FATIMA COLLEGE (AUTONOMOUS)

Re-Accredited with A^{++}(NAAC IV Cycle)

Maryland, Madurai- 625 018, Tamil Nadu, India

NAME OF THE DEPARTMENT: ZOOLOGY

NAME OF THE PROGRAMME : B.Sc

PROGRAMME CODE : UAZO

ACADEMIC YEAR : 2022-2023

FATIMA COLLEGE (Autonomous), MADURAI-625 018

MINUTES OF THE BOARD OF STUDIES

NAME OF THE DEPARTMENT: B.Sc ZOOLOGY

TO BE IMPLEMENTED FROM: 2022-2023 ONWARDS

VENUE: Department of Zoology

CONVENED ON: 15.03.2022 CONVENED AT: 02.00 pm

MEMBERS PRESENT:

1.	Dr. A. Tamil Selvi	Head of the Department 15/03/2022
2.	Dr. Capt. N. Arun Nagendran Associate Professor PG & Research Department of Zoology Thiagarajar College Madurai - 625009	University Nominee 15/3/22
3.	Dr. F. Brisca Renuga Associate Professor Department of Zoology Holy Cross College (Autonomous) Nagercoil - 04	Subject Expert (Zoology) 15/3/2022
4.	Dr. R. Uma Maheswari Assistant Professor PG Department of Zoology Arulmigu Palaniandavar Arts college for women Palani - 624 615	Subject Expert (Zoology) 15/3/22

5.	Dr. A. Vanniarajan Scientist Aravind Medical Research Foundation Madurai – 625 020	Industrialist / Scientist A. Vanni 15/03/2022
6.	Miss. S. Susaritha Research Scholar PG & Research Department of Zoology The American College Madurai – 625020	Alumna S. Susaritha 15/03/22
7.	Dr. N. Malathi	Dean of Academic Affairs N. Malathi 15/3/2022
8.	Dr. Antony Amala Jayaseeli	Staff Member
9.	Dr. N. Malathi	Staff Member N. Malathi 15/3/22
10.	Dr. Sr. Biji cyriac	Staff Member (absent)
11.	Dr. V. Bharathy	Staff Member V. Bhar 15.3.22
12.	Dr. N. Nagarani	Staff Member N. Nag 15/3/2022
13.	Dr. S. Barathy	Staff Member S. Barathy 15/3/22
14.	Mrs. J. Thelma	Staff Member Thelma 15/3/22
15.	Dr. K. Manimegalai	Staff Member K. M 15/3/22

MINUTES OF THE BOARD OF STUDIES:

1. ACTION TAKEN REPORT FOR 2021-2022 B.Sc Zoology

S. NO	COMMON SUGGESTIONS OFFERED IN THE PREVIOUS BOARD	ACTION TAKEN FOR THE ACADEMIC YEAR 2021-22
1.	Group projects/Field Projects maybe given to UG students to document local Biodiversity.	Group Projects/Field projects are given to UG students to document local Biodiversity.
2.	The DOER may have a minimum of 5 links for each paper.	5 links have been included in the DOER of each course to maintain uniformity.

CHANGE OF COURSE TITLE

S. NO	OLD COURSE CODE	NEW COURSE CODE	OLD COURSE TITLE	NEW COURSE TITLE	NEED FOR CHANGE
1.	Z5CC11	19Z5CC13	Biochemistry	Fundamentals of Biochemistry	As per the guidelines of Academic Deans to avoid repetition of course Title
2.	Z6CC14	19Z6CC17	Immunology	Basic Immunology	As per the guidelines of Academic Deans to avoid repetition of course title.
3.	Z6CC15	19Z6CC18	Biotechnology	Principles of Biotechnology	As per the guidelines of Academic Deans to avoid repetition of course title

NEW COURSES INTRODUCED

S. NO	COURSE CODE	COURSE TITLE	RELEVANCE TO				SCOPE FOR			NEED FOR INTRODUCTION
			L	R	N	G	EMP	ENT	SD	
1.	19Z5ME2	Animal Behaviour	L	R	N	G	-	-	SD	To introduce the classical aspects of Zoology
2.	19Z5CC15	Lab - Biochemical Analysis	-	-	N	G	EMP	-	SD	Implementation of Semesterwise Practical

