5	3	3	20	55	75
	III	23UZO2CP1	COREPRACTICALI	CC	2	-	-	-	-	-
	III	23UBO2AP1	ALLIEDPRACTICALI	GEN	2	-	-	-	-	-
	IV	15UVAL101	VALUEEDUCATION	AEC	2	2	2	-	50	50
II	I	23UTAM202/ 23UHIN202/ 23UFRE202	TAMIL/HINDI/FRENCHCOURSEII	LAN	6	3	3	**25**	**75**	100
	II	23UGEN202 23UAEN202	GENERALENGLISHII ADVANCEDENGLISHII	ENG	6	3	3	**25**	**75**	100
	III	23UZO2C03	CORE:LIFEAND DIVERSITYOFANIMALSII **(*Skill Development*)**	CC	7	5	3	**25**	**75**	100
	III	23UZO2CP1	COREPRACTICALI	CC	2	4	3	**25**	**75**	100
	III	23UBO2A02	ALLIED BOTANYII	GEN	5	3	3	**20**	**55**	75
	III	23UBO2AP1	ALLIEDPRACTICALI	GEN	2	4	3	**20**	**30**	50
	IV	21UENS203	ENVIRONMENTALSTUDIES	AEC	2	2	2	-	50	50

III	I	22UTAM303/ 22UHIN303/ 22UFRE303	TAMIL/HINDI/FRENCH III	LAN	6	3	3	**25**	**75**	100
	II	22UGEN303/ 22UAEN303	GENERAL ENGLISH III ADVANCED ENGLISH III	ENG	6	3	3	**25**	**75**	100
	III	22UZO3C04	CORE: DEVELOPMENTAL BIOLOGY (***Employability & Skill Development***)	CC	5	4	3	**25**	**75**	100
	III	22UCH3A01	ALLIED CHEMISTRY I	GEN	4	3	3	20	55	75
	III	22UZO4CP2	CORE PRACTICAL II	CC	2	-	-	-	-	-
	III	22UCH4AP1	ALLIED CHEMISTRY PRACTICAL	GEN	2	-	-	-	-	-
	IV	22UBTA301/ 22UATA301/	BASIC TAMIL I / ADVANCE TAMIL I	AEC	2	2	3	25	25	50
		21UGEA301	INDIAN KNOWLEDGE SYSTEM					-	50	
	IV	21UZO3SB1	SKILL BASED I – INTRODUCTION TO NANOTECHNOLOGY	SEC	3	2	3	**25**	**75**	100
	IV	21UNCCWS1	WOMEN STUDIES	AEC	2	-	2	-	50	50
IV	I	22UTAM404/ 22UHIN404/ 22UFRE404	TAMIL/HINDI/FRENCH IV	LAN	6	3	3	**25**	**75**	100
	II	22UGEN404 22UAEN404	GENERAL ENGLISH IV ADVANCED ENGLISH IV	ENG	6	3	3	**25**	**75**	100
	III	22UZO4C05	CORE:ECOLOGY AND ETHOLOGY **(*Skill Development*)**	CC	5	4	3	**25**	**75**	100
	III	22UZO4CP2	CORE PRACTICAL II	CC	2	4	3	40	60	100
	III	22UCH4A02	ALLIED CHEMISTRY II	GEN	4	3	3	20	55	75
	III	22UCH4AP1	ALLIED CHEMISTRY PRACTICAL	GEN	2	4	3	20	30	50
	IV	22UBTA402/ 22UATA402/	BASIC TAMIL II / ADVANCE TAMIL II	AEC	2	2	3	25	25	50
		21NME402	HUMAN RIGHTS					-	50	
	IV	21UZO4SB2	SKILL BASED II- INTRODUCTION TO IMMUNOLOGY	SEC	3	2	3	**25**	**75**	100

V	III	22UZO5C06	CORE:GENETICS AND EVOLUTION **(*Skill Development*)**	CC	5	5	3	**25**	**75**	100
	III	22UZO5C07	CORE: BIOPHYSICS & BIOSTATISTICS **(*Skill Development*)**	CC	5	5	3	**25**	**75**	100
	III	22UZO5C08	CORE:CELL AND MOLECULAR BIOLOGY (***Employability***)	CC	4	5	3	**25**	**75**	100
	III	21NZO5E01	NME: NUTRITION AND HEALTH ***(Employability)***	GE	4	4	3	**25**	**75**	100
	III	21UZO5E01/ 21UZO5E02	ELECTIVE: BIOINFORMATICS **(*Skill Development*)** / ELECTIVE:PARASITOLOGY (***Employability***)	DSE	4	4	3	**25**	**75**	100
	III	22UZO6CP3	CORE PRACTICAL III	CC	2	-	-	-	-	-
	IV	21UZO5SB3	SKILL BASED III- MEDICAL MICROBIOLOGY	SEC	3	2	3	**25**	**75**	100
	IV	21IDSBZO1	SKILL BASED I- WOMEN AND REPRODUCTIVE HEALTH	SEC	3	2	3	**25**	**75**	100
VI	III	22UZO6C09	CORE: PHYSIOLOGY **(*Employability* & *Skill Development*)**	CC	5	5	3	**25**	**75**	100
	III	22UZO6C10	CORE:INLAND FISH CULTURE (***Entrepreneurship*** &***Skill Development*)**	CC	5	5	3	**25**	**75**	100
	III	22UZO6C11	CORE:BIOTECHNOLOGY **(*Employability* & *Skill Development*)**	CC	5	5	3	**25**	**75**	100
	III	22UZO6CP3	CORE PRACTICAL III	CC	2	4	3	40	60	100
	III	21UZO6E01 / 21UZO6E02	ELECTIVE: MEDICAL LABORATORY TECHNOLOGY (***Employability***) / ELECTIVE : WILD LIFE CONSERVATION AND MANAGEMENT (***Employability***)	DSE	5	4	3	**25**	**75**	100
	IV	21UZO6SB4	SKILL BASED IV- APICULTURE	SEC	3	2	3	**25**	**75**	100
	IV	21IDSBZO1	SKILL BASED II-WOMEN AND REPRODUCTIVE HEALTH	SEC	3	2	3	**25**	**75**	100
			EXTENSION AND CO-CURRICULAR ACTIVITIES (NSS/NCC/YRC/SPORTS/RSP/ NECTAR/CHETNA WOMEN CELL/AICUF)			1	-	-	-	50
			CYBER SECURITY		2	2	2	-	-	50
			SWAYAM/MOOC/NPTEL COURSE			2				
					180 + 2 +2	**140 +2 +2**				**3800 +50**

IH – Instructional hours; CP – Credit Points; CIA – Continuous Internal Assessment; ESE – End Semester Examination

PART WISE TOTAL

ZOOLOGY				
			CP	**TOTAL**
1	PART I	LANGUAGE COURSE	12	400
2	PART II	ENGLISH	12	400
3	PART III	CORE /ALLIED/ PROJECT/ PRACTICAL	95	2100
4	PART IV	BASIC TAMIL I AND II ADVANCED TAMIL I AND II INDIAN KNOWLEDGE SYSTEM AND HUMAN RIGHTS	4	100
	PART IV	SKILL BASED (6 COURSES)	12	600
	PART IV	VALUE EDUCATION	2	50
	PART IV	ENVIRONMENTAL STUDIES	2	50
	PART IV	WOMEN STUDIES		50
	PART V	CO-CURRICULAR ACTIVITIES (NSS/NCC/YRC/SPORTS/RSP/ NECTAR)	1	50
	Total		**140**	**3800**
		CYBER SECURITY	2	50
		MOOCS/ SWAYAM/NPTEL	2	
	Grand Total		**140 +2 +2**	**3800+5 0**

ABBREVIATIONS	NATURE OF COURSE
LAN	LANGUAGE
ENG	ENGLISH
CC	CORE
GEN	GENERIC (Allied)
AEC	ABILITY ENHANCEMENT COURSE
SEC	SKILL ENHANCEMENT COURSE

GE	GENERIC ELECTIVE (NME)
DSE	DISCIPLINE SPECIFIC ELECTIVE

VALUE ADDED COURSES

Career oriented program (COP) in Vermitechnology UGC Funded							
	Course Code	**Courses**	**Title of the Paper**	**Int Mar**	**Ext Mar**	**Tot Mar**	**Ins Hrs**
Certificate Course	13CCVT001	Course-I	The Earthworm	30	70	100	60
	13CCVT002	Course-II	Introduction to vermicomposting	30	70	100	60
	13CCVTP01	Practical-I	Practical -I	40	60	100	60
		Field Work	Field Work/Visit to Vermicompost farm	-	-	-	60
Diploma Course	13UDVT003	Course-III	Vermicomposting - maintenance	30	70	100	60
	13UDVT004	Course-IV	Earthworms for solid waste management	30	70	100	60
	13UDVTP02	Practical-II	Practical -II	40	60	100	60
		Field Work	Field Work				60
Advanced Diploma Course	14ADVT005	Course-V	Earthworm reproduction and heavy metal accumulation	30	70	100	60
	14ADVT006	Course-VI	Earthworm biotechnology for sustainable agriculture	30	70	100	60

	14ADVTP03	Practical-III	Practical -III	40	60	100	60
		Field Work	Field Work	-	-	-	60
	14ADVTPVV	Project	Project	50	50	100	60

SEMESTER: I

COURSE CODE: 23UZO1C01

TITLE OF THE COURSE: CORE: LIFE AND DIVERSITY OF ANIMALS – I

(***Skill Development***)

COURSE OBJECTIVES

- To appraise the students of the level of organization in Invertebrates
- To describe the structure and function of animals from Phylum protozoa to Echinodermata
- To highlight the adaptive features of animals under each phyla

COURSE OUTCOMES

At the end of the course the students will be able to:

CO1	Identify the different taxonomic groups in Invertebrates based on the level of organization	**K1**
CO2	Explain the characteristic features between Acoelomate and Pseudocoelomate animals	**K2**
CO3	Explain the various systems and their functions in earthworm and cockroach	**K2**
CO4	Relate the structural and functional attributes of Phylum Mollusca	**K3**
CO5	Relate the adaptation of radial symmetry in the higher order Phyla Echinodermata.	**K3**

Syllabus

Credits: 4 **Instructional hours: 60**

General Characters, Organization and Classification up to classes

UNIT I: Phylum Protozoa and Porifera (K1) **12 hours**

Type study: Paramecium and Leucosolenia

General Topics - Canal system in sponges,

Nutrition in Protozoa, Locomotion in Protozoa.

Economic importance of sponges

UNIT II: Phylum Coelenterata and Helminthes (K2) **12hours**

Type study: Obelia, Taenia solium and Ascaris.

General Topic - Parasitic adaptations in Platyhelminthes Parasites

Corals and coral reefs

(Beyond the Curriculum: Helminth Diseases – Ascariasis, Ancylostomiasis, Enterobiasis, Trichuriasis, Filariasis, Transmission and treatment)

UNIT III: Phylum Annelida and Arthropoda (K2) 12 hours

Type study: Earthworm and Cockroach

General Topic -Larval forms in Crustacea.

(***Self study: Developmental stages in cockroach)***

UNIT IV: Phylum Mollusca (K3) 12 hours

Type study: Pila

General Topic - Foot modification in Mollusca

UNIT V: Phylum Echinodermata (K3) 12 hours

Type study: Starfish

General Topic - Water vascular system in Echinodermata,

Larval forms in Echinodermata

TEXTBOOKS:

1. Nair NC, Leelavathy S, Soundra Pandian, Murugan T, Arumugam N (2014) A text book of Invertebrates. (6th edition) Saras Publications, Nagercoil.
2. Ekambaranatha Iyer M (1981) A Manual of Zoology Volume I & II. (4th edition). S. Viswanathan PVT Ltd, Chennai.

REFERENCE BOOKS:

1. Barrington E.W.J. (1982) Invertebrate Structure & Function. (2nd Edition) Thomas Nelson and Sons PVT Ltd. London.
2. Barnes R.D. (2006) Invertebrate Zoology. (7th edition) W.B Saunders Company. USA.
3. Dhami P S and Dhami J K (2015) Invertebrate Zoology. S.Chand & Co. New Delhi.
4. Kotpal R.L., Agarwal S.K. & Ketarpal R.P. (1990) Modern Text Book of Zoology – Invertebrates. Rastogi Publications, Meerut.

BLENDED LEARNING

UNIT V: Phylum Echinodermata

Topics	Links
General characters of the Phylum Echinodermata	https://www.youtube.com/watch?v=P0oRWMUn87I
Structure of star fish	https://www.youtube.com/watch?v=IDS2AT24C50
Star Fish – all Systems	https://www.slideshare.net/iiDevil/starfish-childrens-book-project
Water vascular system	https://www.slideshare.net/vidhyakalaivani29/water-vascular-system-of-star-fish
Larval forms in Echinodermata	https://patnawomenscollege.in/upload/e-content/Larval-Forms-Of-Echinodermata.pdf https://www.biologydiscussion.com/invertebrate-zoology/phylum-echinodermata/larva-found-in-phylum-echinodermata/33758

MAPPING OF CO's WITH PO's AND PSO's

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	2	2	2	2	1	3	3	2	3	3
CO2	3	3	3	3	2	2	2	2	1	3	3	2	3	3
CO3	3	3	3	3	2	2	2	2	3	3	3	2	3	3
CO4	3	3	3	3	2	2	2	2	3	3	3	2	3	3
CO5	3	3	3	3	2	2	2	2	1	3	3	2	3	3

(Correlation: 3 – High; 2 – Medium; 1 - Low)

ASSESSMENT TOOLS

S.No	Assessment Methods	Frequency of Assessment
1.	End Semester Examination	Once in a Semester
2.	CIA I	Once in a Semester

3.	CIA II	Once in a Semester
4.	Model	Once in a Semester
5.	Assignment (Unit I & II)	Twice in a Semester
6.	Seminar (Unit III & IV)	Twice in a Semester
7.	Field visit & Report submission (Unit V)	Once in a Semester

Course designed by **Dr.G.Chitra** **Dr.B.Dhanalakshmi**	**Verified by HOD:** **Dr.PawlinVasanthi Joseph**
Checked by CDC: **Mrs.JANSI RANI. A**	**Approved by :** **Principal**

SEMESTER: I
COURSE CODE: 23UZO1C02
TITLE OF THE COURSE: CORE: SERICULTURE

(*Entrepreneurship*)

COURSE OBJECTIVES:

- To provide a knowledge on varieties of silkworm and mulberry propagation methods
- To describe types of eggs, procedure in grainage and rearing methods
- To learn the various skills that provide self-employment in sericulture

COURSE OUTCOMES:

At the end of the course the students will be able to:

CO1	Identify varieties of silkworm and their distribution	**K1**
CO2	Explain the varieties of mulberry and its propagation methods	**K2**
CO3	Explain the types of eggs, grainage systems and rearing houses	**K2**
CO4	Distinguish rearing techniques and diseases that affect silkworm	**K3**

CO5	Demonstrate silk reeling operations and quality evaluation in cocoon marketing.	**K4**

Syllabus

Credits:4 **Instructional hours: 45**

UNIT I: History and scope of sericulture (K1) **9 hours**

Introduction and Scope of Sericulture, History and origin of silk industry and uses of sericulture, Distribution and varieties of silk worms - Mulberry - Tasar - Eri - Muga worms. Morphology and life cycle of *Bombyxmori*.

UNIT II: Mulberry types and propagation techniques (K2) **9 hours**

Varieties of Mulberry, mulberry cultivation in India, different methods of planting, method of propagation - sexual, vegetative methods of propagation of mulberry and new micro propagation method.

(Self Study: Grafting techniques)

UNIT III: Grainage and rearing techniques (K2) **9 hours**

Grainage: Procedure in grainage, diapausing, non - diapausing eggs and incubation. Transport of eggs, Rearing house facilities, rearing equipments and optimum environmental conditions. Chowaki and Lateage mountages.

UNIT IV: Silkworm diseases (K3) **9 hours**

Silkworm Diseases - Flacheri, Grasseri, Pebrine - causative organisms, mode of transmission, control and prevention of diseases, Pest of Silkworm - Uzi fly - symptoms, prevention and control measures.

UNIT V: Harvesting to marketing procedures (K4) **9 hours**

Harvesting and selection of cocoons, silk reeling - operations and appliances; cocoon marketing.

(Beyond the Curriculum: Byproducts from Silk Industry – Products from silkworm faeces, Silk Moths, Mulberry plant and Silk Cosmetics)

TEXT BOOKS:

1. Ganga and J. Sulochana Chetty (2010) Introduction to Sericulture. (2nd edition) Oxford and IBH Publishing, New Delhi.

REFERENCE BOOKS:

1. Metcalf, C.L. and Flint, W.P. (1979) .Destructive and useful insects. Tata McGraw Hill. Pub. Co., New Delhi.
2. Kovalev. P.A. (1970) Central Silk board, Silk worm Breeding Stocks.
3. Megh. Doot. Marine Drive. Bombay-2 (Publishers).
4. Yashmano Thanak. Central Silk board, Sericology. Megh. Doot,

BLENDED LEARNING
UNIT III: Grainage and rearing techniques

Topic	Links
Grainage	https://youtu.be/0cjMjZBX48U https://youtu.be/Vd5dhHRLr7k
Seed Technology	https://slideplayer.com/slide/14318589/ https://youtu.be/Mc6fFl0hp0M
Rearing house facilities, rearing equipments	https://youtu.be/RzNopX1qSOg https://youtu.be/euu3iJhD12c
Silk worm rearing technology	https://www.slideshare.net/nhomthatnice/silkworm-rearing-technology

MAPPING OF CO's WITH PO's AND PSO's

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	3	3	3	3	3	3	1	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	1	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	1	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	1	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	1	3	3

(Correlation: 3 – High; 2 – Medium; 1 - Low)

ASSESSMENT TOOLS

S.No	Assessment Methods	Frequency of Assessment
1.	End Semester Examination	Once in a Semester

2.	CIA I	Once in a Semester
3.	CIA II	Once in a Semester
4.	Model	Once in a Semester
5.	Assignment (Unit I & II)	Twice in a Semester
6.	Seminar (Unit III & IV)	Twice in a Semester
7.	Field visit & Report submission (Unit V)	Once in a Semester

Course designed by **Dr.D. Vigneshpriya**	**Verified by HOD:** **Dr.PawlinVasanthi Joseph**
Checked by CDC : **Mrs.JANSI RANI.A**	**Approved by :** **Principal**

SEMESTER I

COURSE CODE: 23UZO1A01

TITLE OF THE COURSE: ALLIED: ZOOLOGY – I

COURSE OBJECTIVES:

- To provide knowledge on the diversity and organization of animals.
- To describe the structure and functional organization of each group.
- To impart the evolutionary significance of each group in the phylogeny.