3.	19Z5CC16	Lab-Molecular Biology	–	–	N	G	EMP	–	SD	Implementation of Semesterwise Practical
4.	19Z6CC19	Lab-Immunology	–	–	N	G	EMP	–	SD	Implementation of Semesterwise Practical
5.	19Z6CC20	Lab-Biotechnology	–	–	N	G	EMP	–	SD	Implementation of Semesterwise Practical
6.	21Z2SL1	Single cell protein Culture	L	R	N	G	EMP	ENT	SD	Offered to the Advanced Learners

REVISED COURSES

S. NO	COURSE CODE & TITLE	UNIT NO & REVISED CONTENT	% of Revision	NEED FOR REVISION	RELEVANCE TO				SCOPE FOR		
					L	R	N	G	EMP	ENT	SD
1.	19Z5ME1 Biostatistics	Unit-IV - Correlation Regression - Goodness of fitness (problem) and in Unit-V - Test of Variance Student's t test can be specified.	2%	As per the recommendation of Subject Expert	L	R	N	G	EMP	–	SD
2.	19Z5SB3 Ornamental Fish Culture	Entrepreneurial aspects can be included in unit I - Introduction to Aquarium	2%	As per the recommendation of Subject Expert	L	R	N	G	EMP	ENT	SD
3.	19Z5SB4 Sericulture	The topic - National Sericulture Project (NSP) can be included in unit-I, Introduction to Sericulture	5%	As per the recommendation of Subject Expert	L	R	N	G	EMP	ENT	SD
4.	19Z6ME6 Entomology	The topic Lac insect-culture & harvesting can be included in unit-III Beneficial insects	5%	As per the recommendation of Subject Expert	L	R	N	G	–	–	SD
5.	19Z6CC20 Lab-Biotechnology	one example can be specified for Holometabolus (Butterfly), Hemimetabolous (cockroach) insects	5%	As per the recommendation of Subject Expert	L	R	N	G	EMP	–	SD

		Rasmol can be given as example for molecular visualization Tool											
6.	19Z6SB6 Dairy Farming	The topic - Significance of indigenous breeds of cow can be included in Unit-I (Introduction)	2%	As per the recommendation of Subject Expert	L	R	N	G	EMP	ENT	SD

2. Updation of open Educational Resources

S.NO	COURSE CODE	COURSE TITLE	DETAILS OF UPDATION
-	-	-	-

3. Revision of courses

S. NO	COURSE CODE & COURSE TITLE	UNIT NO & REVISED CONTENT	% of Revision	NEED FOR REVISION	RELEVANCE TO SCOPE FOR						
					L	R	N	G	EMP	ENT	SD
1.	19Z4CC10 Microbiology	The Following topics are included - UNIT-II Bacteria - Autotrophic & heterotrophic nutrition, aerobic & anaerobic respiration, Beneficial & harmful role of bacteria UNIT-III Viruses - Lytic & Lysogenic cycle, Transmission of Viruses in Plants, animals & man	10%	As per the guidelines of Academic Deans & recommendation of course teachers	-	-	N	G	EMP	-	SD
2.	19Z4SB2 Mushroom Cultivation	The Following topics are included in Unit-II - Cultivation Techniques Compost - materials for compost preparation - Methods of composting - characteristics of	10%	As per the guidelines of Academic Deans & recommendation of course Teachers	L	R	N	G	EMP	ENT	SD

		compost - spawning - Methods, Types, Storage - Spawn running												
3.	19Z5CC15 Lab - Biochemical Analysis	Sakaguchi test & separation of amino acids by circular paper chromatography are included under experiments. Thin Layer chromatography is included as Spotter.	10%	As per the guidelines of Academic Deans & recommendation of Course Teachers	L	R	N	G	E M P	-	S D
4.	19Z5CC16 Lab - Molecular Biology	Isolation of UV mutations using - colony plate - Replica plating, Setting up of Southern blotting, Chemical mutagenesis & Genotoxicity analysis are included under experiments. Agarose gel electrophoresis & SDS-PAGE are included under Spotters	10%	As per the guidelines of Academic Deans & recommendation of Course Teachers	L	R	N	G	E M P	-	S D
5.	19Z5ME2 Animal Behaviour	The Following topics are included - Unit-I - Introduction to Animal Behaviour - Hormonal regulation of behaviour, Ethogram Unit-III Social & Reproductive Behaviour, Reproductive behaviour - Strategies & mating systems, Mating behaviour of Penguins	10%	As per the guidelines of Academic Deans & recommendation of Course Teachers	L	R	N	G	-	-	S D
6.	19Z6CC19 Lab - Immunology	ELISA, Western Blot & Flow cytometry are included under Immunology Spotters.	10%	As per the guidelines of Academic	L	R	N	G	E M P	-	S D

		Amniocentesis, Pregnancy diagnostic kit, Haemocytometer, Centrifuge and Semi Automated analyzer are included under spotters of Clinical Laboratory Techniques		Deans & recommendation of course Teachers									
7.	19Z6CC20 Lab-Biotechnology	Isolation of genomic DNA from goat liver/bacteria, Isolation of genomic DNA from plants are included under experiments. Southern blotting & UV transilluminator are included under spotters.	10%	As per the guidelines of Academic Deans & recommendation of course Teachers	L	R	N	G	EMP	-	SD
8.	19Z6ME4 Clinical Laboratory Techniques	The following topics are included - Unit II - Analysis of Urine, Benedict's test, Bence Jones Protein test & Nitroprusside Test; Unit III - Hematology, Erythrocyte Sedimentation Rate; Unit-IV - Semen analysis, Cryopreservation, Chorion villus sampling, Foetoscopy	10%	As per the guidelines of Academic Deans & recommendation of course Teachers	L	R	N	G	EMP	-	SD

4. NEW COURSES INTRODUCED

S. NO	COURSE CODE	COURSE TITLE	RELEVANCE TO				SCOPE FOR			NEED FOR INTRODUCTION
			L	R	N	G	EMP	ENT	SD	
1.	22Z6SB6	Poultry Farming	L	R	N	G	EMP	ENT	SD	To enhance the entrepreneurial aspects of the Programme
2.	21Z4SLN1	Public Health & Hygiene	L	R	N	G	EMP	-	SD	Offered to the advanced learners

5. Introduction of Purely Skill-Embedded certificate / Diploma / Advanced Diploma NIL

S.NO	COURSE CODE	COURSE TITLE	SKILLS SHARPENED	COURSE OUTCOME
-	-	NIL	-	-

6. Approval of Ph.D Course Work Syllabus : NIL

7. Rubrics for Project : NA

S.NO	C1 20 MKS	C2 20 MKS	CIA TOTAL 40 MKS	EXTERNAL 60 MKS
-	-	-	-	-

DETAILS OF SIGNED MOU : NIL

OHTER SUGGESTIONS	COMMENDATIONS
1. Hands-on training may be provided to the students whenever possible. 2. Biostatistics problems can be given using real-time data collected from the field. 3. Internship may be included for all UG programmes.	1. Changes made in the course contents of revised courses are useful and relevant to the current need. 2. Introduction of the new skill based course on Poultry Farming improves employability of students.

	Name of	Signature
1.	Head of the Department Dr. A. Tamil Selvi	15/03/2022
2.	University Nominee Dr. Capt. N. Arun Nagendran	15/3/22
3.	Subject Expert Dr. F. Brisca Renuga	15/3/2022
4.	Subject Expert Dr. R. Uma Maheswari	15/3/22
5.	Dr. A. Vanniarajan (Scientist)	15/03/2022
6.	Miss. S. Susaritha (Alumna)	15/03/22
7.	Dr. N. Malathi (Dean of Academic Affairs)	15/3/22
8.	Dr. Antony Amala Jayaseeli	15/03/2022
9.	Dr. N. Malathi	15/3/22
10.	Dr. Sr. Biji cyriac	(absent)
11.	Dr. V. Bharathy	15/3/22
12.	Dr. N. Nagarani	15/3/22
13.	Dr. S. Barathy	15/3/22
14.	Mrs. J. Thelma	15/3/22
15.	Dr. K. Manimegalai	15/3/22