COURSE OUTCOMES:

At the end of the course the students will be able to:

CO1	Explain the organization of animals under phylum Protozoa and Principallenterata.	**K2**
CO2	Explain the morphological and functional organization of Principallomate animals - Earthworm and Cockroach.	**K2**
CO3	Relate the link between the radially and bilaterally symmetrical animals.	**K3**
CO4	Relate the structure and function of Frog and Calotes.	**K3**
CO5	Differentiate between class Aves and Mammals based on the characteristic features.	**K4**

Syllabus

Credits -3 **Instructional hours: 75**

General Characters, Organization and Classification up to classes

UNIT I: Phylum: Protozoa and Coelenterata (K2) 9 hours

Phylum: Protozoa: Paramecium

Phylum: Coelenterata: Obelia organization and life history of Obelia

UNIT II: Phylum Annelida and Arthropoda (K2) 9 hours

Phylum Annelida: Earthworm

Phylum Arthropoda: Cockroach

(***Self study: Developmental stages in cockroach)***

UNIT III: Phylum: Echinodermata and Protochordata (K3) 9 hours

Phylum: Echinodermata: Starfish

Phylum: Protochordata: Amphioxus

UNIT IV: Phylum: Chordata

(Classification up to orders) (K3) 9 hours

Class: Amphibia- Frog

Class: Reptilia: Calotes

(Excluding endoskeleton)

UNIT V: Phylum: Chordata - Pigeon and Rabbit (K4) 9 hours

Class: Aves - Pigeon

Class: Mammalia - Rabbit

(Excluding endoskeleton)

TEXT BOOKS:

1. Nair NC, Leelavathy S, Soundra Pandian, Murugan T, Arumugam N (2014) A text book of Invertebrates. (6th edition) Saras Publications, Nagercoil.
2. Thangamani A, Prassanakumar, S, Narayanan L M, Arumugam N (2014) Text book of Chordates. (6thedititon), Saras Publications, Nagercoil.
3. Ekambaranath Iyer M (1981) A Manual of Zoology Volume I & II. (4th edition). S. Viswanathan PVT Ltd, Chennai.

REFERENCE BOOKS:

1. Kotpal R.L., Agarwal S.K. and Ketarpal R.P. (1990) Modern Text Book of Zoology – Invertebrates. Rastogi Publications, Meerut.

BLENDED LEARNING
UNIT II: Phylum Annelida and Arthropoda

Topic	Links
General characters of the Phylum Annelida	https://www.slideshare.net/RidaTabassum/phylm-annelida-characteristics
Structure of Earthworm and all systems	https://www.slideshare.net/prof_aarif/earthworm-79257978
General characters of the Phylum Arthropoda	https://www.slideshare.net/jessidildy/phylum-arthropoda-characteristics
Structure of cockroach and all systems	https://www.slideshare.net/samriddhisingh/cockroach-67454273

MAPPING OF CO's WITH PO's AND PSO's

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	2	2	2	1	1	1	3	1	3	3
CO2	3	3	3	3	2	2	2	1	3	3	3	1	3	3
CO3	3	3	3	3	2	2	2	1	2	1	3	1	3	3
CO4	3	3	3	3	2	2	2	1	3	1	3	1	3	3
CO5	3	3	3	3	2	2	2	1	1	2	3	1	3	3

(Correlation: 3 – High; 2 – Medium; 1 - Low)

ASSESSMENT TOOLS

S.No	Assessment Methods	Frequency of Assessment
1.	End Semester Examination	Once in a Semester
2.	CIA I	Once in a Semester
3.	CIA II	Once in a Semester
4.	Model	Once in a Semester

5.	Assignment (Unit I & II)	Twice in a Semester
6.	Seminar (Unit III & IV)	Twice in a Semester
7.	Other component (Quiz/ Power point presentation) (Unit V)	Once in a Semester

Course designed by **Dr.G.Chitra** **Dr. D. Vigneshpriya**	**Verified by HOD:** **Dr.PawlinVasanthi Joseph**
Checked by CDC : **Mrs. JANSI RANI.A**	**Approved by :** **Principal**

SEMESTER: II
COURSE CODE: 23UZO2C03
TITLE OF COURSE: CORE: LIFE AND DIVERSITY OF ANIMALS – II
(*Skill Development*)

COURSE OBJECTIVES:

- To understand the systematic position and functional morphology of various groups of chordates
- To illustrate parental care in amphibians and poisonous snakes in India
- To emphasize the adaptive mechanism for migration in birds and aquatic life in mammals

COURSE OUTCOMES:

At the end of the course the students will be able to:

CO1	Identify the functional attributes of prochordates based on their primitive chordate features	**K1**

CO2	Explain the characters of animals living in water with their adaptive features	**K2**
CO3	Explain the morphological and functional attributes of Frog and Calotes	**K2**
CO4	Relate the biological mechanism of migration to flight adaptation in birds	**K3**
CO5	Demonstrate the morphological and functional attributes that have made mammals a successful class	**K4**

Syllabus

Credits - 5 **Instructional hours - 105**

General Characters, Organization and Classification up to orders

Unit I: Prochordata (K1) **21 hours**

Type Study: Amphioxus, Balanoglossus and Ascidia

Retrogressive Metamorphosis in Urochordates

Unit II: Pisces (K2) **21 hours**

Type Study: Shark

Accessory respiratory organs in Fishes

Scales and fins in Fishes

(Self study – scales and fins in fishes)

Unit III: Amphibia and Reptilia (K2) **21 hours**

Types: Frog and Calotes

Parental care in Amphibians

Poisonous snakes of India

Unit IV: Aves (K3) **21 hours**

Type Study: Pigeon

Migration in Birds

Flight adaptation in Birds

(Self Study: Flight adaptation in Birds)

Unit V: Mammalia (K4) **21 hours**

Type Study: Rabbit

Aquatic adaptation in Mammals

Dentition in Mammals

(*Beyond the Curriculum: Endangered (Bengal tiger Lion-tailed macaque) and Critically Endangered (Pygmy Hog and Javan Rhinoceros) Mammals*)

TEXT BOOKS:

1. Thangamani A, Prassanakumar, S, Narayanan L M, Arumugam N (2014) Text book of Chordates. (6th edititon), Saras Publications, Nagercoil.
2. Ekambaranatha Iyer M (1981) A Manual of Zoology Volume I & II. (4th edition). S. Viswanathan PVT Ltd, Chennai.

REFERENCE BOOKS:

1. Jordan E.L. and Verma P S (2013) Chordate Zoology. (14th edition), S. Chand Publishing & Co. New Delhi.
2. Hyman L.H. (2004) Comparative Vertebrate Anatomy. Sathish Serial Publishing House, New Delhi.
3. Kent G.C. (2015) Comparative Anatomy of Vertebrates. (9th edition)McGraw Hill India.
4. Kotpal R.L., Agarwal S.K. & Ketarpal R.P. (1990) Modern Text Book of Zoology - Vertebrates. Rastogi Publications, Meerut.

BLENDED LEARNING
Unit V: Mammalia

Topic	Links
General characters of Phylum Mammalia	https://byjus.com/biology/mammalia-diversity-in-living-organisms/
Morphology of Rabbit	https://www.notesonzoology.com/rabbit/external-morphology/external-morphology-of-rabbit-with-diagram-chordata-zoology/7642
Digestive system and Dental formula	https://www.notesonzoology.com/rabbit/digestive-system/digestive-system-of-rabbit-with-diagram-chordata-zoology/7714
Blood vascular system	https://www.notesonzoology.com/rabbit/blood-vascular-system/blood-vascular-system-of-rabbit-with-diagram-chordata-zoology/7816
Nervous system	https://www.notesonzoology.com/rabbit/nervous-system-rabbit/nervous-system-of-rabbit-with-diagram-chordata-zoology/7744
Reproductive system	https://www.notesonzoology.com/rabbit/reproductive-system/reproductive-system-of-rabbit-with-diagram-chordata-zoology/7728#:~:text=Female%20reproductive%20system%20
Endoskeleton	https://www.notesonzoology.com/rabbit/endoskeleton/endoskeleton-of-rabbit-with-diagram-vertebrates-chordata-zoology/7690
Sensory organs	https://www.notesonzoology.com/rabbit/sense-organs/sense-organs-of-rabbit-with-diagram-vertebrates-chordata-

	zoology/7780
Aquatic adaptations in mammals	https://www.notesonzoology.com/mammals/aquatic-mammals-and-adaptations-chordata-zoology/8523#:~:text=In%20aquatic%20mammals%2C%20the%20large,in%20water%20due%20to%20buoyancy.
Dentition in mammals	https://www.biologydiscussion.com/zoology/mammals/dentition-in-mammals-definition-origin-types-and-unusual-teeth-in-mammals/41558#:~:text=The%20arrangement%20of%20teeth%20in,is%20found%20in%20some%20mammals.

MAPPING OF CO'S WITH POs/ PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	2	1	1	2	3	2	3	1	3	3
CO2	3	3	3	3	2	2	1	2	3	3	3	1	3	3
CO3	3	3	3	3	2	2	1	2	3	1	3	1	3	3
CO4	3	3	3	3	2	2	1	2	3	3	3	1	3	3
CO5	3	3	3	3	2	2	1	2	1	3	3	1	3	3

(Correlation: 3 – High; 2 – Medium; 1 - Low)

ASSESSMENT TOOLS

S.No	Assessment Methods	Frequency of Assessment
1.	End Semester Examination	Once in a Semester
2.	CIA I	Once in a Semester
3.	CIA II	Once in a Semester
4.	Model	Once in a Semester
5.	Assignment (Unit I & II)	Twice in a Semester
6.	Seminar (Unit III & IV)	Twice in a Semester
7.	Other component (Field visit and report submission/ Quiz) (Unit V)	Once in a Semester

Course designed by **Dr.G.Chitra**	**Verified by HOD:** **Dr. Pawlin Vasanthi Joseph**

Dr. D. Vigneshpriya	
Checked by CDC : **Mrs.JANSI RANI.A**	**Approved by :** **Principal**

SEMESTER II
COURSE CODE: 23UZO2A02
TITLE OF THE COURSE: ALLIED: ZOOLOGY – II

COURSE OBJECTIVES:

- To provide knowledge on the cytological techniques.
- To understand the role of genetic engineering in health and agriculture.
- To describe the analysis of blood fluids such as blood, urine and semen.
- To show the mechanism of nutrition in man.
- To define the importance of natural resources.

COURSE OUTCOMES
At the end of the course the students will be able to:

CO1	Understand the principles of optics in microscopy and the use of staining techniques.	**K1**
CO2	Explain the application of genetic engineering in medicine and agriculture.	**K2**
CO3	Interpret the results of various techniques used in the analysis of blood, urine and semen.	**K3**
CO4	Summarize nutrition in man and its metabolism.	**K4**
CO5	Demonstrate the ecological importance of forest and water resources.	**K4**

Syllabus

Total credits: 3 **Instructional hours: 75**

UNIT I: Microscopic techniques (K1) **15 hours**

Microscopy - Compound, Electron microscope - Transmission and Scanning electron microscope. Staining techniques - Principles of staining, different types of stains.

UNIT II: Genetic engineering and Genetic disorders (K2) 15 hours

Genetic engineering - a brief outline, major areas and scope, principles of genetic Engineering, Applications in Medicine (insulin) and in Agriculture (Nif gene)

Genetic disorders in Man - Haemophilia and Colour blindness.

(Self study – Colour blindness in Man)

UNIT III: Medical Laboratory techniques (K3) 15 hours

Blood - Estimation of Haemoglobin, Bleeding and clotting time.

Urine - Physical - Specific gravity, Chemical - Sugar and Albumin.

Semen - Sperm morphology, count and motility.

UNIT IV: Food metabolism (K4) 15 hours

Nutrition in Man. - Digestion, absorption and assimilation.

Metabolism of- Carbohydrates, proteins and lipids.

UNIT V: Natural Resources (K4) 15 hours

Forest resources - Types of Forests, Deforestation and Conservation.

Water resources - Over utilization of surface and ground water.

Dams - benefits and problems. Natural calamities - Floods, droughts and conflicts over water.

(Self Study: Conservation of water)

TEXTBOOKS:

1. Arumugam, N. (2014) Concepts of Ecology. Saras Publications, 8^{t3} edition, Nagercoil.
2. Powar, C.B. (1983) Cell biology. Three Edition, Himalayan publishing house, Mumbai.
3. Sharma, P.D. (2007) Ecology and Environment. Rastogi Publications, Meerut.

REFERENCE BOOKS:

1. Veer BalaRastogi (2000) A textbook of genetics. Kedar Nath Ram Nath Publishers, Meerut.
2. Kumaresan (2012) Biotechnology (6^{th} edition) Saras Publications, Nagercoil.
3. Gupta, P.K (2009) Elements of Biotechnology. Rastogi Publications - Meerut.
4. Verma, P.S. and V.K. Agarwal (2000) Environmental biology (Principle of Ecology). S. Chand Limited. New Delhi.
5. Sinnott, E.W. Dunn, Dobzhanky. T.H. (1958) Principles of Genetics. 5^{th} Edition. McGraw - Hill, Karnataka.

BLENDED LEARNING
UNIT III: Medical Laboratory techniques

Topic	Links
Estimation of blood Haemoglobin	https://youtu.be/-TDL9Jp0dg4
Bleeding time	https://youtu.be/bMVy6pCWhRk
Clotting time	https://youtu.be/CG3_u9oCl7Q
Determination Specific gravity of urine	https://youtu.be/-sRJ9zLmkc0
Estimation of sugar in urine	https://youtu.be/-atHARq0JbQ
Estimation of albumin in urine	https://youtu.be/rq8AhBoF74Y
Sperm morphology, count and motility	https://youtu.be/Pe9iSprA4mQ

MAPPING OF CO's WITH PO's AND PSO's

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	3	3	3	3	3	3	1	2	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	2	3	3
CO3	3	3	3	3	3	3	3	3	3	3	1	2	3	3
CO4	3	3	3	3	3	3	3	3	3	2	1	2	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	2	3	3

(Correlation: 3 – High; 2 – Medium; 1 - Low)

ASSESSMENT TOOLS

S.No	Assessment Methods	Frequency of Assessment
1.	End Semester Examination	Once in a Semester
2.	CIA I	Once in a Semester
3.	CIA II	Once in a Semester
4.	Model	Once in a Semester
5.	Assignment (Unit I & II)	Twice in a Semester

6.	Seminar (Unit III & IV)	Twice in a Semester
7.	Other component (Quiz/ Power point presentation) (Unit V)	Once in a Semester

Course designed by **Dr. B.Dhanalakshmi** **Dr.G.Chitra**	**Verified by HOD:** **Dr.Pawlin Vasanthi Joseph**
Checked by CDC : **Mrs.JANSI RANI.A**	**Approved by :** **Principal**

SEMESTER: II
COURSE CODE: 23UZO2CP1
TITLE OF THE COURSE: CORE: PRACTICAL – I

CORE PRACTICAL – I: (Based on core papers - Life and Diversity of Animals I & II and Sericulture)

COURSE OBJECTIVES:

- To understand the different system of animals through dissection, display and mounting

- To identify and explain the diversity of animals, biological importance and structure and function of body parts
- To understand the biological significance of organisms in different ecological habitats

COURSE OUTCOMES:

At the end of the practical the students will be able to:

CO1	**Major Practicals:** Dissect and display the digestive, nervous and reproductive system in cockroach, fish and prawn and to determine Denier and Renditta of silk filament	**K4**
CO2	**Minor Practicals:** Mount placoid scales of fish, mouth parts of cockroach and appendage of prawn and determine the shell ratio of the cocoon	**K4**
CO3	**Spotters**: Classify organisms, relate the structure and function of body parts and biological significance of animals	**K2**
CO4	**Record**: Transfer the diagrammatic representation and results of experimental works through a record presentation	**K3**

Syllabus

Credits: 4 **Instructional hours: 60**

DISSECTIONS

COCKROACH

Mounting of Mouth Parts
Digestive System
Nervous System
Reproductive System

PRAWN

Nervous System
Appendages

FISH

Digestive System

SPOTTERS

A. Classify giving reasons:-

1. Amoeba 2. Euglena 3. Paramecium 4. Hydra 5. Sea Anemone 6. Chiton

7. Dentalium. 8. Starfish 9. Amphioxus entire 10. Shark 11. Venomous snakes – Naja naja. 12. Non – Poisonous snakes- Green snake.

B. Draw labeled sketch: -

1. T.S. of Fasciola. 2. T.S. of Nereis.
3. T.S. through Pharynx of Amphioxus.
4. Endoskeleton- Skull and Vertebra of Frog.

C. Relate structure and function:-

1. Sponge Gemmule 2. Spicules 3. Sepia 4. Placoid. 5. Ctenoid scales.
6. Quill Feather 7. Cocoon 8. Nettrika

D. Comment on Biological Significance:-

1. Taenia solium. 2. Ascaris male &female. 3. Chaetopterus.
4. Larval forms of Crustacea and Echinodermata-, Zoea, Megalopa, Alima and Bipinnaria larva. 5. Amblistoma. 6. Chameleon. 7. Different stages of silkworm from egg to adult.

E. Write Descriptive Notes:-

1. Pectoral and Pelvic girdles of Frog. 2. Limb skeleton of Frog. 3. Pigeon.
4. Rabbit 5. Mulberry leaves – different types.

MAPPING OF CO's WITH PO's AND PSO's

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	3	3	3	3	3	3	1	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	1	3	1	3	3	3	3	3	1	3	3
CO4	3	3	3	1	3	2	3	3	3	3	3	1	3	3

(Correlation: 3 – High; 2 – Medium; 1 - Low)

ASSESSMENT TOOLS

S. No	Assessment Methods	Frequency of Assessment
1.	Internal Exam Major practicals Minor practicals Spotters	Once in a Semester

	Record	
2.	End Semester Exam	End of the year

Course designed by **Dr.G.Chitra** **Dr. D. Vigneshpriya**	**Verified by HOD:** **Dr.PawlinVasanthi Joseph**
Checked by CDC : **Mrs.JANSI RANI.A**	**Approved by :** **Principal**

SEMESTER II
COURSE CODE –23UZO2AP1
TITLE OF THE COURSE: ALLIED: PRACTICAL-I
(Based on Allied course I& II)

COURSE OBJECTIVES:

- To understand the different system of animals through dissection, display and mounting
- To demonstrate the importance of the biochemical tests in blood and urine
- To understand the biological significance of organisms in different ecological habitats

COURSE OUTCOMES:
At the end of the practical the students will be able to:

CO1	**Major practical:** Dissect and display the digestive, nervous and reproductive system in cockroach and perform biochemical tests in urine	**K4**
CO2	**Minor practical:** Estimate and analyse the biochemical tests in the blood samples	**K4**
CO3	**Spotters**: Classify organisms and write suitable descriptive notes on them	**K2**
CO4	**Record**: Transfer the diagrammatic representation and results of experimental works through a record presentation	**K3**

Syllabus

Total Credits: 4 **Instructional hours: 60**

DISSECTION:

Cockroach

Mouth parts, Digestive system, Nervous system, Reproductive system

Fish

Digestive system, Placoid Scale

Prawn

Appendages, Nervous system

Medical Lab Techniques

Estimation of Bleeding and clotting time.

Estimation of Specific gravity of Urine.

Qualitative analysis of sugar in Urine.

SPOTTERS

Paramecium entire, Paramecium conjugation, Obelia colony, Obelia medusa, Earthworm, Cockroach, Starfish, Frog, Calotes, Pigeon and Rabbit, Pigeon –Quill feather. Haemoglobinometer, Urinometer, Benedict's reagent.