VISION OF THE DEPARTMENT

Women Empowerment through Biological Education for the Betterment of Environment and Mankind

MISSION OF THE DEPARTMENT

- To ensure quality education offering skill based program
- To render entrepreneurial training to make students employable
- To create awareness on the conservation of Biodiversity
- To give ultimate insight into the correlation of various branches of biology that has overwhelming applications
- To facilitate Higher education & research (for the advanced learners)

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

PEO 1	Our graduates will be academic, digital and information literates; creative, inquisitive, innovative and desirous for the "more" in all aspects
PEO 2	They will be efficient individual and team performers, exhibiting progress, flexibility, transparency and accountability in their professional work
PEO 3	The graduates will be effective managers of all sorts of real – life and professional circumstances, making ethical decisions, pursuing excellence within the time framework and demonstrating apt leadership skills
PEO 4	They will engage locally and globally ,evincing social and environmental stewardship demonstrating civic responsibilities and employing right skills at the right moment.

GRADUATE ATTRIBUTES (GA)

Fatima College empowers her women graduates holistically. A Fatimite achieves all-round empowerment by acquiring Social,

Professional and Ethical competencies. A graduate would sustain and nurture the following attributes:

I. SOCIAL COMPETENCE	
GA 1	Deep disciplinary expertise with a wide range of academic and digital literacy
GA 2	Hone creativity, passion for innovation and aspire excellence
GA 3	Enthusiasm towards emancipation and empowerment of humanity
GA 4	Potentials of being independent
GA 5	Intellectual competence and inquisitiveness with problem solving abilities befitting the field of research
GA 6	Effectiveness in different forms of communications to be employed in personal and professional environments through varied platforms
GA 7	Communicative competence with civic, professional and cyber dignity and decorum
GA 8	Integrity respecting the diversity and pluralism in societies, cultures and religions
GA 9	All – inclusive skill - sets to interpret, analyse and solve social and environmental issues in diverse environments
GA 10	Self-awareness that would enable them to recognise their uniqueness through continuous self-assessment in order to face and make changes building their strengths and improving on their weaknesses
GA 11	Finesse to co-operate exhibiting team-spirit while working in groups to achieve goals
GA 12	Dexterity in self-management to control their selves in attaining the kind of life that they dream for

GA 13	Resilience to rise up instantly from their intimidating setbacks
GA 14	Virtuosity to use their personal and intellectual autonomy in being life-long learners
GA 15	Digital learning and research attributes
GA 16	Cyber security competence reflecting compassion, care and concern towards the marginalised
GA 17	Rectitude to use digital technology reflecting civic and social responsibilities in local, national and global scenario
II. PROFESSIONAL COMPETENCE	
GA 18	Optimism, flexibility and diligence that would make them professionally competent
GA 19	Prowess to be successful entrepreneursand employees of trans-national societies
GA 20	Excellence in Local and Global Job Markets
GA 21	Effectiveness in Time Management
GA 22	Efficiency in taking up Initiatives
GA 23	Eagerness to deliver excellent service
GA 24	Managerial Skills to Identify, Commend and tap Potentials
III. ETHICAL COMPETENCE	
GA 25	Integrity and disciplinein bringing stability leading a systematic life promoting good human behaviour to build better society
GA 26	Honesty in words and deeds
GA 27	Transparency revealing one's own character as well as self-esteem to lead a genuine and authentic life

GA 28	Social and Environmental Stewardship
GA 29	Readiness to make ethical decisions consistently from the galore of conflicting choices paying heed to their conscience
GA 30	Right life skills at the right moment

PROGRAMME OUTCOMES (PO)

On completion of B.Sc. ZOOLOGYprogramme, the graduates would be able to

PO 1	Apply acquired scientific knowledge to solve complex issues.
PO 2	Attain Analytical skills to solve complex cultural, societal and environmental issues.
PO 3	Employ latest and updated tools and technologies to analyse complex issue.
PO 4	Demonstrated Professional Ethics that foster community, Nation and Environment Building Initiatives.
PO 5	Apply the knowledge and skill to take up higher education, entrepreneurship and employment in government and private sectors.