MAPPING OF CO's WITH PO's AND PSO's

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	3	3	3	3	3	3	1	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	1	3	1	3	3	3	3	3	1	3	3
CO4	3	3	3	1	3	2	3	3	3	3	3	1	3	3

(Correlation: 3 - High; 2 - Medium; 1 - Low)

ASSESSMENT TOOLS

S. No	Assessment Methods	Frequency of Assessment
1.	Internal Exam Major practicals Minor practicals Spotters Record	Once in a Semester
2.	End Semester Exam	End of the year

Course designed by **Dr.B. Dhanalakshmi** **Dr.G.Chitra**	**Verified by HOD:** **Dr.PawlinVasanthi Joseph**
Checked by CDC : **Mrs.JANSI RANI.A**	**Approved by :** **Principal**

SEMESTER: III
COURSE CODE: 21UZO3SB1
TITLE OF THE COURSE: SKILL BASED COURSE I : INTRODUCTION TO NANOTECHNOLOGY

COURSE OBJECTIVES

- To provide the basic concept of nanomaterials and its applications
- To describe the fabrication process of carbon nanotubes
- To highlights the application of nanoparticles in medicine and its future potential

COURSE OUTCOMES

At the end of the course the students will be able to:

CO1	Explain the scope of nanotechnology and its manufacturing processes.	**K2**
CO2	Explains the principles and processing techniques of nano materials.	**K2**
CO3	Differentiate the carbon nanotubes and its fabrication processes.	**K3**
CO4	Summarize the use of nanoparticles in diagnostic and therapeutic applications.	**K4**
CO5	Present the future potentials of Nanotechnology	**K5**

Syllabus

Total Credits: 2 **Instructional hours: 45**

Unit I: **Nanotechnology and Manufacturing process (K2) 9 hours**

Introduction: understanding various effects in nanotech process, Advantages of Nanotechnology, Scope of Nanotechnology, Primer on manufacturing process: Bottom

up self-assembly - Sol - gel Process, aerosol based process, gas phase condensation process, Top - down assembly - Lithography, nanolithography, Dip pen and Soft lithography, e-beam and Deep UV lithography, Production processes.

(Self study- Scope of Nanotechnology)

Unit II: **Microelectromechanical systems (MEMS) and Nanoelectromechanical systems (NEMS) (K2) 9 hours**

MEMS thin film deposition - due to chemical reactions; due to physical reactions, Application of MEMS in Nanotechnology processes, Lithography - pattern transfer, alignment exposure, lithography module. Etching- Wet and Dry etching, Current challenges in MEMS and NEMS.

Unit III: **Carbon Nanotubes (K3) 9hours**

Types: Single Wall and Multi wall Carbon Nanotubes, Fabrication process - Laser ablation / pulsed laser vaporization, chemical vapour deposition, High pressure Co conversion, nanotube modeller software. Applications of CNT - in day to day life; elector magnetic field; electrical field; drug delivery Properties of CNT, Nanotube rings.

Unit IV: **Nanomedicines (K4) 9 hours**

Basic innovations in nanomedicines - drug delivery; cancer diagnosis; surgery; in -vivo therapy neuroelectronic interface; cell repair machines. Nano biotechnological devices: Quantum dot nano crystals; Dendrimers; nano robots; nubots; nano shells, biosensors; naobiosensors; nano - DNA technology. Nanostructures in medicine - use in diagnostic and therapeutic applications.

Unit V: **Ethical issues, limits and future of Nanotechnology (K5) 9 hours**

Dangers of molecular manufacturing, Environmental and social issues, Green nanotechnology, Positive and negative aspects of nanotechnology, Implications of nanotechnology in the society, the future and the latest in the nanotechnology.

(Self study: The future of Nanotechnology)

TEXT BOOKS:

1. Appin Labs (2007) Nanotechnology. (1st edition) BPB Publications, India
2. Shanmugam S (2010) Nanotechnology. MJP Publishers, Chennai.

REFERENCE BOOKS:

1. Pradeep T (2010) Nano-the essentials. Tata McGraw Hill. India
2. Subbiah Balaji (2010) Nanobiotechnology. MJP Publishers, Chennai.

BLENDED LEARNING
Unit IV: **Nanomedicines**

Topic	Links
Basic innovations in nanomedicines	https://www.slideshare.net/drashutoshtiwari/nanomedicine-44702923 https://www.slideshare.net/VishnuAmbareesh/nanotechnology-in-surgery-and-medicine
Quantum dot nano crystals	https://www.slideshare.net/keyhan5/quantum-dots-and-application-in-medical-science
Nanorobots, nubots	https://www.slideshare.net/AnilPethe/nano-robotics-future-medicine-80799649
Biosensor	https://www.slideshare.net/asertseminar/biosensor-ppt
Nanostructures in medicine	https://www.slideshare.net/keyhan5/nanoparticle-in-drug-delivery-system

MAPPING OF CO's WITH PO's AND PSO's

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	1	1	2	1	1	3	3	2	1	2
CO2	3	3	3	2	3	3	3	1	3	3	3	2	3	3
CO3	3	3	3	2	3	3	3	1	3	3	3	2	3	3

CO4	3	3	3	2	3	3	3	1	3	3	3	2	3	3
CO5	3	3	3	2	3	3	3	1	3	3	3	2	3	3

(Correlation: 3 - High; 2 - Medium; 1 - Low**)**

ASSESSMENT TOOLS

S.No	**Assessment Methods**	**Frequency of Assessment**
1.	End Semester Examination	Once in a Semester
2.	CIA I	Once in a Semester
3.	CIA II	Once in a Semester
4.	Model	Once in a Semester
5.	Assignment (Unit I & II)	Twice in a Semester
6.	Seminar (Unit III & IV)	Twice in a Semester
7.	Other component (Educational tour/Quiz) (Unit V)	Once in a Semester

Course designed by **Dr.PawlinVasanthi Joseph**	**Verified by HOD:** **Dr.PawlinVasanthi Joseph**
Checked by CDC : **Mrs.JANSI RANI.A**	**Approved by :** **Principal**

SEMESTER: III

COURSE CODE: 22UZO3C04

TITLE OF THE COURSE: CORE: DEVELOPMENTAL BIOLOGY
(*Skill Development & Employability*)

COURSE OBJECTIVES:

- To provide the historical background of developmental biology and its scope in different fields
- To understand the mechanisms of development from egg to an adult.
- To impart knowledge on the basic concepts of differentiation, growth and embryonic induction.

COURSE OUTCOMES:
At the end of the course the students will be able to:

CO1	Explain the process of gametogenesis and the mechanism of fertilization	**K2**
CO2	Classify the patterns of cleavage and blastulation in different classes of vertebrates	**K3**
CO3	Demonstrate the morphogenetic movements with reference to gastrulation and organogenesis in chick	**K3**
CO4	Categorize reproductive mechanisms, extra embryonic membranes and placenta in the vertebrate classes	**K4**
CO5	Analyze the different types of growth patterns and differentiation in Vertebrates	**K4**

Syllabus

Credits: 4 **Instructional hours: 75**

UNIT I: Gametogenesis and Types of Eggs (K2) 15 hours

Introduction - historical background; developmental biology and human - welfare; theories - preformation theory - epigenesis - Baer's law - biogenetic law - germ plasm theory - experimental embryology - mosaic and regulative theories - gradient theory - organizer theory; gametogenesis - spermatogenesis and oogenesis; fertilization - mechanism - significance - factors involved - physical, chemical, cytological and physiological changes; types of eggs.

(Self study: Study of Different types of Eggs)

UNIT II: Cleavage and Blastulation (K3) 15 hours

Cleavage - definition - characteristics of cleavage - planes of cleavage; patterns of cleavage; factors affecting cleavage - physical factors - physiological factors; nuclear transplantation experiments - Spemann's hair loop experiment; laws of cleavage; blastulation in chick.

UNIT III: Gastrulation and Organogenesis (K3) 15 hours

Gastrulation - definition; events in gastrulation - formation of endoderm - formation of primitive streak and mesoderm; morphogenetic movements - epiboly and emboly; mechanism of morphogenetic movements; gastrulation in chick; fate map of chick; organogenesis - development of eye - development of optic cup and development of lens; development of heart of chick.

(Self study: Development of Heart of Chick)

UNIT IV: Embryonic membranes and Regeneration (K4) 15 hours

Regeneration - patterns of regeneration - mechanism; factors affecting regeneration; inductive interaction; metaplasia - definition - metaplasia in invertebrates and vertebrates; extra-embryonic membranes of chick; placenta - classification - foetal membranes - distribution of villi - nature of contact - histology - functions.

UNIT V: Growth and Differentiation (K4) 15 hours

Growth - definition; types of growth patterns; mechanism of growth; measurement of growth; differentiation - blastema formation; cell commitment; determination; cytodifferentiation. Embryonic induction - types and examples. In vitro fertilization in cattle and man.

(*Beyond the curriculum: Stem Cells and its types- Embryonic stem cells; Tissue specific stem cell; Mesenchymal Stem cells; Induced pluripotent stem cells*)

TEXT BOOKS:

1.Arumugam N. (2014) A Text Book of Embryology. (15th edition) Saras publication, Nagercoil.

2. Verma P.S. and Agarwal, V.K. (2010) Chordate Embryology. S. Chand Company

REFERENCE BOOKS:

1.Rastogi (2014) Chordate Embryology ,Kedar Nath Ram Nath, Meerut.

2.Berril(1980)Developmental Biology. McGraw-Hill Education, India

3.Balinsky B.I and Fabian B C (2012) An introduction to Embryology,
(5th edition) CBS College Publishers, Cengage Learning India Pvt. Ltd. New Delhi.

BLENDED LEARNING

UNIT V: Growth and Differentiation

Topic	Links
Growth - definition; types of growth patterns; mechanism of growth; measurement of growth	https://youtu.be/_zXJv-p5ykQ
Differentiation-blastema formation	https://youtu.be/okBdSenXneo
Cell-commitment	https://youtu.be/rr288bY99hQ
Determination	https://youtu.be/W8xx975RtP4
Cytodifferentiation	https://youtu.be/SLn-rYKR_BM
Embryonic induction - types and examples	https://youtu.be/9cq7221FG4
In vitro fertilization in cattle	https://youtu.be/4oJU7yNzvUs
In vitro fertilization in Man	https://youtu.be/ZVrTO5NleSA

MAPPING OF CO's WITH PO's AND PSO's

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	3	2	2	1	3	1	1	1	2	2
CO2	3	3	1	1	3	1	2	1	3	2	2	1	2	3
CO3	3	3	2	1	3	2	2	1	3	2	1	1	2	2
CO4	3	2	2	2	3	2	2	2	3	1	1	1	1	1
CO5	3	2	2	2	3	2	2	2	3	2	1	2	2	2

(Correlation: 3 - High; 2 - Medium; 1 - Low)

ASSESSMENT TOOLS

S.No	Assessment Methods	Frequency of Assessment
1.	End Semester Examination	Once in a Semester
2.	CIA I	Once in a Semester

3.	CIA II	Once in a Semester
4.	Model	Once in a Semester
5.	Assignment (Unit I & II)	Twice in a Semester
6.	Seminar (Unit III & IV)	Twice in a Semester
7.	Other component (Educational tour/Quiz/ (Unit V)	Once in a Semester

Course designed by **Dr. Rosaline Mary**	**Verified by HOD:** **Dr.PawlinVasanthi Joseph**
Checked by CDC : **Mrs.JANSI RANI.A**	**Approved by :**  **Principal**

SEMESTER: IV
COURSE CODE: 21UZO4SB2
TITLE OF THE COURSE: SKILL BASED COURSE II – INTRODUCTION TO IMMUNOLOGY

COURSE OBJECTIVES:

- To elaborate in detail the organs and cells of the immune system.
- To highlight the different types of immune response and functions of the different types of immunoglobulin.

COURSE OUTCOMES

At the end of the course the students will be able to:

CO1	Identify the different types of immunity.	**K1**
CO2	Explain primary and secondary lymphoid organs and their role in the immune system.	**K2**
CO3	Distinguish the cells of the immune system and their involvement in lymphatic traffic.	**K3**

CO4	Demonstrate the essential factors for antigenicity and the properties of immunoglobulins	**K4**
CO5	Classify the immune responses and the techniques for their detection.	**K4**

Syllabus

Credits -2 **Instructional hours – 45**

Unit I: Introduction (K1) 9 hours

History of immunology, Immunity - Innate immunity - Acquired immunity - Active immunity - Cell-mediated immunity - Natural active - Artificial active - Passive immunity.

(Self study: History of Immunology)

Unit II: Lymphoid organs (K2) 9 hours

Primary lymphoid organs - Thymus - Bursa of fabricius - Bone marrow, Secondary lymphoid organs - Lymph node - spleen - MALT – Peyer's patches - Tonsils.

Unit III: Cells of the immune system (K3) 9 hours

Stem cells, Lymphocytes, surface markers of human lymphocytes, Null cells, macrophages, antigen presenting cells, Mast cells, Platelets, Lymphocytic traffic.

Unit IV: Antigens and immunoglobulins (K4) 9 hours

Antigens - Epitopes and paratopes - Essential factors for antigenicity - cross reactive antigens, Immunoglobulins - properties - IgG, IgA, IgM, IgD, IgE - Functions of immunoglobulins.

(Self study: Functions of immunoglobulins)

Unit V: Immune response (K4) 9 hours

Humoral immune response, B cell activation, Cell mediated immune response, Cell co-operation in immunity, Memory cells, Immunological memory.

Antigen - antibody reaction - salient features - detection - Application of immunoflourescence techniques.

TEXT BOOKS:

1. Dulcy Fatima and Arumugam N (2017) Introduction to Immunology. (5th edition), Saras Publications, Nagercoil.
2. Madhavee Latha (2006) Textbook of Immunology. S. Chand and Company. New Delhi.

REFERENCE BOOKS:

1. Annadurai B (2010) A text Book of Immunology and Immunotechnology. S Chand and Company Ltd. New Delhi.
2. Latha P. Madhavee A Textbook of Immunology Paperback (2012) S Chand and Company Ltd. New Delhi.
3. Kuby (1997) Immunology. W.H. Freeman and Co. Ltd. New York.
4. Nandhini Shetty (2005) Immunology. New Age International Publishers. New Delhi.

BLENDED LEARNING
Unit V: Immune response

Topic	Links
Humoral immune response	https://www.slideshare.net/sufihannan/humoral-immune-response
Cell mediated immune response	https://www.slideshare.net/sufihannan/cell-mediated-immune-response https://www.youtube.com/watch?v=2vh24StylNo
Antigen - antibody reaction	https://www.slideshare.net/DrMedical2/antigen-antibody-reactions-or-interaction

MAPPING OF CO's WITH PO's AND PSO's

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	2	2	2	1	2	3	2	2	1	3	2
CO2	3	3	1	2	3	2	1	2	3	2	2	1	3	2
CO3	3	3	1	2	3	2	1	2	3	2	2	1	3	2

CO4	3	3	3	2	2	2	1	2	3	2	2	1	3	2
CO5	3	3	3	2	2	2	1	2	3	2	3	1	3	2

(Correlation: 3 – High; 2 – Medium; 1 - Low)

ASSESSMENT TOOLS

S.No	**Assessment Methods**	**Frequency of Assessment**
1.	End Semester Examination	Once in a Semester
2.	CIA I	Once in a Semester
3.	CIA II	Once in a Semester
4.	Model	Once in a Semester
5.	Assignment (Unit I & II)	Twice in a Semester
6.	Seminar (Unit III & IV)	Twice in a Semester
7.	Other component (Educational tour/ Power point presentation) (Unit V)	Once in a Semester

Course designed by **Dr. Dr.B.Dhanalakshmi**	**Verified by HOD:** **Dr.PawlinVasanthi Joseph**
Checked by CDC : **Mrs.JANSI RANI.A**	**Approved by :** **Principal**

SEMESTER: IV
COURSE CODE: 22UZO4C05
TITLE OF THE COURSE: CORE: ECOLOGY AND ETHOLOGY
(*Skill Development*)

COURSE OBJECTIVES:

- To illustrate the different habitats and its physico - chemical characteristics.
- To explain the animal population attributes and community structure and stratification.
- To present different patterns of behavior and social organization among animals.

COURSE OUTCOMES:

At the end of the course the students will be able to:

CO1	Distinguishes the different types of habitats and its physico chemical characteristics that accommodates the respective Biota	**K2**
CO2	Relates the animal population attributes and its relationship for growth and sustainability	**K3**
CO3	Demonstrate changes in the structure and stratification of the plant and animal community in different habitats	**K3**
CO4	Differentiate between patterns of behavior and interactions among the biotic community	**K4**
CO5	Categorize the different aspects of social organization and learning	**K4**

Syllabus

Credits - 4 **Instructional hours - 75**

UNIT I: Habitat Ecology (K2) 15 hours

Habitat study - physicochemical characteristics and adaptations - aquatic - freshwater - pond and river - structure, biota and lotic adaptations, marine - ocean - classification of marine environment - diurnal rhythm in planktons - littoral, intertidal zones, deep sea - terrestrial - desert and cave.

(Self study: Lotic biota and adaptations)

UNIT II: Population Ecology (K3) 15 hours

Animal population - attributes - density, natality, mortality, age distribution, growth

form, population equilibrium, biotic potential, dispersal - biotic relationship - antibiosis - symbiosis - mutualism and commensalism -parasitism

(*Beyond the curriculum: Deep Learning in Ecology and its applications*)

UNIT III: Biotic Community and Succession (K3) 15 hours

Animal Community - structure and stratification - ecotone and edge effect - habitat and ecological niche - Gauze's principle - ecological equivalents - ecological succession - kinds of succession - concept of climax - theories of succession - patterns and significance of succession.

UNIT IV: Patterns of Behaviour (K4) 15 hours

Introduction and patterns of behavior - stereotyped behavior - spatial orientation, reflexes, instincts, motivation - reproductive behavior - parental behavior - social interactions and social facilitation - communication - aggregation.

(Self study: Parental behavior in animals)

UNIT V: Social organization and Learning (K4) 15 hours

Social organization - dominance - signals of dominance - types of dominance hierarchies - colonial organization, territoriality - characteristics, functions of territoriality - comparative aspects of learning - non - associative learning, associative learning, latent learning, insight learning and phase specific learning.

TEXT BOOKS:

1. Rastogi (1998) Ecology and animal distribution. Kedarnath Ram Nath Publications, Meerut.
2. Reena Mathur (1996) Animal Behaviour. (1st edition) Rastogi Publications. Meerut.

REFERENCE BOOKS:

1. Hoshang.S., Gurdevia., Hare Govind Singh (2001) Text book of Animal Behaviour. S.Chand and Company Ltd.
2. Odum. E.P. (1953) Fundamentals of Ecology. W B. Saunders Co., Philadelphia and London.
3. Koromondy R J. (1996) Concepts of Ecology. (4th edition) Pearson Publishers, London.
4. Clarke (2012) Elements of Ecology. Publisher Chapman & Hall./John Wiley & Son, London.
5. Bernard C.J. (1983) Animal Behaviour, Ecology and Evolution. Croom Helm, Dundee, UK.
6. Manning Aubrey (2012) Introduction to Animal behaviour. (6th edition) Cambridge University Press, Chennai.

BLENDED LEARNING

UNIT IV: Patterns of Behaviour

Topic	Links
Introduction and patterns of behavior	https://youtu.be/S3JsTHMWgss, https://youtu.be/EyyDq19Mi3A,

	https://youtu.be/K4cKnOGJZlI, https://youtu.be/CVr23RWnkZE
Stereotyped behavior	https://youtu.be/IdnndbX-z8Q
Spatial orientation, reflexes, instincts, motivation	https://youtu.be/u_h03C4Q0BA, https://youtu.be/1eBn-73RE6c.
Reproductive behavior	https://youtu.be/E6cJJGXin-A, https://youtu.be/LsMbn3b1Bis
Parental behavior	https://youtu.be/nCMZXaBfhlI
Social interactions and social facilitation	https://youtu.be/w0R17R_OBl0
Communication	https://youtu.be/S3X-NkvE49o
Aggregation	**https://youtu.be/EvAeA9LIHRI**

MAPPING OF CO's WITH PO's AND PSO's

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	2	3	2	2	2	2	2	2	3	3
CO2	3	3	2	2	2	3	2	2	2	2	2	2	3	2
CO3	3	3	2	2	2	3	2	2	2	2	2	2	3	2
CO4	3	3	2	2	2	3	2	2	2	2	2	2	3	2
CO5	3	3	2	2	2	3	2	2	2	2	2	2	3	2

(Correlation: 3 – High; 2 – Medium; 1 - Low)

ASSESSMENT TOOLS

S.No	Assessment Methods	Frequency of Assessment
1.	End Semester Examination	Once in a Semester
2.	CIA I	Once in a Semester
3.	CIA II	Once in a Semester
4.	Model	Once in a Semester
5.	Assignment (Unit I & II)	Twice in a Semester

6.	Seminar (Unit III & IV)	Twice in a Semester
7.	Other component (Educational tour/ Power point presentation) (Unit V)	Once in a Semester

Course designed by **Dr. PawlinVasanthi Joseph**	**Verified by HOD:** **Dr.PawlinVasanthi Joseph**
Checked by CDC : **Mrs.JANSI RANI.A**	**Approved by :** **Principal**

SEMESTER: IV
COURSE CODE: 22UZO4CP2

TITLE OF THE COURSE: CORE: PRACTICAL-II

(Based on core courses –Developmental Biology, Ecology & Ethology)

COURSE OBJECTIVES:

- To help students analyze the presence and quantitatively estimate the inorganic salts in water samples.
- To demonstrate smear preparations for mitosis and meiosis
- To understand the biological significance of organisms in different ecological habitats

COURSE OUTCOMES:
At the end of the practical the students will be able to:

CO1	**Major Practicals**: Estimate the amount of inorganic salts in water samples	**K4**
CO2	**Minor Practicals :** Examine the preparation of microscopic slides and demonstrate simple tests for the presence of inorganic salts in water sample	**K4**
CO3	**Spotters**: Comment, draw and write descriptive notes on ecological adapations and developmental stages of chick embryo	**K2**
CO4	**Record**: Transfer the diagrammatic representation and results of experimental works through a record presentation	**K3**

Syllabus

Credits - 4 **Instructional hours - 60**

ECOLOGY

- Estimation of hydrological features of Pond: (Salinity, Free Carbon-di-oxide, Carbonates and Bicarbonates and Oxygen).
- Measurement of the pH in the water samples using pH meter
- Measurement of turbidity in water using Turbidity meter.
- Measurement of electrical conductivity and total dissolved solids of water samples
- Identification & Mounting of Marine Planktons.
- Spotters- Intertidal Rocky, Sandy & Muddy shores (Habitat, Ecological adaptations)
- Estimation of Total Hardness in the given water samples.
- Estimation of Iron in the given water samples.
- Estimation of Calcium in the given soil samples.
- Estimation of Chloride in the given soil samples.
- Identification of the viability of microorganisms in the samples (Most Probable number)
- Detection of E.coli, V.cholera and Salmonella sp. from sewage
- Detection of coliphage from water/ sewage

ETHOLOGY

- Study of locomotary behavior in Earthworm.
- Spotters- Bee hive, Social colony-Insects.

DEVELOPMENTAL BIOLOGY

- Squash preparation for the study of sperm in the Testis of Grasshopper.
- Squash preparation for the study of Meiosis stages in the Testis of Grasshopper.
- Squash preparation of Onion root tip for the study of Mitosis stages.

- Slides showing gametogenesis.
- Different types of Egg-slides and specimens (Frog, Hen, Human ovum).
- Chick embryo whole mounts – 18, 24, 33, 48 & 72 hours.
- Placenta of Mammals – Pig, Sheep, Rabbit & Man.

FIELD TRIP- To coastal areas for the study of intertidal shore fauna.

MAPPING OF CO's WITH PO's AND PSO's

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	2	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	2	3	3

(Correlation: 3 – High; 2 – Medium; 1 - Low)

ASSESSMENT TOOLS

S. No	Assessment Methods	Frequency of Assessment
1.	Internal Exam Major practicals Minor practicals Spotters Record	Once in a Semester
2.	End Semester Exam	End of the year

Course designed by **Dr. Rosaline Mary** **Dr.B.Dhanalakshmi**	**Verified by HOD:** **Dr.PawlinVasanthi Joseph**
Checked by CDC : **Mrs.JANSI RANI.A**	**Approved by :** **Principal**

SEMESTER: V
COURSE CODE: 22UZO5C06
TITLE OF THE COURSE: CORE: GENETICS AND EVOLUTION
(*Skill Development*)

COURSE OBJECTIVES:

- To enable the students to understand the basic principles of Genetics.
- To understand the mode of inheritance of genes in a given population.
- To create an awareness on the Human Genome Project and its significance in research

COURSE OUTCOMES:

At the end of the course the students will be able to:

CO1	Explain linkage and crossing over using the principle of Mendelian inheritance	**K2**
CO2	Apply the concept of multiple alleles and Sex linked inheritance in Man for transfer of genetic diseases.	**K3**
CO3	Demonstrate the changes during mutation based on the fine structure of a gene	**K3**
CO4	Compute changes in the gene frequency affecting a population and the formation of new species	**K3**
CO5	Appraise the significance of adaptation to a successful life in the environment	**K4**

Syllabus

Credits: 5 **Instructional Hours: 75**

UNIT I: Mendelian Genetics (K2) 15 hours

Mendelian inheritance - Monohybrid and Dihybrid cross - Linkage - Theories of Linkage - Complete - Incomplete Linkage - Crossing over - Mechanism of recombination - Theories of Crossing over - Stage at which Crossing over takes place - Factors controlling Crossing over Cytological evidence of crossing over - Stern's experiment

(Self study: Mendelian Inheritance)

UNIT II: Multiple Alleles, Sex and Sex linked inheritance (K3) 15 hours

Multiple Alleles - Coat colour in Rabbits - Blood group inheritance - ABO Blood group- MN Blood group - Rh factor-Sex determination- Chromosome theory of Sex determination - Ratio theory of Sex determination and Sex linked inheritance in man - Colour blindness and Haemophilia - Cytoplasmic inheritance - Cases showing maternal effects - Cases showing presence of Infective Particles

UNIT III: Molecular Genetics (K3) 15 hours

Identification of genetic material - Evidences of DNA as the Genetic material - Fine structure of the gene - Mutation - Chromosomal aberration in structure and number - Gene Mutation - Point mutation - Detection of mutation by CLB method

(*Beyond the curriculum: CRISPR technology and its applications*)

UNIT IV: Population Genetics and Species formation (K3) 15 hours

Population genetics, Gene pool, Gene frequency and Genotype frequency - Genetic Equilibrium-Hardy Weinberg law of Equilibrium and factors affecting it - Continental hypothesis and earthquake - Barriers, significance of island fauna, Isolation and types of isolating mechanisms - Role of isolation in species formation.

UNIT V: Adaptation and Evolution (K4) 15 hours

Adaptation and Co-adaptation - Adaptive radiation - Placental Mammals and Marsupials - Mimicry and colouration - Role of adaptation in Natural selection of evolution - Patterns of Evolution - Microevolution - Macroevolution - Mega evolution.

(Self study: Evolution of Man)

TEXT BOOKS:

1. Veer Bala Rastogi. (2000) A textbook of genetics. Kedar Nath Ram Nath Publishers, Meerut.
2. Meyyan. (2016) Genetics. (7th edition) Saras Publications, Nagercoil.
3. Arumugam. N. (2001) Organic Evolution. Saras Publications Nagercoil.
4. Veer Bala Rastogi. (1988) Organic Evolution. Kedar Nath Ram Nath Publishers, Meerut.

REFERENCE BOOKS:

1. Gardener. E.J. Simmons J ,Snusad. D P, (2006) Principles of genetics. John Wiley & Sons, Hoboken, New Jersey
2. Brown. T.A, (1998) Genetics –A molecular approach.Chapman Hall, London. .
3. Verma. P.S. &Agarwal. P.K, (2016)Genetics .(1st edition) S Chand and Company Ltd.
4. Gupta P K. (2015) Genetics. (4th edition), Rastogi Publications, Meerut.
5. Sajib Chattopadhyay (2002) Life- origin, Evolution and Adaptation. Books and Allied Pvt. Ltd. Kolkatta, India.

BLENDED LEARNING

UNIT V: Adaptation and Evolution

Topic	Links
Adaptations in animals	https://www.youtube.com/watch?v=EiB-F8WnWJo
Adaptive radiation	https://www.youtube.com/watch?v=14jONxaWJVE
Marsupial and placental mammals	https://www.youtube.com/watch?v=3Ccb-OcQntM; https://www.youtube.com/watch?v=XEylZ7z2XAA
Natural selection	https://www.youtube.com/watch?v=WmTlwD2Zd7E
Mimicry and colouration	https://www.youtube.com/watch?v=01YUP1zKEUw https://www.youtube.com/watch?v=XPxVpjM1XCU
Patterns of evolution	https://www.youtube.com/watch?v=iBNsHNkgIQI ; https://www.youtube.com/watch?v=jeza0g3E8wEp
Co evolution	https://www.youtube.com/watch?v=QDVbt2qQRqs

MAPPING OF CO's WITH PO's AND PSO's

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	2	3	1	2	1	2	2	2	3	2
CO2	3	3	1	2	1	2	1	1	2	2	2	2	3	2
CO3	3	3	2	1	2	2	1	1	1	2	2	2	3	2
CO4	3	3	3	3	3	3	2	3	3	1	3	2	3	3
CO5	3	3	1	3	3	3	2	2	2	1	3	2	3	3

(Correlation: 3 – High; 2 – Medium; 1 - Low)

ASSESSMENT TOOLS

S.No	Assessment Methods	Frequency of Assessment
1.	End Semester Examination	Once in a Semester
2.	CIA I	Once in a Semester
3.	CIA II	Once in a Semester
4.	Model	Once in a Semester

5.	Assignment (Unit I & II)	Twice in a Semester
6.	Seminar (Unit III & IV)	Twice in a Semester
7.	Other component (Quiz/ Power point presentation) (Unit V)	Once in a Semester

Course designed by **Dr. Pawlin Vasanthi Joseph** **Dr. Rosaline Mary**	**Verified by HOD:** **Dr. Pawlin Vasanthi Joseph**
Checked by CDC : **Mrs. JANSI RANI.A**	**Approved by :** **Principal**

SEMESTER: V
COURSE CODE: 22UZO5C07
TITLE OF THE COURSE : CORE: BIOPHYSICS AND BIOSTATISTICS
(*Skill Development*)

COURSE OBJECTIVES:

- To understand the basic principles of physics governing all biological functions.
- To apply measures of central tendency, deviation and correlation in biological data
- To interpret the goodness of fit and significance in small and large samples

COURSE OUTCOMES:

At the end of the course the students will be able to:

CO1	Understand the physical principles underlying all biological mechanisms	**K2**
CO2	Distinguish different types of data and illustrates measures of central tendency	**K3**
CO3	Differentiate measures of central tendency and measures of deviation	**K3**
CO4	Compute correlation and regression for data analysis	**K3**
CO5	Analyze the test of significance for small and large samples and examines the goodness of fit.	**K4**

Syllabus

Credits: 5 **Instructional hours: 75**

UNIT I: Biophysics (K2) **15 hours**

Electromagnetic Radiation - Absorption of light - Beer-Lambert's law - its applications - Colorimeter and Spectrophotometer - Biophysical principles - Osmosis, Donnan equilibrium, surface tension, Hydrotrophy - Colloids - separation of colloids - Dialysis, Chromatography, Electrophoresis - Buffers.

(B*eyond the curriculum: Nuclear magnetic resonance spectroscopy*)

UNIT II: Collection and Representation of data (K3) 15 hours

Collection of data - primary and secondary data - Classification - Tabulation - Raw, frequency and class interval series data - Diagrammatic Representation - Graphic Representation - Histogram, Frequency polygon, Frequency curve, Ogive curve

(Self study: Classification of data)

UNIT III: Measures of Central tendency and Dispersion (K3) 15 hours

Measures of central Value - Arithmetic Mean, Median and Mode - Graphic location of median and mode - Problems, merits and demerits - Measures of Dispersion - Range, Standard deviation, Co-efficient of variation, Standard Error.

UNIT IV: Correlation and Regression (K3) 15 hours

Correlation- Methods of studying correlation -Types of correlation-Co-efficient-of-correlation-Rank correlation -Regression - types -Regression co-efficient-Regression lines.

UNIT V: Test of Significance for samples and Chi square (K4) 15 hours

Statistical inference - Test of significance for small and large samples - Sample size, testing of Hypothesis, Null hypothesis, alternate hypothesis - Chi - square - Test of goodness of fit.

TEXT BOOKS:

1. Ramakrishnan S. (2010) Text book of Biostatistics. Saras Publication, Nagercoil.
2. Palanichamy S. and Shanmugavelu. M. (1992) Biophysics. Paramount Publications, Palani.

REFERENCE BOOKS:

1. Subramanian, M.A. (2005) Biophysics Principles and techniques, MJP Publishers, New Delhi.
2. Roy, R.N. (1996) Textbook of Biophysics. New cultural Book agency, Calcutta.
3. Gupta, S.P. (2000) Statistical Methods. S. Chand and Co. New Delhi.
4. Pranab Kumar Banerjee (2004) Introduction to Biostatistics. S. Chand &Company, New Delhi.

BLENDED LEARNING

UNIT II: Collection and Representation of data

Topic	Links
Collection of data - primary and secondary data	https://youtu.be/0_HpiRFrNAk
Classification	https://youtu.be/vfasNAd5CEc
Tabulation - Raw, frequency and class interval series data	https://youtu.be/1akrkTfKoxE, https://youtu.be/Xr0BgvtXWwA https://youtu.be/qWO0IdWBKt8
Diagrammatic Representation	https://youtu.be/cOuUsZ9yNyk

Graphic Representation - Histogram, Frequency polygon, Frequency curve, Ogive curve	https://youtu.be/1vQrE9d_RMc, https://youtu.be/uHRqkGXX55I https://youtu.be/Rx8wSEDq5Hs

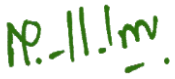
MAPPING OF CO'S WITH POs/ PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	2	1	1	2	2	1	1	3	2	2
CO2	3	2	2	1	2	2	1	1	2	1	1	3	2	1
CO3	3	2	2	3	2	3	2	1	2	2	1	3	2	2
CO4	3	2	2	3	2	2	2	1	2	2	1	3	2	2
CO5	3	2	2	3	2	2	2	1	2	2	1	3	2	2

(Correlation: 3 – High; 2 – Medium; 1 - Low)

ASSESSMENT TOOLS

S.No	Assessment Methods	Frequency of Assessment
1.	End Semester Examination	Once in a Semester
2.	CIA I	Once in a Semester
3.	CIA II	Once in a Semester
4.	Model	Once in a Semester
5.	Assignment (Unit I & II)	Twice in a Semester
6.	Seminar (Unit III & IV)	Twice in a Semester
7.	Other component (Problem solving/ Quiz) (Unit V)	Once in a Semester

Course designed by **Dr.PawlinVasanthi Joseph** **Dr. Rosaline Mary**	**Verified by HOD:** **Dr.PawlinVasanthi Joseph**
Checked by CDC : **Mrs. JANSI RANI.A**	**Approved by :**  **Principal**

SEMESTER: V
COURSE CODE: 22UZO5C08
TITLE OF THE COURSE: CORE: CELL AND MOLECULAR BIOLOGY
(Employability)

COURSE OBJECTIVES:

- To provide an understanding of the structure and functioning of biological macromolecules and intracellular chemical reactions.
- To understand the importance of the fundamental biological principles that governs the activity of an organism.

COURSE OUTCOMES:

At the end of the course the students will be able to

CO1	Explain the structure and function of prokaryotic and eukaryotic cells using microscopic techniques.	**K2**
CO2	Explain the cytoplasmic organelles based on their origin and function.	**K2**
CO3	Summarize the structure and function of nucleus and chromosome with its significance in cell division.	**K3**
CO4	Relate different types of recombination and replication methods based on the structure of nucleic acids.	**K4**
CO5	Compute the importance of genetic code in protein synthesis.	**K5**

Syllabus

Credits: 4 **Instructional Hours: 80**

UNIT I: Microscopy (K2) **16 hours**

Simple, compound and electron microscopes - Transmission electron microscope, Scanning electron microscope. Microtomy, Stains - Nuclear and cytoplasmic stains and staining techniques. Introduction to cell, cell types. Study of prokaryotes and eukaryotes - bacteria - structure and classification, virus- structure and characteristics of virus classification.

UNIT II: **Cytoplasmic organelles (K2)** **16 hours**

Structure, function, origin, isolation and chemical composition, occurrence and distribution of Plasma membrane, Mitochondria, Golgi complex, Endoplasmic reticulum and ribosome.

III: Nucleus and cell cycle (K3) **16 hours**

Structure, function, chemistry and isolation techniques of Nucleus. Structure and function of Nucleolus, Chromosome- morphology, types and functions. Special types of chromosomes - polytene and lamp brush chromosomes. Cell cycle - mitosis, meiosis and its significance.

(Beyond the Curriculum : Cell Signalling – Types - Paracrine, Autocrine, Endocrine, Direct Contact , Process and Importance)

UNIT IV: Replication and Recombination (K4) **16 hours**

Structure, chemical composition and types of DNA and RNA. Types of DNA replication - Semi conservative method of replication. Mechanism of DNA replication in Prokaryotes and Eukaryotes. Recombination, Homologous and Non - homologous recombination.

UNIT V: Protein synthesis (K5) **16 hours**

Genetic code and its characteristics.

Protein synthesis. Mechanism of protein synthesis.

Stages of Polypeptide synthesis in Prokaryotes – Initiation, elongation and termination.

(Self study: Protein synthesis in Eukaryotes)

TEXT BOOK:

1. Verma P.S and Agarwal V.K. (1991) Cell Biology and Molecular Biology. (8^{th} edition), S Chand and Company Ltd. New Delhi.

REFERENCE BOOKS:

1. De Robertis (2010) Cell and Molecular Biology. (5th edition), W.H. Frerman & company. New York.
2. Harvey Lodish. (2007) Molecular Cell Biology (6th edition). W.H. Freeman & Co Ltd. New York.
3. Gupta P K (2017) Cell and Molecular Biology. (5th edition), Rastogi Publcation, Meerut.
4. Verma P.S and Agarwal V. K (2016) Cell Biology. (1st edition). S Chand and Company Ltd. New Delhi.

BLENDED LEARNING
UNIT V: Protein synthesis

Topic	Links
Genetic code and it's characteristics	https://youtu.be/a48GfC0ygpg
Mechanism of Protein Synthesis	https://youtu.be/NDIJexTT9j0
Stages of polypeptide synthesis in Prokaryotes	https://youtu.be/MWWV4LJsfC0 https://youtu.be/KZBljAM6B1s
Protein synthesis in Eukaryotes	https://youtu.be/nwG8rQajyEo

MAPPING OF CO's WITH PO's AND PSO's

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	3	3	3	3	3	3	2	2	3	2
CO2	3	3	3	1	3	3	3	3	3	3	2	2	3	2
CO3	3	3	3	1	3	3	3	3	3	3	2	2	3	2
CO4	3	3	3	1	3	3	3	3	3	3	2	2	3	2
CO5	3	3	3	1	3	3	3	3	3	3	2	2	3	2

(Correlation: 3 – High; 2 – Medium; 1 - Low)

ASSESSMENT TOOLS

S.No	Assessment Methods	Frequency of Assessment
1.	End Semester Examination	Once in a Semester
2.	CIA I	Once in a Semester
3.	CIA II	Once in a Semester
4.	Model	Once in a Semester
5.	Assignment (Unit I & II)	Twice in a Semester
6.	Seminar (Unit III & IV)	Twice in a Semester
7.	Other component (Quiz/ Institutional visit and report submission)	Once in a Semester

Course designed by **Dr.Sr.Mary Fabiola** **Dr.G.Chitra**	**Verified by HOD:** **Dr.PawlinVasanthi Joseph**
Checked by CDC : **Mrs. JANSI RANI. A**	**Approved by :**  **Principal**

SEMESTER: V
COURSE CODE: 21NZO5E01

TITLE OF THE COURSE: NON MAJOR ELECTIVE - NUTRITION AND HEALTH (*Employability*)

COURSE OBJECTIVES:

- To highlight the food groups and balanced diet for different age groups
- To list the dietary modifications for various diseases
- To show the different software tools for clinical care and nutrition.