PROGRAMME SPECIFIC OUTCOMES (PSO)

On completion ofB.Sc.ZOOLOGYprogramme, the graduates would be able to

PSO 1	Gain comprehensive knowledge in different branches of Zoology–Invertebrata, Chordata, Cell biology, Physiology, Environmental Biology, Biochemistry, Microbiology, Immunology, Embryology, Entomology,

	Genetics, Molecular Biology, Biotechnology, Biostatistics, Bioinformatics and Evolution.
PSO 2	Acquire technical skills in performing experiments in the field of Microbiology, Cell Biology, Biochemistry, Plant Physiology, Human Physiology, Molecular Biology, Environmental Biology, Developmental Biology, Biostatistics, Immunology, Evolution, Genetics, Clinical Laboratory Techniques, Biotechnology and Bioinformatics.
PSO 3	Develop empathy and instil love towards conserving plants and animals.
PSO 4	Express ideas and concept through seminar and assignments.
PSO 5	Solve the environmental problems by applying the biological principles for minimizing pollutants in air, water and land.
PSO 6	Develop environmental concern towards value of economically important plants, Biodiversity promote Bioremediation, Bio fertilizer and vegetative propagation.
PSO 7	Adopt Good Laboratory Practice, bioethics and biosafety guidelines to ensure minimal use of animals during experiments.
PSO 8	Exhibit the holistic growth by developing subject proficiency, interpersonal skills, and show vertical mobility in taking up PG courses and horizontal mobility by enrolling in B.Ed institution, clinical

	laboratory course and seek employment in schools, Medical coding and IT companies.
PSO 9	Make them self employed/ Entrepreneur in the field of Sericulture, Vermitechnology, Ornamental fish culture, Dairy farming, Apiculture, Mushroom cultivation and Horticulture.
PSO 10	Use of computers for Power point presentation, Virtual Dissection, analysis of bio- molecules using bioinformatics tools and computing biological data.
PSO 11	Healthy diet pattern for combat life style disorder.

OLD SYLLABUS

II B.Sc. Zoology

SEMESTER –IV

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
UAZO	19Z4CC10	Microbiology	Lecture	5	4

COURSE DESCRIPTION

This course deals with the study of microorganisms and its interaction with the environment.

COURSE OBJECTIVES

- To understand the fundamentals of the world of Microbes, distribution and their application for human welfare.
- To understand the structural similarities and differences among various microorganisms.
- To know various types of Culture media and the techniques for isolation of pure cultures of microbes.
- Comprehend the intricate interaction between viruses and host cells.

UNIT –I INTRODUCTION TO MICROBIOLOGY (15HRS.)

The historical development and scope of Microbiology -Sterilization and disinfections - physical and chemical methods - Culture media – Types -Culture techniques – Batch, Continuous, Synchronous and Fed-batch – Methods of culturing bacteria – Isolation of bacteria by Pure culture techniques. - Identification of Bacteria – Staining (Simple & Gram), Phenol red & Lipid hydrolysis Tests and Motility test.

Self-Study-Scope of Microbiology

4%

UNIT –II BACTERIA (15 HRS.)

Outline classification of Bacteria according to Bergey's Manual -Morphology and Physiology of Bacteria – Nutrition and growth –Bacterial respiration- Bacterial reproduction- Conjugation - Recombination- Economic importance.

Self-Study-Economic importance.

6%

UNIT –III VIRUSES (15 HRS.)

General properties of Viruses –Structure of viruses- TMV, Adenovirus, Bacteriophages – Shape of viruses (Polyhedral, helical and complex)-Classification and Nomenclature of Viruses - DNA & RNA viruses – Viral Multiplication - Cultivation of Viruses - Types of cultures and assay - Viriods, Virion and Prion (Short notes only)

UNIT –IV MICROBES IN THE ENVIRONMENT (15 HRS.)