COURSE OUTCOMES:
At the end of the course the students will be able to:

CO1	Determine the energy requirements of the body based on different food groups	**K1**
CO2	Categorize the type of nutritional requirements in relation to different age groups	**K2**
CO3	Explain the type of nutrition to be provided for gastrointestinal and liver diseases	**K2**
CO4	Infer the dietary modifications for alleviation of infection, obesity and cancer	**K3**
CO5	Apply the related software for clinical care and nutrition research	**K4**

Syllabus

Credits - 4 **Instructional hours: 60**

UNIT I: Food and nutrition (K1) 12 hours

Introduction to nutrition, Scope of nutrition science, Food - Food groups, Recommended Dietary allowances, BMR, Calorific value of food - Bomb calorimeter, determination of energy requirements of the body.

UNIT II: Nutrition during normal life - cycle (K2) 12 hours

Balanced diet, Nutrition in Infancy, preschool and school children, Nutrition for Adolescence, Pregnancy - complications during pregnancy, Lactation - Nutritional requirements and its related problem in old age.

(Self study: Fitness and its measurements)

UNIT III: Nutrition in Diseases (K2) 12 hours

Gastrointestinal disease - Ulcer - peptic, duodenal and gastric ulcer - symptoms, diagnosis and treatment. Constipation - types, causes, dietary modification. Diarrhoea - causes - acute, chronic. Liver diseases - causes, symptoms, food modification for Cirrhosis, Hepatitis, Diabetes.

UNIT IV: Nutrition in Diseases (K3) 12 hours

Role of nutrition in infections - Fever - effect of fever on metabolic process, dietary

modifications. Allergy - types of reactions involved in sensitivity, symptoms, diagnosis, treatments. Skin care, Obesity - types, factors, measurement and diet during obesity. Cancer - types, symptoms, diagnosis and dietary modifications.
(***Self study: Nutrition for HIV patients)***

UNIT V: Computers in nutrition practice (K4) 12 hours

Data - input, output analysis communications, Clinical care and nutrition, types and applications of nutrition software, nutrition research, production tools.

TEXTBOOKS:

1. Nutrition and Dietetics (2004) Shubhangini A Joshi, (3rd edition), Tata Mcgraw - Hill Publishing Company Ltd, New Delhi.
2. Sri Lakshmi B, (2008) Nutrition science. (3rd Edition) New Age International Publishers, New Delhi.

REFERENCE BOOKS:

1. Raheena Begum (1994) A textbook of Foods, Nutrition and Dietetics, Sterling Publishers, India.
2. Srilakshmi B (2014) Dietetics. New Age International Private Limited, New Delhi.
3. Gopalan C, Rama Sastri B V and Balasubramanian S C. (2016) Nutritive Value of Indian Food. Elite Publishing House Pvt. Ltd.
4. Agarwal A (2013) Textbook of Human Nutrition. Jaypee Brothers Medical Publishers, New Delhi.

BLENDED LEARNING
UNIT II: Nutrition during normal life - cycle

Topic	Links
Balanced Diet	https://www.slideshare.net/ShakirChataiwala/presentation-on-balanced-diet
Nutrition during Infancy	https://www.slideshare.net/MohammedOsmanYahyaYahya/nutrition-20 https://slideplayer.com/slide/11837800/
Nutrition for preschool and school children	https://slideplayer.com/slide/8835974/
Nutrition for Adolescence	https://www.slideshare.net/DrLouay/nutrition-in-adolescence https://www.slideshare.net/romancepunk/nutrition-throughout-adolescence
Nutrition during pregnancy and lactation	https://slideplayer.com/slide/6425354/

Nutritional requirements and its related problem in old age	https://www.slideshare.net/shalinipandey77985/nutrition-during-old-age-34986746 https://slideplayer.com/slide/5986876/
Nutritional Requirements in different age groups	https://www.slideshare.net/AliFaris12/nutritional-requirements-in-different-age-groups https://slideplayer.com/slide/766553/

MAPPING OF CO's WITH PO's AND PSO's

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	3	2	3	3	2	3	2	2	2	2
CO2	3	3	2	2	3	2	3	3	2	3	2	2	2	2
CO3	3	3	2	2	3	2	3	3	2	3	2	2	3	3
CO4	3	3	2	2	3	2	3	3	2	3	2	2	3	3
CO5	3	3	2	2	3	2	3	3	2	3	2	3	3	2

(Correlation: 3 – High; 2 – Medium; 1 - Low)

ASSESSMENT TOOLS

S.No	Assessment Methods	Frequency of Assessment
1.	End Semester Examination	Once in a Semester
2.	CIA I	Once in a Semester
3.	CIA II	Once in a Semester
4.	Model	Once in a Semester
5.	Assignment (Unit I & II)	Twice in a Semester
6.	Seminar (Unit III & IV)	Twice in a Semester
7.	Other component (Group Discussion/ Presentation of balanced diet with chart) (Unit V)	Once in a Semester

Course designed by	Verified by HOD:

Dr.B.Dhanalakshmi **Dr.G.Chitra**	**Dr.PawlinVasanthi Joseph**
Checked by CDC : **Mrs.JANSI RANI.A**	**Approved by :**  **Principal**

SEMESTER: V

COURSE CODE: 21UZO5E01

TITLE OF THE COURSE: ELECTIVE –BIOINFORMATICS

(*Skill Development*)

COURSE OBJECTIVES:

- To understand the window operating system using microsoft program
- To identify different biological databases and their basic servers.
- To describe gene findings programs protein visualization.
- To present tools for sequence analysis and phylogenetic analysis.

COURSE OUTCOMES:

At the end of the course the students will be able to:

CO1	Identify the different components of a computer.	**K1**
CO2	Construct slides, graphs and tables using Microsoft windows.	**K2**
CO3	Distinguish generalized and specialized databases and their basic servers.	**K3**

CO4	Demonstrate the gene finding programs and molecular visualization tools.	**K4**
CO5	Distinguish sequence analysis and phylogenetic analytic tool for species identification	**K4**

Syllabus

Credits: 5 **Instructional Hours: 60**

UNIT I: Introduction to computer components (K1) 12 hours

Historical perspective of computers, Application of computer in biological sciences. Components of computer - input, output units, Windows operating systems - Types of operating systems, Creating files, word processing with Microsoft windows.

(Self study: Application of computers in biological sciences)

UNIT II: Microsoft applications (K2) 12 hours

Uses of PowerPoint - application for slide preparation, Use of Microsoft Excel to construct graphs and tables. Creating tables using MS, Access. Internet basics - E-mail, Browsers, Search engines.

(Self study: Internet basics)

UNIT III: Biological databases and Basic servers (K3) 12 hours

Biological data bases. Data mining. Generalized and specialized databases. Basic Servers - NCBI, EBI, EMBL, DDBJ - Data mining

UNIT IV: Gene finding programs and visualization (K4) 12 hours

Genomics - Approaches in gene finding by applying - Genmark, Genscan.

Proteomics - Analysis of primary, secondary structures of Protein.

Molecular visualization using RASMOL.

UNIT V: Sequence and phylogenetic analysis (K4) 12 hours

Sequence alignment - criteria, techniques, optimal alignment, substitution matrices, BLOSUM, PAM, pair wise sequence alignment. Multiple sequence analysis - methods, Tools for sequence analysis: BLAST, Hidden Markov Model. Phylogenetic analysis - structure of phylogenetic tree; Tools for Phylogenetic tree building - interpretation of results.

TEXT BOOKS:

1. K. Mani and N. Vijayaraj (2009) Bioinformatics. MJP Publishers, Chennai.

2. Rastogi (2013) Bioinformatics-Methods and Applications. (4th edition) PHI Learning, New Delhi. .

REFERENCE BOOKS:

1. T.K. Attwood and Parry Smith (1999) Introduction to Bio-informatics. Addison Wesley Long Man Ltd. Boston.
2. Howard Parish (2002) Instant Notes in Bio - informatics. Taylor & Francis, UK.
3. Misener and A.S. Krawetz (2000) Bio - informatics Methods & Protocols. Humana Press, New York.
4. G. VonHeijne (1987) Sequence analysis in Molecular Biology. Academic Press, USA.

BLENDED LEARNING
UNIT IV: Gene finding programs and visualization

Topic	Links
Approaches in gene finding by applying – Genmark Genscan	https://www.youtube.com/watch?v=77zt7eriCTk https://www.youtube.com/watch?v=63tJCnb_-yM
Primary structure of protein Secondary structure of protein	https://www.slideshare.net/damarisb/protein-structure-details https://www.slideshare.net/VijayP7/secondary-structure-prediction-of-proteins
Molecular visualization using RASMOL.	https://www.youtube.com/watch?v=NDDn-iUgUCE

MAPPING OF CO'S WITH PO's AND PSO's

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	3	1	3	2	3	3	1	3	2	1
CO2	3	3	1	1	3	2	3	2	3	3	1	3	2	1

CO3	3	3	1	1	3	3	3	2	3	3	1	3	3	1
CO4	3	3	1	1	3	3	3	1	3	3	1	3	3	1
CO5	3	3	1	1	3	3	3	1	3	3	1	3	3	1

(Correlation: 3 – High; 2 – Medium; 1 - Low)

ASSESSMENT TOOLS

S.No	Assessment Methods	Frequency of Assessment
1.	End Semester Examination	Once in a Semester
2.	CIA I	Once in a Semester
3.	CIA II	Once in a Semester
4.	Model	Once in a Semester
5.	Assignment (Unit I & II)	Twice in a Semester
6.	Seminar (Unit III & IV)	Twice in a Semester
7.	Other component (Group Discussion/ Quiz) (Unit V)	Once in a Semester

Course designed by **Dr. Sr. Mary Fabiola** **Dr.B.Dhanalakshmi**	**Verified by HOD:** **Dr.PawlinVasanthi Joseph**
Checked by CDC : **Mrs.JANSI RANI.A**	**Approved by :** **Principal**

SEMESTER: V
COURSE CODE: 21UZO5E02
TITLE OF THE COURSE : ELECTIVE – PARASITOLOGY

(*Employability*)

COURSE OBJECTIVES:

- To understand the host- parasite relationship and the involvement of mechanical and biological vectors
- To observe the morphology and life cycle of parasite in Protozoa, Platyhelminthes, Nematoda and Arthropoda.
- To visualize the epidemiology, pathogenicity, prophylaxis and treatment of diseases caused by parasites

COURSE OUTCOMES:

At the end of the course the students will be able to:

CO1	Classify parasites, parasitoid and vectors and enumerate the relationship between Host and Parasites	**K2**
CO2	Summarize the morphology , life cycle and the pathogenicity of the disease caused by Protozoan parasites	**K3**
CO3	Identify Platyhelminth parasites, their life cycle and diagnosis of diseases caused by them in the host	**K3**
CO4	Illustrate the Nematode diseases, prophylaxis and treatment towards the disease	**K3**
CO5	Relate the importance and control of Ticks and Mites in Mammals	**K3**

Syllabus

Total Credits: 5 **Instructional Hours: 60**

UNIT I: Introduction to Parasitology (K2) 12 hours

Brief introduction of Parasitism, Parasite, Parasitoid and Vectors (mechanical and biological vector) Host parasite relationship

UNIT II: Parasitic Protists (K3) 12 hours

Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of *Entamoeba histolytica, Giardia intestinalis, Trypanosoma gambiense, Leishmania donovani, Plasmodium vivax*

UNIT III: Parasitic Platyhelminthes (K3) 12 hours

Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of *Fasciolopsis buski, Schistosoma haematobium, Taenia solium* and *Hymenolepis nana*

UNIT IV: Parasitic Nematodes (K3) 12 hours

Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of *Ascaris lumbricoides, Ancylostoma duodenale, Wuchereria bancrofti* and *Trichinella spiralis.* Study of structure, life cycle and importance of *Meloidogyne* (root knot nematode), *Pratylencus* (lesion nematode)

Unit V: Parasitic Arthropoda (K3) 12 hours

Biology, importance and control of ticks, mites, *Pediculus humanus* (head and body louse), *Xenopsylla cheopis* and *Cimex lectularius*

(Self Study: Biology, importance and control of mites)

TEXT BOOKS:

1. K. D. Chatterjee (2009). Parasitology: Protozoology and Helminthology. XIII Edition, CBS ***Publishers*** & Distributors (P) Ltd.
2. Arora, D. R and Arora, B. (2001) *Medical Parasitology*. II Edition. CBS Publications and Distributors
3. Parija, S. C. Textbook of medical parasitology, protozoology & helminthology (Text and colour Atlas), II Edition, All India Publishers & Distributers, Medical Books Publishers, Chennai, Delhi
4. Rattan Lal Ichhpujani and Rajesh Bhatia. Medical Parasitology, III Edition, Jaypee Brothers Medical Publishers (P) Ltd., New Delhi

REFERENCE BOOKS:

1. Ahmed, N., Dawson, M., Smith, C. and Wood, Ed. (2007) *Biology of Disease*. Taylor and Francis Group

2. Meyer, Olsen & Schmidt's (1996).Essentials of Parasitology, 6th Edition-Murray, D. Dailey, W.C.Brown Publishers

3. E.R. Noble and G.A. Noble (1982) Parasitology: The biology of animal parasites. V Edition, Lea & Febiger

BLENDED LEARNING

UNIT I: Introduction to Parasitology **12 hours**

Topic	Links
Brief introduction of Parasitism	https://youtu.be/ZOLCXWvRt2I
Parasite	https://youtu.be/V4iSB0_7opM
Parasitoid and Vectors (mechanical and biological vector)	https://youtu.be/2515lwe1yt8 https://youtu.be/X8Nlb9VZHn4
Host parasite relationship	https://youtu.be/2wjMiSEKGOk

MAPPING OF CO's WITH PO's AND PSO's

(Correlation: 3 – High; 2 – Medium; 1 - Low)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	2	3	2	2	3	2	1	1	3	2
CO2	3	3	2	3	2	3	2	2	3	2	1	1	3	2
CO3	3	3	2	3	2	3	2	2	3	2	1	1	3	2
CO4	3	3	2	3	2	3	2	2	3	2	1	1	3	2
CO5	3	3	2	3	2	3	2	2	3	2	1	1	3	2

ASSESSMENT TOOLS

S.No	Assessment Methods	Frequency of Assessment
1.	End Semester Examination	Once in a Semester
2.	CIA I	Once in a Semester
3.	CIA II	Once in a Semester

4.	Model	Once in a Semester
5.	Assignment (Unit I & II)	Twice in a Semester
6.	Seminar (Unit III & IV)	Twice in a Semester
7.	Other component (Group Discussion/ Quiz) (Unit V)	Once in a Semester

Course designed by **Dr. Pawlin Vasanthi Joseph**	**Verified by HOD:** **Dr. Pawlin Vasanthi Joseph**
Checked by CDC : **Mrs. JANSI RANI.A**	**Approved by :** **Principal**

SEMESTER: V
COURSE CODE: 21UZO5SB3
TITLE OF THE COURSE : SKILL BASED COURSE -

MEDICAL MICROBIOLOGY

COURSE OBJECTIVES

- To study the structure of bacteria and viruses.
- To understand the diagnosis and control of bacterial, viral and fungal diseases.
- To illustrate the mechanism of action of antibiotics and antimicrobial drugs.

COURSE OUTCOMES

At the end of the course the students will be able to:

CO1	Differentiate the Bacteria and Viruses based on the morphological characteristics.	**K2**
CO2	Predict the immunity, diagnosis and control of Protozoan and Fungal diseases.	**K3**

CO3	Differentiate the types of bacterial diseases with their transmission and control.	**K4**
CO4	Distinguish between environmental borne and sexually transmitted viral diseases.	**K4**
CO5	Evaluate therapeutic measures like antibiotics and antimicrobial drugs to different microbial diseases.	**K5**

Syllabus

Credits: 2 **Instructional Hours: 45**

UNIT I: Study of Bacteria and Virus (K2) 9 hours

Introduction, History and Scope of Microbiology; Applications of Microbiology; Theories; Study of Bacteria and Viruses - Occurrence, Morphology; Examples of Bacteria and Animal Viruses.

(Self study: Structure of Bacteria)

UNIT II: Protozoan, Fungal and Bacterial diseases (K3) 9 hours

Medical Microbiology - Immunity, Diagnosis and Control of Protozoan Disease - Malaria; Fungal Disease - Dermatophytoses; Bacterial Diseases - Tuberculosis and Pneumonia.

UNIT III: Environmental borne and sexually transmitted disease (K4) 9 hours

Immunity, Diagnosis and Control of Food - borne and Water borne diseases - Typhoid and Cholera. Soil borne diseases - Botulism and Tetanus. Animal borne diseases - Anthracis. Sexually Transmitted disease - Syphilis.

UNIT IV: Viral diseases (K4) 9 hours

Viral Diseases - Air borne diseases - Measles; Insect borne disease - Dengue fever. Food and water borne diseases - Polio. Direct contact diseases - Viral Hepatitis B. AIDS in India - Transmission, prevention and control of AIDS.

UNIT V: Antibiotics and Antimicrobial drugs (K5) 9 hours

Antimicrobial chemotherapy - History of development of antibiotics. General features of antimicrobial drugs. Mechanism of action of antimicrobial Drugs; Drug resistance.

TEXT BOOK:

1. Dubey R.C., Maheshwari D.K. (2004) A Text Book of Microbiology, S Chand and Company Publication Ltd. New Delhi.

REFERENCE BOOKS:

1. Sharma P.D. (2010) Microbiology, Rastogi Publications, Meerut.
2. Kanai L. Mukherjee. (2010) Medical Microbiology,Vol-.I-III, (2nd edition)Tata McGraw-Hill Publishing company Ltd , Karnataka.
3. Sastry AS, Bhat KS. (2016) Essentials of Medical Microbiology. (1st edition) Jaypee Brothers Medical Publishers, New Delhi.
4. Brooks F, Carroll KC, Butel JS, Morse SA. (2007) Medical Microbiology, (24th edition) McGraw-Hill Medical Publishing, USA.

BLENDED LEARNING

UNIT IV: Viral diseases

Topic	Links
Viral Diseases	https://youtu.be/x4c6hBXU8a4
Air borne diseases - Measles	https://youtu.be/ounaJeW2bDA
Insect borne disease - Dengue fever	https://youtu.be/ZQwOvNe9-Yo
Food and water borne diseases- Polio	https://youtu.be/K9eZTm4TL2c
Direct contact diseases - Viral Hepatitis B	https://youtu.be/y6XfSQ_zQgQ
AIDS in India-Transmission, prevention and control of AIDS	https://youtu.be/EG3h71vwzYc

MAPPING OF CO's WITH PO's AND PSO's

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	3	1	2	1	2	1	1	3	3

CO2	3	2	2	2	2	3	2	2	2	2	2	2	3	3
CO3	3	3	2	2	3	2	3	3	3	3	3	3	3	3
CO4	3	3	3	2	2	2	3	3	3	3	3	3	3	3
CO5	3	2	2	2	2	2	2	2	2	2	2	3	3	3

(Correlation: 3 – High; 2 – Medium; 1 - Low)

ASSESSMENT TOOLS

S.No	**Assessment Methods**	**Frequency of Assessment**
1.	End Semester Examination	Once in a Semester
2.	CIA I	Once in a Semester
3.	CIA II	Once in a Semester
4.	Model	Once in a Semester
5.	Assignment (Unit I & II)	Twice in a Semester
6.	Seminar (Unit III & IV)	Twice in a Semester
7.	Other component (Hospital visit and report submission /Group Discussion) (Unit V)	Once in a Semester

Course designed by **Dr.Rosaline Mary**	**Verified by HOD:** **Dr.PawlinVasanthi Joseph**
Checked by CDC : **Mrs. JANSI RANI.A**	**Approved by :** **Principal**

SEMESTER: V
COURSE CODE: 21IDSBZO01/21IDSBZO02
TITLE OF THE COURSE : SKILL BASED COURSE 1 & 2:

WOMEN AND REPRODUCTIVE HEALTH

COURSE OBJECTIVES:

- To provide an understanding of the structure and functioning of the female system.
- To create an awareness of family planning measures.
- To provide the necessary information for preparation and counseling towards marriage.

COURSE OUTCOMES:
At the end of the course the students will be able to

CO1	Understand the female reproductive system and its associated structures	**K2**
CO2	Summarize the functional mechanism of the female reproductive system	**K2**
CO3	Implement the type of fertility control methods for effective family planning measures	**K3**
CO4	Predict and analyze the disease conditions at different developmental stages of women	**K3**
CO5	Appraise the health requirements before marriage and the need for genetic counseling towards a successful marriage	**K4**

Syllabus

Credits: 2 **Instructional hours: 45**

UNIT I: Female Anatomy (K2) **9 hours**

Female reproductive system - External structure and Histology - Ovary, Uterine tubes Uterus, Vagina, External genitalia and Mammary glands.

UNIT II: Physiology of Female Reproduction (K2) 9 hours

Puberty - secondary sexual characters - Hormonal feedback - Menstrual cycle - ovarian and uterine cycle - Menopause - symptoms and therapeutic measures.

UNIT III: Female fertility (K3) 9 hours

Pregnancy, Parturition - stages of labor - Hormonal influence - Lactation - role of prolactin - Fertility control - Rhythm method, mechanical barrier, oral contraceptives, intra uterine contraceptive device, medical termination of pregnancy, surgical methods.

UNIT IV: Disease conditions of developmental stages (K3) 9 hours

Causes, effects and Remedial measures - Dysmenorrhoea, Acne / pimples, Body dysmorphic disorder, Bulimia nervosa, Breast conditions, Juvenile rheumatoid arthritis, Unpleasant body odour, Sexually transmitted disease.

(Self study: Acne / Pimples)

UNIT V: Preparation and Counseling to Marriage (K4) 9 hours

Health requirements before marriage, Early and Late marriage - Eugenics - Positive and Negative - Genetic counseling - Diagnosis, Recurrence risks, Heterozygote detection, Reproductive options, Intrauterine diagnosis - Consanguineous marriages.

(Self study: Early and Late Marriages)

REFERENCE BOOKS:

1. Seely, Stephen and Tate (1989) Anatomy and Physiology - Times Mirror / Mosby College publishers - St Louis, Toronto.
2. Sembulingam K (2004) Essentials of Medical Physiology - Jaypee Brothers medical publishers (P) Ltd. New Delhi.
3. Dr. R. Kumar and Dr. Meena Kumar (2009) Encyclopedia of female youth health management. Deep and Deep publishers - New Delhi.

BLENDED LEARNING
UNIT IV: Disease conditions of developmental stages

Topic	Links
Dysmenorrhoea	https://www.youtube.com/watch?v=JRUErEu6BJs
Acne / pimples	https://www.youtube.com/watch?v=lAx5gwhmsdo
Body dysmorphic disorder	https://www.youtube.com/watch?v=Pl5WyYI8Goc
Bulimia nervosa:	https://www.youtube.com/watch?v=hk0moXO7W74
Breast conditions	https://www.youtube.com/watch?v=6OWM-PyitlU
Juvenile rheumatoid arthritis	https://www.youtube.com/watch?v=EygBjL182Ao
Unpleasant body odour	https://www.youtube.com/watch?v=4z94Dgde4c8
Sexually transmitted disease: Gonorrhoea	https://www.youtube.com/watch?v=6hGWGk39B9o
Syphilis	https://www.youtube.com/watch?v=l9o6icvgr1s

MAPPING OF CO'S WITH POs/ PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	2	2	1	2	2	1	2	2	2
CO2	3	3	2	2	1	2	2	1	2	2	1	2	2	2
CO3	3	3	2	2	2	2	2	1	2	2	1	2	2	2
CO4	3	3	2	2	1	2	2	1	2	2	1	2	2	2
CO5	3	3	2	2	2	2	2	1	2	2	3	2	2	2

(Correlation: 3 – High; 2 – Medium; 1 - Low)

ASSESSMENT TOOLS

S.No	Assessment Methods	Frequency of Assessment
1.	End Semester Examination	Once in a Semester
2.	CIA I	Once in a Semester
3.	CIA II	Once in a Semester

4.	Model	Once in a Semester
5.	Assignment (Unit I & II)	Twice in a Semester
6.	Seminar (Unit III & IV)	Twice in a Semester
7.	Other component (Group Discussion/ Quiz) (Unit V)	Once in a Semester

Course designed by **Dr.Rosaline Mary**	**Verified by HOD:** **Dr.PawlinVasanthi Joseph**
Checked by CDC : **Mrs.JANSI RANI.A**	**Approved by :** **Principal**

SEMESTER: VI
COURSE CODE: 22UZO6C09
TITLE OF THE COURSE: CORE: PHYSIOLOGY
(*Employability* & *Skill Development*)

COURSE OBJECTIVES:

- To study the physiological mechanism of digestion, circulation, excretion and reproduction.

- To highlight the correlation between muscle and nerve physiology.
- To introduce the students to the physiological concept of homeostasis.

COURSE OUTCOMES:
At the end of the course the students will be able to

CO1	Associate the transport of gases and its influence on metabolism of major food constituents.	**K2**
CO2	Explain the mechanism of circulation and excretion among different vertebrates.	**K2**
CO3	Present the structure of a muscle and a nerve and infer its functions.	**K3**
CO4	Relate the adaptation of animals to its environmental factors.	**K3**
CO5	Categorize the impact of hormones in the reproductive mechanism of the male and female organism.	**K4**

Syllabus

Total Credits: 5 **Instructional hours: 75**

UNIT I: Metabolism of Food constituents and Transport of Gases (K2) 15 hours

Nutritive principles in the body - Food Constituents - Proteins, Carbohydrates and Lipids. Metabolism of Carbohydrate - Glycogenesis - Glycogenolysis - Glycolysis - Kreb's cycle - Electron Transport system - Gluconeogenesis - Cori cycle - Uronic acid pathway; Lipid metabolism - Oxidation of Glycerol- Fatty acid - Ketosis; Protein metabolism - Deamination - Transamination - Ornithine cycle; Mechanism of transport of Oxygen and Carbon dioxide - Factors regulating respiration.
(Self study: Vitamins)

UNIT II: Physiology of Circulation and Excretion (K2) 15 hours

Circulation of body fluids - Pattern of Circulation - Cardiac cycle - Pace Maker - Origin and Conduction of Heart beat - ECG - Blood Clotting mechanisms; Formation of nitrogenous compounds - Ammoniotelism, Ureotelism, Uricotelism. Environmental influence on excretion.
(*Beyond the curriculum: Myocardial protection*)

UNIT III: Muscle Physiology and Nerve Physiology (K3) 15 hours

Artificial neural networks for working of the human brain (Industry 4.0)- Structure of striated muscle - Physiology of muscle contraction - Theories of Muscle

Contraction - Physico - chemical changes during muscular contraction; Origin of conduction and Propagation of nerve impulses in Non - myelinated neuron, myelinated neuron - Synapse - Neuromuscular Junction - theories - Properties of Nerve impulse - Reflex action and its mechanism.

UNIT IV: Homeostasis and Osmoregulation (K3) 15 hours

Environmental relationship of animals to water and salts - Osmo - iono regulation - Classification of animals on the basis of Osmoregulation; Temperature relationship of animals - Thermoregulatory mechanisms - Adaptation in Ecto and Endotherms - Vant Hoff's Law.

(Self study: Adaptation in Endotherms)

UNIT V: Reproductive Physiology (K4) 15 hours

Physiology of Reproduction - Role of hormones in reproduction - Stress hormones - Puberty - Ovulation - Menstrual cycle - Gestation - Parturition - Lactation. Menopause - Ageing and Senescence.

TEXT BOOKS:

1. Arumugam. N and Mariakuttikan A (2014) Animal Physiology . Saras Publication, Nagercoil.
2. Parameswaran(1991) Outlines of Animal Physiology. S.Viswanathan (Printers and Publishers), Pvt., ltd. Chennai.

REFERENCE BOOKS:

1. Berry A.K (1993) Textbook of Animal Physiology & Endocrinology. Emkay Publications, New Delhi.
2. Makari, H. K,Gurumurthy, H, Ravi Kumar Patil, H S,Sowmya S. V (2009) A Textbook of Human Physiology. I K International Publishing House, New Delhi.
3. VeerbalaRastogi. (2007) Animal Physiology. Kedar Natha Ram Nath Publishers, Meerut.
4. Verma P.S and Agarwal (2000) Animal Physiology. S Chand and Company Ltd, New Delhi

BLENDED LEARNING
UNIT V: Reproductive Physiology

Topic	Links

Physiology of Reproduction	https://youtu.be/o9otFaBaD_s
Role of hormones in reproduction, Puberty	https://youtu.be/80YcFqo_CLQ https://youtu.be/ex3p1sczsIk
Stress hormones	https://youtu.be/sWZWjPob0hQ
Ovulation, Menstrual cycle	https://youtu.be/usEIVynA0Ck
Gestation	https://youtu.be/HhFLtY_FZlI
Parturition, Lactation.	https://youtu.be/ysZAwtvnVmQ
Menopause	https://youtu.be/7fkNNznHmGo
Ageing and Senescence	https://youtu.be/V0wO7DIZdfg

MAPPING OF CO's WITH PO's AND PSO's

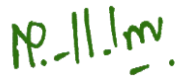
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	2	3	2	1	3	2	1	2	2	2
CO2	3	3	2	3	2	3	2	1	3	2	2	2	2	2
CO3	3	3	2	3	2	3	2	1	3	2	2	2	2	2
CO4	3	3	2	3	2	3	2	1	3	2	2	2	2	2
CO5	3	3	2	3	2	3	2	1	3	2	2	2	2	2

(Correlation: 3 – High; 2 – Medium; 1 - Low)

ASSESSMENT TOOLS

S.No	Assessment Methods	Frequency of Assessment
1.	End Semester Examination	Once in a Semester
2.	CIA I	Once in a Semester
3.	CIA II	Once in a Semester
4.	Model	Once in a Semester
5.	Assignment (Unit I & II)	Twice in a Semester
6.	Seminar (Unit III & IV)	Twice in a Semester

7.	Other component (Hospital visit and report submission/Quiz) (Unit V)	Once in a Semester

Course designed by **Dr.Rosaline Mary**	**Verified by HOD:** **Dr.PawlinVasanthi Joseph**
Checked by CDC : **Mrs.JANSI RANI.A**	**Approved by :**  **Principal**

SEMESTER: VI
COURSE CODE: 22UZO6C10
TITLE OF THE COURSE: CORE: INLAND FISH CULTURE
(*Entrepreneurship* & *Skill Development*)

COURSE OBJECTIVES:

- To provide a comprehensive view of cultivable fishes and their cultural methods.
- To highlight the by - products of fishing industry.
- To provide the necessary information for the setting and maintenance of an aquarium.

COURSE OUTCOMES:

At the end of the course the students will be able to:

CO1	Understand the scope and the bionomics of the cultivable fish species.	**K1**
CO2	Distinguish the culture systems followed in aquaculture farming practices.	**K2**
CO3	Explain the fishery management and breeding techniques.	**K2**
CO4	Classify the fishing methods and by products obtained from fishing industry.	**K3**
CO5	Construct and maintain an aquarium of their own.	**K4**

Syllabus

Total Credits: 4 **Instructional hours: 75**

UNIT I: Cultivable fresh water fishes (K1) 15 hours

Scope of aquaculture, types of cultivable Fishes - Fin fishes - *Catla catla, Labeo rohita, Cirrhinus mirgal.* Exotic carp - Silver carp, Grass carp; Air breathing fishes- Tilapia, Channa, Cat fish - *Clarias batrachus, Heteropneustes fossils*; Shell fish: Fresh Water Prawn.

UNIT II: Fish culture system (K2) 15 hours

Types of Culture - Based on habitat, expenses, sites, varieties, climatic condition. Integrated fish culture - principle, scope, historical background, salient features, importance and types of integrated fish farming. Types of fish ponds - Breeding pond, nursery pond, rearing pond, culture pond, stocking pond. Sewage fed fish culture-principle, production and quality of fishes. Composite farming - principle, objectives, stocking density, stocking densities in different countries.

(Beyond the curriculum**: **New and emerging technologies for sustainable fisheries-Sensors and its types- Optical sensors; Biochemical sensors; Radar; LiDAR Radar Information Technology in fish farming)

UNIT III: Fishery Management (K2) 15 hours

Factors affecting fish culture. Preparation of fish pond, management of fish culture. Breeding - natural breeding; induced breeding. Hatching - fish seed collection - transport of fish seeds - harvesting.

UNIT IV: Fishing Methods and Economic importance (K3) 15 hours

Methods of Fishing - Unconventional methods (Crafts), Conventional methods (Gears) - surrounding nets; seine and its types, trawl and its types; Dredges, Lift nets, cast nets, gill nets, trap nets and its types; dip net, hooks and lines, by products of fishing industry.

UNIT V: Aquafeed and Diseases (K5) 15 hours

Fish feed - artificial feed - classification-nutritional composition of an ideal feed - qualities of good feed - FCR - principles of feed formulation - preparation of artificial feed - types of artificial feed - feeding methods, Live feed - Artemia culture, daphnia culture brachionus culture, cyclops culture, tubifex culture, spirulina culture, chlorella, scenedesmus; Fish diseases - protozoan, helminthic, leech, crustacean, fungal, bacterial, viral, nutritional deficiency diseases. Aquarium keeping - Setting up of an aquarium - identification of fresh water ornamental Fishes - maintenance of aquarium

(Self study: Aquarium keeping)

TEXT BOOKS:

1. Arumugam, N (2014). Aquaculture, 2nd edition, Saras Publication, Nagercoil.

2. Pandey.K and Shukla.J.P. (2010). Fish and Fisheries, 2nd edition, Rastogi publications, Meerut.

REFERENCE BOOKS:

1. Gupta S K and PC Gupta (2010) General and Applied Ichthyology. S Chand and Company Ltd, New Delhi.
2. Jhingran. V.G. (2009) Fish and Fisheries of India. Hindustan Publishing Corporation, New Delhi.
3. Pandey (2014) Fish Fisheries. Rastogi Publications, Meerut.
4. Rath R K (2011) Freshwater Aquaculture. (3rd edition) Scientific Publishers.
5. Pillay TVR and Kutty MN. (2011) Aquaculture: Principles and Practices. (2nd edition) Wiley India Pvt Ltd; New Delhi.

BLENDED LEARNING
UNIT IV: Fishing Methods and Economic importance

Topic	Links
Methods of Fishing	https://www.slideshare.net/prk8960/fishing-methods
Crafts and Gears	https://www.slideshare.net/BalwantSingh16/type-of-fishing https://www.slideshare.net/ShobiyaParamasivam/fishing-gears
By products of fishing industry	https://www.notesonzoology.com/india/fishery/17-important-by-products-of-fish/826 https://www.slideshare.net/CREATIVEAvro/fish-byproducts-80986938

MAPPING OF CO's WITH PO's AND PSO's

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	3	3	3	2	2	3	2	1	3	3
CO2	3	3	3	3	3	3	3	2	2	3	2	1	3	3
CO3	3	3	3	3	3	3	3	2	2	3	2	1	3	3
CO4	3	3	3	3	3	3	3	2	2	3	2	1	3	3
CO5	3	3	3	3	3	3	3	2	2	3	2	1	3	3

(Correlation: 3 – High; 2 – Medium; 1 – Low)

ASSESSMENT TOOLS

S.No	Assessment Methods	Frequency of Assessment
1.	End Semester Examination	Once in a Semester
2.	CIA I	Once in a Semester
3.	CIA II	Once in a Semester
4.	Model	Once in a Semester
5.	Assignment (Unit I & II)	Twice in a Semester
6.	Seminar (Unit III & IV)	Twice in a Semester
7.	Other component (Field visit and report submission/Group Discussion) (Unit V)	Once in a Semester

Course designed by **Dr. B.Dhanalakshmi**	**Verified by HOD:** **Dr.PawlinVasanthi Joseph**
Checked by CDC : **Mrs.JANSI RANI.A**	**Approved by :**  **Principal**

SEMESTER: VI
COURSE CODE: 22UZO6C11

TITLE OF THE COURSE:CORE: BIOTECHNOLOGY

(*Employability* & *Skill Development*)

COURSE OBJECTIVES:

- To provide a comprehensive view of Genetic engineering and cell culture techniques.
- To understand the importance of biotechnology in industrial applications and global environmental problems.

COURSE OUTCOMES:

At the end of the course the students will be able to:

CO1	Understand the principles of genetic engineering in Prokaryotes and Eukaryotes	**K2**
CO2	Relate cell culture technology in Transgenic techniques and SCP production	**K3**
CO3	Demonstrate the importance of monoclonal antibodies and Immobilization of enzymes in medicine and fermentation technology	**K3**
CO4	Categorize microbes for the production of antibiotics, enzymes organic acids, amino acids and alcohols	**K4**
CO5	Investigate the biotechnological principles to counteract the global environmental problems	**K4**

Syllabus

Total Credits - 5 **Instructional hours - 60**

Unit I: Introduction and Genetic Engineering (K2) 12 hours

Major areas and scope, Principles of genetic engineering - Enzymes useful in Genetic engineering- DNA polymerase, DNA ligase, restriction endonuclease, reverse transcriptase, alkaline phosphatase - Preparation of desired DNA - Gene cloning in Prokaryotes (Plasmid and λ phage) Gene cloning in Eukaryotes (Agrobacterium), Southern blotting technique.

Unit II: Cell culture Technology (K3) 12 hours

Animal cell culture - Basic requirements, Explants, culture media, storage and applications - Cryopreservation - Transgenic techniques - methods and applications - Transgenic fish and sheep - advantages, mass culture, Drying and packing, uses.

Unit III: Industrial Biotechnology (K3) 12 hours

Fermentation design and types - stages of fermentation, types of fermenters, purification of products - Monoclonal antibodies - production of Hybridomas, applications and Hazards, Immobilization of enzymes and its applications – methods.

(Beyond the curriculum: Biosensors – Types – Thermal, Optical, Enzyme Electrodes, Immobilized Cell, Bio affinity, IFSET Based, Applications.)

Unit IV: Microbial Biotechnology (K4) 12 hours

Microbial production of Antibiotics - penicillin, streptomycin; Enzymes - Proteases, Amylases; Organic Acids - Citric acid, acetic acid; Amino acids - Glutamic acid, lysine; Production of Alcohol - Biochemistry of ethanol fermentation. Production of single cell proteins (Algae and Bacteria).

Unit V: Environmental Biotechnology (K4) 12 hours

Waste water treatment - physical, chemical and biological treatment processes. Solid waste - Source and management - Composting making - Biopesticides and Biofertilizers - Global environmental problems- Ozone depletion, green house effect and acid rain.

(Self study: Greenhouse effect and Acid rain)

INDUSTRIAL VISIT: Visit to an industry or institution that focuses on biotechnology

TEXT BOOKS:

1. Kumaresan (2012) Biotechnology. (6th edition) Saras Publications, Nagercoil.
2. Gupta P.K (2009) Elements of Biotechnology. Rastogi Publications- Meerut.

REFERENCE BOOKS:

1. Dubey, R C (2017) A text Book of Biotechnology. S Chand and Company Ltd. New Delhi.
2. Casida, L.E. (2008) Industrial Microbiology - Wiley Eastern Pvt. Ltd. New Delhi.
3. Irfan Ali Khan and AtiyaKhanum (2006) New frontiers in Biotechnology, Ukaaz publications, Hyderabad.
4. InduShekhar Thakur (2006) Environmental biotechnology - Basic concepts of Applications. IK International PVT Ltd, New Delhi.
5. Sharma, P.D. (2012) Ecology and Environment (9th edition). Rastogi Publication, Meerut.

BLENDED LEARNING

Unit IV: Microbial Biotechnology

Topic	Links
Penicillin Production	https://www.slideshare.net/Nischithalraj/industrial-production-of-penicillin-76679880
Streptomycin Production	https://www.slideshare.net/SoodShipra/streptomycin-production
Citric acid Production	https://www.slideshare.net/DineshS50/citric-acid-production-74641179
Ethanol and Acetic acid Production	https://www.slideshare.net/ArchanaShaw2/production-of-acetic-acid-and-ethanol
Glutamic acid Production	https://www.slideshare.net/EssamYahya2/industrial-production-of-chemical-acids-glutamic-acid https://youtu.be/rCwAl0JYv38
Lysine Production	https://www.slideshare.net/MdMominulIslam18/industrial-production-of-amino-acid-llysine
Proteases and Amylases Production	https://www.slideshare.net/KrishnaMoorthy126/production-of-protease-and-amylase
Single cell protein Production	https://www.slideshare.net/FIRDOUS88/single-cell-protein

MAPPING OF CO's WITH PO's AND PSO's

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CO3	3	3	2	3	2	2	2	1	2	2	2	2	3	2
CO4	3	3	2	2	2	2	2	1	2	2	2	2	3	2
CO5	3	3	3	2	2	2	2	1	2	2	2	2	3	2

(Correlation: 3 – High; 2 – Medium; 1 - Low)

ASSESSMENT TOOLS

S.No	Assessment Methods	Frequency of Assessment
1.	End Semester Examination	Once in a Semester

2.	CIA I	Once in a Semester
3.	CIA II	Once in a Semester
4.	Model	Once in a Semester
5.	Assignment (Unit I & II)	Twice in a Semester
6.	Seminar (Unit III & IV)	Twice in a Semester
7.	Other component (Industrial visit and report submission /Group Discussion) (Unit V)	Once in a Semester

Course designed by **Dr.PawlinVasanthi Joseph** **Dr G Chitra**	**Verified by HOD:** **Dr.PawlinVasanthi Joseph**
Checked by CDC : **Mrs.JANSI RANI.A**	**Approved by :**  **Principal**

SEMESTER: VI

COURSE CODE: 21UZO6E01

TITLE OF THE COURSE: ELECTIVE - MEDICAL LABORATORY TECHNOLOGY

(*Employability*)

COURSE OBJECTIVES:

- To describe the organization and function of a medical laboratory
- To explain the analysis of body fluids, its interpretation with clinical significance
- To demonstrate the analytical methods in clinical chemistry

COURSE OUTCOMES:

At the end of the course the students will be able to:

CO1	Define the scope, organization and function of a Medical laboratory	**K1**
CO2	Differentiate the haematological parameters and its clinical significance	**K2**
CO3	Demonstrate the importance of blood grouping in transfusion technology	**K3**
CO4	Investigate the clinical conditions from the analysis of urine, CSF, sputum and faeces	**K4**

CO5	Estimate the clinical chemistry and biochemical tests to the health condition of the individual	**K5**

Syllabus

Total Credits: 5 **Instructional hours: 75**

UNIT I: Scope, instrumentation and safety measures (K1) 15 hours

Introduction - scope of the subject - safety measures - laboratory safety and first aid - sterilization methods - dry heat, moist heat, chemicals, filtration - maintenance of records - requisition, records, reporting, inventory use of instruments (compound microscope, centrifuge, balances, distillation units).

(Self study: First aid)

UNIT II: Haematology (K2) 15 hours

Bioinspired computing- computer immune systems- quantum computing, DNA computing (**Industry 4.0**)- Haematology - collection of specimens - techniques, normal values and clinical significance - Total RBC, WBC, DLC, Platelet count, ESR and PCV; Bleeding and Clotting time, Anaemia - types - Haemoglobin estimation - methods - photoelectric, colour matching, spectrophotometric methods.

UNIT III: Blood grouping and Genetic abnormalities (K3) 15 hours

Blood grouping - A, B, O, Rh - methods of blood grouping - Coomb's test - Direct and Indirect Coombs test - sub grouping in A - Transfusion technology - screening tests - genetic abnormalities in blood - Haemophilia, Sickle cell anaemia.

UNIT IV: Analysis of urine, CSF, Sputum and semen (K4) 15 hours

Urine analysis - collection, physical and biochemical tests - albumin, sugar, bile pigments, bile salts, urobilinogen - blood in urine - microscopic examination - acidic and alkaline urine - collection of CSF - physical and chemical examination - collection of semen - microscopic examination, total sperm count, morphological examination - collection of sputum and analysis.

UNIT V: Clinical chemistry (K5) 15 hours

Clinical chemistry - Liver function tests - Bilirubin metabolism, carbohydrate, protein, lipid metabolic tests, enzyme estimation - Gastric analysis - Tube, tubeless methods, Microscopic and chemical examination - GTT and OGTT curves - Diabetes mellitus - Analysis of Cholesterol - Albumin - qualitative and quantitative tests - Blood Urea - Faecal analysis.

(Self study: Diabetes mellitus)

HOSPITAL VISIT: Visit to the laboratories of a Hospital to understand its organization and functioning

TEXT BOOK:

1. Sachdev. K.N. (2000) Clinical Pathology and Bacteriology. Jaypee Brothers Publishing, New Delhi.

REFERENCE BOOKS:

1. Dr. Chitra Bharucha et.al. (1999) Hand book of Medical Laboratory Technology.
2. Kanai L. Mukerjee and Ghosh S (2010) Medical Laboratory Technology. (2nd edition) McGraw Hill Education, New Delhi.
3. Talib. V.H and Khurana.S.R (2008) A hand book of Medical Laboratory Technology. (2nd edition) CBS Publishers, New Delhi.
4. Nanda Maheshwari (2016) Clinical Pathology Haematology and Blood Banking. (3rd edition) JPB publishers.

BLENDED LEARNING
UNIT V: Clinical chemistry

Topic	Links
Liver function tests:	https://www.youtube.com/watch?v=57mvZvV3zpY
Gastric analysis:	https://www.youtube.com/watch?v=IzTH2pIrPR0
Faecal analysis:	https://www.youtube.com/watch?v=-iI2PxmHxuo
GTT and OGTT curves:	https://www.youtube.com/watch?v=zBOyi5Y4LmM
Diabetes mellitus:	https://www.youtube.com/watch?v=-B-RVybvffU
Cholesterol:	https://www.youtube.com/watch?v=Kqmx6nz2PDc
Urea:	https://www.youtube.com/watch?v=VfzDE9R3M6E

MAPPING OF CO's WITH PO's AND PSO's

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CO1	3	3	2	2	2	3	2	2	3	3	2	2	3	2
CO2	3	3	2	2	2	3	2	2	3	3	2	2	3	2
CO3	3	3	2	2	2	3	2	2	3	3	2	2	3	2
CO4	3	3	2	2	2	3	2	2	3	3	2	2	3	2
CO5	3	3	2	2	2	3	2	2	3	3	2	2	3	2

(Correlation: 3 – High; 2 – Medium; 1 - Low)

ASSESSMENT TOOLS

S.No	Assessment Methods	Frequency of Assessment
1.	End Semester Examination	Once in a Semester
2.	CIA I	Once in a Semester
3.	CIA II	Once in a Semester
4.	Model	Once in a Semester
5.	Assignment (Unit I & II)	Twice in a Semester
6.	Seminar (Unit III & IV)	Twice in a Semester
7.	Other component (Hospital visit and report submission /Group Discussion) (Unit V)	Once in a Semester

Course designed by **Dr.PawlinVasanthi Joseph** **Dr Rosaline Mary**	**Verified by HOD:** **Dr.PawlinVasanthi Joseph**
Checked by CDC : **Mrs.JANSI RANI.A**	**Approved by :** **Principal**

SEMESTER: V
COURSE CODE: 21UZO6E02
TITLE OF THE COURSE: ELECTIVE - WILD LIFE CONSERVATION AND MANAGEMENT

(*Employability*)

COURSE OBJECTIVES:

- To elucidate the causes of depletion and the importance of conservation
- To highlight the evaluation and management of wild life and Habitats
- To provide an in depth study of population estimates and management of Protected areas

COURSE OUTCOMES:

At the end of the course the students will be able to:

CO1	Identify the causes of depletion of wild life and examine the conservation strategies	**K1**
CO2	Demonstrate the standard evaluation procedures for Habitat analysis	**K2**
CO3	Distinguish degraded habitats and discuss the methods of restoration	**K2**
CO4	Estimate population density and faecal analysis of Ungulates and Carnivores	**K3**
CO5	Compute the carrying capacity of an eco-system and the management of protected areas.	**K3**

Syllabus

Total Credits: 5 **Instructional Hours: 60**

UNIT 1: Introduction to Wild Life (K1) **12 hours**

Values of wild life - positive and negative; Conservation ethics; Importance of conservation; Causes of depletion; World conservation strategies.

UNIT 2: Evaluation and management of wild life (K2) **12 hours**

Habitat analysis, Physical parameters: Topography, Geology, Soil and water; Biological Parameters: food, cover, forage, browse and cover estimation; Standard evaluation procedures: remote sensing and GIS.

UNIT 3: Management of habitats (K2) **12 hours**

Setting back succession; Grazing logging; Mechanical treatment; Advancing the successional process; Cover construction; Preservation of general genetic diversity; Restoration of degraded habitats

UNIT 4: Population estimation (K3) 12 hours

Population density, Natality, Birth rate, Mortality, fertility schedules and sex ratio computation; Faecal analysis of ungulates and carnivores: Faecal samples, slide preparation, Hair identification, Pug marks and census method.

UNIT 5: Management planning of wild life in protected areas (K3) 12 hours

Estimation of carrying capacity; Eco tourism / wild life tourism in forests; Concept of climax persistence; Ecology of perturbence. Bio- telemetry; Care of injured and diseased animals; Quarantine; Common diseases of wild animals. National parks & sanctuaries, Community reserve; Important features of protected areas in India

(Self Study: Protected Areas in India)

TEXT BOOK:

1. S K Singh, (2018) Textbook of wildlife Management, CBS Publishers.
2. Gautam Kumar Sahu and Subhendu Mazumdar, (2018) Wildlife Biology: An Indian perspective, PHI Learning Publisher
3. Banarjee Ananda, (2017) Nature Chronicles of India - Essays on Wildlife, Rupa and Co Publishers

REFERENCE BOOKS:

1. Caughley, G., and Sinclair, A.R.E. (1994). Wildlife Ecology and Management. Blackwell Science.
2. Woodroffe R., Thirgood, S. and Rabinowitz, A. (2005). People and Wildlife, Conflictor Co-existence? Cambridge University.
3. Bookhout, T.A. (1996). Research and Management Techniques for Wildlife and Habitats, 5th edition. The Wildlife Society, Allen Press.
4. Sutherland, W.J. (2000). The Conservation Handbook: Research, Management and Policy. Blackwell Sciences
5. Hunter M.L., Gibbs, J.B. and Sterling, E.J. (2008). Problem-Solving in Conservation Biology and Wildlife Management: Exercises for Class, Field, and Laboratory. Blackwell Publishing.

BLENDED LEARNING

UNIT 5: Management planning of wild life in protected areas 12 hours

National parks & sanctuaries, Community reserve; Important features of protected areas in India	https://www.youtube.com/watch?v=fH9DXc7D3yA
Common diseases of wild animals, Care of injured and diseased animals; Quarantine	https://www.youtube.com/watch?v=i7q0U8C8cNw

Concept of climax persistence; Ecology of perturbence. Bio- telemetry	https://www.youtube.com/watch?v=7B0QjIWLBUQ
Eco tourism / wild life tourism in forests	https://www.youtube.com/watch?v=_PL6tk110iI https://www.youtube.com/watch?v=Ab0H5pYVyKo
Estimation of carrying capacity	https://www.youtube.com/watch?v=edwf8XNldjQ

MAPPING OF CO's WITH PO's AND PSO's

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CO4	3	3	3	3	3	2	2	2	3	2	3	2	2	2
CO5	3	3	3	3	3	2	2	2	3	2	3	2	2	2

(Correlation: 3 – High; 2 – Medium; 1 - Low)

ASSESSMENT TOOLS

S.No	Assessment Methods	Frequency of Assessment
1.	End Semester Examination	Once in a Semester
2.	CIA I	Once in a Semester
3.	CIA II	Once in a Semester
4.	Model	Once in a Semester
5.	Assignment (Unit I & II)	Twice in a Semester
6.	Seminar (Unit III & IV)	Twice in a Semester
7.	Other component (Field visit and report submission / Power point presentation) (Unit V)	Once in a Semester

Course designed by **Dr.PawlinVasanthi Joseph**	**Verified by HOD:** **Dr.PawlinVasanthi Joseph**
Checked by CDC :	**Approved by :**

Mrs.JANSI RANI.A	**Principal**

SEMESTER: VI
COURSE CODE: 21UZO6SB4
TITLE OF THE COURSE: SKILLBASED COURSE – APICULTURE

COURSE OBJECTIVES:

- To provide a comprehensive knowledge on bees and bee culture.
- To highlight bee products and bee keeping equipments.
- To describe the management of bees and the control of pests and disease.

COURSE OUTCOMES:
At the end of the course the students will be able to

CO1	Identify the caste differentiation in a bee colony.	**K1**
CO2	Associate the behavior of bees with intra-specific communication.	**K2**
CO3	Summarize bee products and bee keeping equipments.	**K2**
CO4	Present the different management techniques and rearing in Queen bees.	**K3**
CO5	Analyze the type of pests and diseases produced that affect the normal development of bees.	**K4**

Syllabus

Credits: 2 **Instructional hours: 45**

Unit I: Classification and life history (K1) 9 hours

History and Scope of Apiculture, Early Hives, Choice of Bee in Apiculture; Classification - Caste differentiation - Queen, Drones, Workers; Functions of Honey Bees; Life cycle of a bee; Development of Honey bee - Egg, Larva, Pupa and Adult.

Unit II: Behaviour and communication (K2) 9 hours

External characters of Bee; Behaviour - Dances, Purpose of Honey bee dance - Types - Round dance - Tail wagging dance - Tremble dance - Alarm dance - Cleaning dance - Joy dance - Massage dance; Swarming - Process, types, methods of Swarm control; Absconding; Bee communication.

Unit III: Bee products and Bee keeping equipments (K2) 9 hours

Bee Products - Honey - Properties, Chemical composition, Nutritional values, Medicinal values - Pollen, Bee Wax- Production - Characteristics - Extraction - Uses, Propolis, Royal Jelly, Bee Venom - Composition - Extraction - Uses; Principles of Bee Keeping- Bee Keeping Equipment's.

(Self study: Study of Nutritional and Medicinal value of Honey)

Unit IV: Bee management (K3) 9 hours

Bee Management, Seasonal Management, Queen rearing - Procedure - Principles of Queen rearing - Hopkin's method - Miller method- Doolittle method - Alley method - Requirements; Mating Yards; Bee Pollination.

Unit V: Diseases and their control (K4) 9 hours

Bee Diseases - Brood disease - Bacterial brood disease - Fungal brood disease - Viral brood disease - Adult Bee disease - Dysentery - Septiceamia; Enemies - Wax moths - Wax beetles - Wasps - Black Ants - Their Control; Pesticide bee poisoning, Economics of Bee keeping.

REFERENCE BOOKS:

1. Pradip V. Jabde (2005) Text Book of Applied Zoology. Discovery Publishing House, New Delhi.

2. Addison Webb (2007) Bee Keeping – for profit and pleasure, Agrobios, India.

3. Shukla G S and Upadhyay V B. (1994) Economic Zoology. Rastogi Publications, Meerut.

BLENDED LEARNING
Unit IV: Bee management

Topic	Links
Bee Management, Seasonal Management	https://youtu.be/ef1HrneiDWw, https://youtu.be/CohtHUThEVc, https://youtu.be/386qWGnt_CU
Queen rearing - Procedure	https://youtu.be/uWsWUSCFIxY
Principles of Queen rearing - Hopkin's method	https://youtu.be/kjoiZTirJ-A https://youtu.be/R8-9DgXcrfI
Miller method	https://youtu.be/Fc1MIvEiDdI
Doolittle method	https://youtu.be/GNSkOlNT4vM
Alley method	https://youtu.be/Zgeby2Q5v40 https://youtu.be/OtogwPcoYro
Requirements	https://youtu.be/iWtoIzT1wA4
Mating Yards;	https://youtu.be/VeaqMdKjd7E
Bee Pollination.	https://youtu.be/c0PhQPq5wvs

MAPPING OF CO'S WITH POs/ PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	3	2	3	3	2	3	2	3	2	2
CO2	3	2	2	2	2	1	2	2	2	1	2	3	2	2
CO3	3	3	2	2	2	3	2	2	2	3	2	2	2	2
CO4	3	3	2	2	2	2	2	3	1	2	2	2	2	2

CO5	2	2	2	2	2	2	3	3	2	2	2	2	2	2

(Correlation: 3 – High; 2 – Medium; 1 - Low)

ASSESSMENT TOOLS

S.No	**Assessment Methods**	**Frequency of Assessment**
1.	End Semester Examination	Once in a Semester
2.	CIA I	Once in a Semester
3.	CIA II	Once in a Semester
4.	Model	Once in a Semester
5.	Assignment (Unit I & II)	Twice in a Semester
6.	Seminar (Unit III & IV)	Twice in a Semester
7.	Other component (Field visit and report submission / Quiz) (Unit V)	Once in a Semester

Course designed by **Dr.PawlinVasanthi Joseph** **Dr Rosaline Mary**	**Verified by HOD:** **Dr.PawlinVasanthi Joseph**
Checked by CDC : **Mrs. JANSI RANI. A**	**Approved by :** **Principal**

SEMESTER: VI
COURSE CODE: 22UZO6CP3
TITLE OF THE COURSE: CORE: PRACTICAL – III

(Based on Core course – Genetics & Evolution, Cell & Molecular Biology, Physiology, Inland Fish Culture & Biotechnology and Elective course – Bioinformatics, Medical Laboratory Technology, Parasitology and Wild life conservation and management)

COURSE OBJECTIVES:

- To examine biochemical parameters in urine and blood samples of man.
- To analyze the gut content and oxygen consumption in fishes and excretory products in animals
- To understand the functioning of various components of medical lab and the industrial process of a dynamic industry

COURSE OUTCOMES:
At the end of the practical's the students will be able to:

CO1	**Major practicals** : Determine the haematological parameters in blood samples, oxygen consumed and gut content analysis of fishes	**K4**
CO2	**Minor practicals** : Perform the necessary tests in urine and blood samples and attribute their clinical significance	**K4**
CO3	**Spotters**: Illustrate the importance of bioinformatics and molecular tools , instruments and biotechnological significance of prokaryotes and instruments	**K2**
CO4	**Record**: Transfer the diagrammatic representation and results of experimental works through a record presentation	**K3**

Syllabus

Credits - 4 **Instructional hours - 60**

GENETICS & EVOLUTION

Blood group in man

Fossils-Ammonite and Nautiloid fossils

BIOTECHNOLOGY

Isolation and estimation of DNA & RNA from animal tissues (Liver)

Isolation of genomic DNA

Isolation of Plasmid DNA

Agarose Gel Electrophoresis

Separation of proteins-SDS PAGE

Blotting technique – observation of photographs

Spotters – Spirulina, Mushroom seed, antibiotic (Penicillin), Yeast, Pressure Cooker, Fungi (Aspergillus), Azolla, Agarose electrophoresis kit, Bacteriophage, Insulin,

Visit to Industry/ Laboratory – A report to be submitted.

PHYSIOLOGY

Preparation of haemin crystals.

Oxygen consumption by fish.

Ciliary activity in fresh water mussel.

Qualitative analysis of excretory products.

CELL & MOLECULAR BIOLOGY

Identification of Salivary Gland for the study of Polytene Chromosomes in Chironomous Larva.

Spotters – Models of DNA & RNA.

INLAND FISH CULTURE

Analysis of gut contents of fishes to study their feeding habits.

Morphometric measurement of fish

Spotters: Identification of cultivable food fishes and Ornamental fishes.

Identification of fish diseases.

ELECTIVES

MEDICAL LABORATORY TECHNOLOGY

Total RBC and WBC count

Differential leucocyte count

Haemoglobin estimation,

Estimation of Sugar and Albumin in urine.

Spotters: RBC and WBC pipettes, Urinometer, Albuminometer, Haemoglobinometer, Ryle's tube, ESR tubes, Bacilli and Cocci.

BIOINFORMATICS

Bioinformatic Tools: BLAST, Rasmol, Genmark and Genscan

PARASITOLOGY

1. Study of life stages of *Entamoeba histolytica, Giardia intestinalis,Trypanosoma gambiense, Leishmania donovani* and *Plasmodium vivax* through permanent slides/micro photographs
2. Study of adult and life stages of *Ascaris lumbricoides, Ancylostoma duodenale, Wuchereria bancrofti* and *Trichinella spiralis* through permanent slides/micro photographs
3. Study of *Pediculus humanus* (Head louse and Body louse), *Xenopsylla cheopis* and *Cimex lectularius* through permanent slides/ photographs

WILD LIFE CONSERVATION AND MANAGEMENT

1. Identification of flora, mammalian fauna, avian fauna, herpeto-fauna
2. Demonstration of basic equipments needed in wildlife studies - use, care and maintenance - Compass, Binoculars, Spotting scope, Range Finders, Global Positioning System, Various types of Cameras and lenses

MAPPING OF CO'S WITH POs/ PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3

(Correlation: 3 – High; 2 – Medium; 1 - Low)

ASSESSMENT TOOLS

S. No	Assessment Methods	Frequency of Assessment
1.	Internal Exam Major practicals Minor practicals Spotters	Once in a Semester

	Record	
2.	End Semester Exam	End of the year

Course designed by **Dr.PawlinVasanthi Joseph** **Dr Rosaline Mary**	**Verified by HOD:** **Dr.PawlinVasanthi Joseph**
Checked by CDC : **Mrs.JANSI RANI.A**	**Approved by :** **Principal**

VERMITECHNOLOGY-CERTIFICATE COURSE

COURSE – I : THE EARTHWORM
COURSE CODE : 13CCVT001
CLASS : I-B.Sc Zoology

OBJECTIVES: To provide a comprehensive view of the Earthworm, its organization, behavior, role and the effects of parasite / predator on earthworm biomass.

At the end of the course the students will be able to:

CO1	Identify the different taxonomic groups in Annelida with different class types	K1
CO2	Explain the characteristic features, various systems and their functions in earthworm	K1
CO3	Explains the behavioral role of earthworm	K2
CO4	Explain the different methods of collection and measurement of earthworms	K2
CO5	Relates the predation, parasitism and beneficial role of earthworms	K3

Syllabus

Instructional Hours-60Hrs

UNIT-I : Phylum Annelida-Earthworm (K1)

Systematic position of Phylum Annelida; Importance of earthworms; Families - Lumbricidae, Eudrilidae, Megascolecidae, Octochaetidae, Moniligastridae; Earthworm ecological types.

UNIT-II: Earthworm Organization (K1)

Body wall, Principallom, locomotion, organ systems, fertilization and cocoon formation. Life cycle patterns (importance to be given to digestive, excretory and reproductive systems)

UNIT-III: Behaviour and role of earthworm (K2)

Light reaction, chemoreaction, thigmotactic, response to electrical stimuli, burrowing, feeding, casting, locomotion, adaptation, functional interaction, toxico kinetic behavior.

UNIT-IV : Measurement of earthworm (K2)

Methods- manual, floatation, chemical extraction, electrical, heat extraction, vibration, trapping, earthworm biomass, earthworm as a natural bioreactor.

UNIT-V: Predation/parasitism and Benefits of earthworm (K3)

Predation, parasitism-units, pathogens, competition. Role of earthworm-sustainable agriculture, organic farming, soil texture, fertility and Vermi-medicine

TEXT BOOK

1. 'Vermicomposting and vermiwash'- Somani, L.L- 2008 - Agrotech publishing academy-Udaipur, Rajasthan.

REFERENCE BOOKS

1. The complete technology book on vermiculture and vermicompost-NCPS board of Consultants and Engineers-2000-Asian Specific Business Press Inc. New Delhi.
2. Vermiresource technology - Tripathi, G- 2008-Discovery publishing house, New Delhi.
3. Vermitechnology - Mary Violet Christy, A-2008-MJP Publishers, Chennai.
4. Vermicomposting for sustainable agriculture-Gupta, P.K.-2008-Agrobios, India.
5. Vermibiotechnology - From Soil Health to Health- Ranganathan, L.S. -2006-Agrobios, India.

VERMITECHNOLOGY-CERTIFICATE COURSE

COURSE-II : INTRODUCTION TO VERMICOMPOSTING
COURSE CODE : 13CCVT002
CLASS : I-B.Sc Zoology
OBJECTIVES: 1) To understand the criteria and requirements of vermicomposting.
2) To be acquainted with the culturing techniques and vermicomposting process.

At the end of the course the students will be able to:

CO1	Explain how to Identify , collect and select earthworms for vermicomposting	K1
CO2	Explains the requirements needed for vermicomposting	K2
CO3	Describes the various culturing techniques in composting	K2
CO4	Explain how to process of vermicomposting at small scale through various methods	K2
CO5	Explain how to process of vermicomposting at large scale through various methods	K2

Syllabus

Instructional Hours-60Hrs

UNIT-I : Criteria for vermicomposting (K1)

Selection of species, flow sheet, suitable earthworms-basic characteristics, collection of earthworms, fixing, transporting, dissection, identification.

UNIT-II : Requirements for vermicomposting (K2)

Bedding materials, containers, food, factors- physical, chemical, biological, maintenance of base culture.

UNIT-III: Culturing techniques/vermicomposting materials (K2)

Vermicomposting materials, culturing techniques-general methods, pot method, wooden box, multiplication rate, propagation, factors affecting culture of earthworms.

UNIT-IV: Vermicomposting process- small scale/indoor (K2)

Developments in vermicomposting system, Indoor vermicomposting-Bed and Bin system, Plastic bin. Pit method, Heap method, Expendable worm tower assembly, Hanging basket, Indoor Dual Bin

UNIT-V : Vermicomposting process-large scale/outdoor(K2)

Outdoor dual bin, raised cage, dual pit, tanks, cement rings, commercial model, windrow method, wedge system, trickling filters, reactor systems, INORA, raised gantry feed beds, KISS plan, Steps and process in vermicomposting

TEXT BOOK

1. 'Vermicomposting and vermiwash'- Somani, L.L- 2008 - Agrotech publishing academy-Udaipur, Rajasthan.

REFERENCE BOOKS

1. The complete technology book on vermiculture and vermicompost-NCPS board of consultants and Engineers-2000-Asian specific Business Press Inc.
2. Vermiresource technology - Tripathi, G- 2008-Discovery publishing house, New Delhi.
3. Vermitechnology - Mary Violet Christy, A-2008-MJP Publishers, Chennai.
4. Vermicomposting for sustainable agriculture-Gupta, P.K.-2008-Agrobios, India.
5. Vermibiotechnology - from soil health to health- Ranganathan, L.S. -2006-Agrobios, India.

VERMITECHNOLOGY-CERTIFICATE COURSE

COURSE : PRACTICAL-I
COURSE CODE : 13CCVTP01
CLASS : I-B.Sc Zoology

OBJECTIVES: To provide a comprehensive view of the Earthworm, its organization, behavior, role and the effects of parasite / predator on earthworm biomass and requirements of vermicomposting.

Syllabus

Instructional Hours-60Hrs

1. Key to identify different types of earthworms.
2. Study of Sytematic position of Earthworms suitable for vermicomposting.
3. Study of Life stages & development of *Eisenia foetida*.
4. Study of Life stages & development of *Eudrilus eugeniae*.
5. Study of Vermiculture, Vermiwash & Vermicompost equipment's and devices.
6. Study of earthworm diseases / parasites.
7. Dissection of earthworm to show the viscera.

Field trip: To a vermicompost unit

VERMITECHNOLOGY DIPLOMA COURSE

COURSE –III :VERMICOMPOSTING - MAINTENANCE
COURSE CODE : 13UDVT003
CLASS : II-B.Sc Zoology

OBJECTIVE: To provide knowledge on vermicomposting schemes, changes, effects of vermiwash and vermicompost on soil and crop growth.

At the end of the course the students will be able to:

CO1	Explain the phases and schemes of vermicomposting	K2
CO2	Explains the effect of physico-chemical and biological factors on earthworms in vermicomposting	K2
CO3	Describes the various methods of production of vermiwash and its effects on crops	K3
CO4	Explains the effect of vermicompost on physic- chemical and biological properties of soil	K3
CO5	Explains the effect of vermicompost on crop growth and yield	K3

Syllabus

Instructional Hours-60Hrs

UNIT-I: Vermicomposting phases / schemes (K2)

Phases, schemes, trouble shooting, overcoming obstacles-innovative ways, vermicompost properties, demand and market potential, benefits and characterization, regulatory guidelines.

UNIT-II: Changes during vermicomposting (K2)

Biodiversity on vermicompost, changes in temperature, nutrient contents, rate of decomposition, biomass production, effect on earthworm species on composting, soil organic matter, organic waste, earthworm population.

UNIT-III: Vermiwash (K3)

Chemical composition, methods of vermiwash production (12 methods), effect of vermiwash on yield and quality of crops.

UNIT-IV: Effect of vermicompost on soil properties (K3)

Soil physical properties, PH, chemical properties, organic carbon content, available nutrients-NPK, soil biological properties

UNIT-V: Effect of vermicompost on crop growth and yield (K3)

Rice, mulberry, black gram, forest tree species, vegetables, flowers, disease management, growth promoting activity, quality of crops.

TEXT BOOK

1. 'Vermicomposting and Vermiwash'- Somani, L.L- 2008 - Agrotech publishing academy- Udaipur, Rajasthan.

REFERENCE BOOKS

1. Vericulture and Vermicomposting-Bhatnagar, R.K. and Palta, R.K. - 1996- Kalyani Publications, New Delhi.
2. A Hand book of Organic Farming-Arun, K. Sharma-2002-Agrobios, Johhpur, India.
3. The Earthworm-Ismail, S.A.-2005-Other India press, Goa.
4. Vermicomposting for Sustainable Agriculture-Gupta, P.K.-2008-Agrobios, India.
5. Vermicompost-Crown Jewel of Organic Farming-Kale, R.D.-2006-Author Publication, 4, Archana apartment, (S-1), Malleswaram, Bangalore-560 003, India.

VERMITECHNOLOGY DIPLOMA COURSE

COURSE –IV : EARTHWORMS FOR SOLID WASTE MANAGEMENT

COURSE CODE : 13UDVT004

CLASS : II-B.Sc Zoology

Objectives:

- To understand the importance of earthworms for solid waste management.
- To highlight the importance of vermicompost production for sustainable agriculture.

At the end of the course the students will be able to:

CO1	Explain the types of waste, disposal methods and recycling of waste by vermitechnology	K2
CO2	Explains the vermicompost enrichment technology	K2
CO3	Explains about conventional and vermiculture waste treatment methods, waste management and resource recovery	K3
CO4	Describes the biological management of paper mill sludge by influence of earthworms	K3
CO5	Describes the techniques in biological management of sericulture and plantation wastes	K3

Syllabus

Instructional Hours-60Hrs

UNIT-I: SOLID WASTE MANAGEMENT (K2)

Hazards with mismanagement of wastes – Types of wastes - Disposal methods - Vermitechnology for recycling of wastes

UNIT-II: VERMICOMPOST ENRICHMENT TECHNOLOGY (K2)

Compost process - processing Strategies - vermicompost as organic fertilizer - enrichment of PO_4 solubilizing microorganisms - Compost maturity

UNIT-III: SOLID INDUSTRIAL WASTE TREATMENT(K3)

Conventional waste treatment methods - Vermiculture based treatment methods - Waste management and resource recovery – Treatment protocol

UNIT-IV: BIOMANAGEMENT OF PAPER MILL SLUDGE (K3)

Paper mill sludge - Physico-chemical parameters of sludge - Influence of earthworms on physico-chemical and microbial properties of paper mill sludge

UNIT-V: BIO MANAGEMEN TOF SERICULTURAL/PLANTATION WASTES (K3)

Sericultural wastes - Techniques of vermicomposting - Impact on mulberry production - Solid agricultural wastes - System of vermicomposting - Plantation waste management – Vermicompost technology for coconut, areca, cocoa and coffee.

REFERENCE BOOKS

1. Earthworms for Solid Waste Management-Satyendra M. Singh-2009-International book distributing Co., Dehradun. Uttarakhand - 248 001.
2. Earthworm Ecology and Environment-Satyendra M. Singh-2009-International book distributing Co., Dehradun. Uttarakhand - 248 001.

VERMITECHNOLOGY DIPLOMA COURSE

II YEAR PRACTICALS

COURSE : PRACTICAL II

COURSE CODE : 13UDVTP02

CLASS : II-B.Sc Zoology

Objectives: To determine the physical and biochemical nature of vermicompost and Vermiwash

Syllabus

Instructional Hours-60Hrs

1. Sample preparation for physical/chemical analysis

2. Determination of pH of Vermicompost / Vermiwash

3. Determination of electrical conductivity of Vermicompost / Vermiwash

4. Determination of total organic matter of Vermicompost

5. Biochemical analysis in Vermicompost

- Carbohydrates by Anthrone method
- Proteins by Lowry *et al*.,1957
- Fats by Petroleum ether method

ADVANCED DIPLOMA COURSE IN VERMITECHNOLOGY

COURSE V : Earthworm reproduction and heavy metal accumulation

COURSE CODE : 14ADVT005

CLASS : III-B.Sc Zoology

Objectives -

- To dissipate the important role of earthworms in the bio-accumulation of heavy metals
- To understand that the earth worm tolerates wide variations of ecological factors and wide variety of wastes

At the end of the course the students will be able to:

CO1	Explain the effect of heavy metals in soil, plants, animals and human beings	K2
CO2	Explain how to estimate the minerals present in vermicompost	K2
CO3	Explains the preparation of vermibed, process of vermicomposting and analysis of heavy metals in vermicompost	K3
CO4	Explain the growth and reproduction of earthworms and chemical analysis in vermicompost	K3
CO5	Heavy metal accumulation, reproduction and development in *Eisenia foetidia*	K3

Syllabus

Instructional Hours: 60 Hrs

Unit I- (K2)

Heavy metals in soil, effect of heavy metal on animal and human health, Phyto accumulation of heavy metals

Unit II- (K2)

Vermiculture - vermicomposting- estimates - total organic carbon, nitrogen, potassium, phosphorus and calcium

Unit III-(K3)

Vermi bed method of vermicomposting – collection of wastes, process of vermicomposting, analysis of heavy metals

Unit IV-(K3)

Reproduction and growth rate of earth worms, chemical analysis of vermicompost

Unit V-(K3)

Heavy metal accumulation by ***Eisenia foetidia***, reproduction and development, factors affecting growth and reproduction

Text Books-

1. Earth worm reproduction and heavy metal accumulation – Keshav Singh *et al*. – 2014 – Gene Tech Books, New Delhi
2. Vermiculture and vermicomposting – S. K. Singh – 2014 – Satyam publisher
3. Vermicomposting for sustainable agriculture- Gupta P.K - 2008-Agrobios,India

ADVANCED DIPLOMA COURSE IN VERMITECHNOLOGY

COURSE VI **:** Earthworm biotechnology for sustainable agriculture

COURSE CODE **:** 14ADVT006

CLASS :III-B.Sc ZOOLOGY

Objectives -

- To understand that earthworms have a major role to play in the modification of the habitat through their feeding and casting activity
- To authenticate that earthworms can serve as the most beneficial group for application in biotechnology
- To emphasize substrates, vermicomposting design and experimental findings (nutrient status) in each unit.

At the end of the course the students will be able to:

CO1	Explain earthworm biotechnology in controlling weeds	K2
CO2	Explain earthworm biotechnology for recycling fly ash as a source of plant nutrient	K2
CO3	Explains the optimization of press mud waste by vermicomposting	K3
CO4	Explain the vermin degradation for bioremediation of chemical sludge	K3
CO5	Explain the process vermicomposting using paddy straw	K3

Syllabus

Instructional Hours-60Hrs

Unit I-(K2)

Earth worm biotechnology – an introduction

Earthworms for weed control

Unit II- (K2)

Vermicomposting biotechnology for recycling fly ash as a source of plant nutrient

Unit III-(K3)

Optimization of press mud waste by vermicomposting

Unit IV-(K3)

Vermin degradation for bioremediation of chemical sludge

Unit V-(K3)

Vermicomposting of paddy straw

Text Books-

1. Biology and ecology of tropical earth worm – P. Chaudhary and S. M. Singh – 2014 – Discovery Publishing House
2. Vermiculture and vermicomposting – S. K. Singh – 2014 – Satyam publisher
3. Vermicomposting for sustainable agriculture- Gupta P.K - 2008-Agrobios,India

ADVANCED DIPLOMA COURSE IN VERMITECHNOLOGY

COURSE : PRACTICALS- III

COURSE CODE : 14ADVTP03

CLASS :III-B.Sc ZOOLOGY

Objectives: To determine the NPK ratio and enzyme estimation in vermicompost.

Syllabus

Instructional Hours-60Hrs

1. Determination of N_2 (Kjeldahl method)

2. Determination of phosphorus

3. Determination of potassium

4. Enzyme study in vermicompost

- Cellulase
- Amylase

ADVANCED DIPLOMA COURSE IN VERMITECHNOLOGY

Instructional Hours-60Hrs

COURSE : PROJECT

COURSE CODE : 14ADVTPVV

CLASS : III B.Sc Zoology

FIELD WORK

Working Hours- 60Hrs