Bacteriology of Water- Microbes in Pond, lake, Sea and domestic water-methods of purification of water: Water potability analysis, determination of sanitary quality- Microbes in air and Measurement of air contamination - Biogeochemical cycles -Nitrogen Cycle, Phosphorus Cycle, Nitrogen fixation - Microbes for alternate source of energy - Hydrogen producing bacteria - *Halobacteriumhalobium.*

Self-Study-Biogeochemical cycles -Nitrogen Cycle

UNIT –V INDUSTRIAL MICROBIOLOGY (15 HRS.)

Fermentation technology – Fermentor – Types of fermentor – Production of microbial products through fermentor – Production of Antibiotics (Penicillin, Streptomycin &Tetracyclines), Organic acids (Citric acid & Acetic acid), Solvents (Ethyl alcohol & Glycerol), Yeast (Brewer's and Baker's), Single cell proteins (Bacterial proteins).

TEXT BOOK:

Anandhanarayanan.R and Panicker C.K., (2016).Text book of Microbiology, 8th Edition, Universities Press (India) Private Limited.

REFERENCES:

1. Pelczar, M.J., Chan, E.C.S and Krieig N.R.,(2008). Microbiology, 5th Edition, Tata McGraw Hill Edition. United States.
2. Tortora G.J, Funke B.R and Case C.L., (2009).Microbiology: An Introduction,11th Edition, United States.
3. Prescott L.M. Harley J.P and Klein D.A., (2010) Microbiology, 8th Edition. New Delhi.
4. Patel A.H. (2008).Industrial microbiology, Macmillan India LTD, Chennai.

Digital Open Educational Resources (DOER) :

1. https://libguides.wccnet.edu/oer-subjects/microbiology
2. https://library.fvtc.edu/Microbiology/OER
3. https://www.oercommons.org/browse?f.keyword=microbiology
4. http://oer2go.org/mods/en-boundless/www.boundless.com/microbiology/textbooks/boundless-microbiology-textbook/industrial-microbiology-17/index.html
5. https://www.merlot.org/merlot/viewMaterial.htm?id=484489821

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 INTRODUCTION TO MICROBIOLOGY				
1.1	The historical development and scope of Microbiology	2	Chalk &Talk	Black Board

1.2	Sterilization and disinfections - physical and chemical methods	2	Chalk &Talk	LCD
1.3	Culture media – Types	1	Lecture	PPT & White board
1.4	Culture techniques – Batch, Continuous, Synchronous and Fed-batch	2	Lecture	Smart Board
1.5	Methods of culturing bacteria	2	Lecture	Black Board
1.6	Isolation of bacteria by Pure culture techniques	1	Discussion	Black Board
1.7	Identification of Bacteria	2	Specimen	Microscope
1.8	Staining (Simple & Gram), Phenol red & Lipid hydrolysis Tests and Motility test.	3	Discussion	Black Board
UNIT -2 BACTERIA				
2.1	Outline classification of Bacteria according to Bergey's Manual	2	Lecture	Black Board
2.2	Morphology and Physiology of Bacteria	4	Chalk & Talk	Black Board
2.3	Nutrition and growth	2	Chalk & Talk	Black Board
2.4	Bacterial respiration	3	Lecture	Black Board
2.5	Bacterial reproduction- Conjugation –Recombination	3	Chalk & Talk	Black Board
2.6	**Economic importance**	1	Lecture	Black Board
UNIT -3 VIRUSES				

3.1	General properties of Viruses	1	Chalk &Talk	Black Board
3.2	Structure of viruses- TMV, Adenovirus, Bacteriophages	3	Chalk & Talk	LCD
3.3	Shape of viruses (Polyhedral, helical and complex)	1	Lecture	PPT & White board
3.4	Classification and Nomenclature of Viruses	3	Lecture	Smart Board
3.5	DNA & RNA viruses	2	Lecture	Black Board
3.6	Viral Multiplication	3	Lecture	Black Board
3.7	Cultivation of Viruses	3	Discussio n	Black Board
3.8	Types of cultures and assay	2	Lecture	Black Board
3.9	Viriods, Virion and Prion (Short notes only)	2	Discussio n	Black Board
UNIT -4 MICROBES IN THE ENVIRONMENT				
4.1	Bacteriology of Water	1	Lecture	Black Board
4.2	Microbes in Pond, lake, Sea and domestic water	3	Chalk & Talk	Black Board
4.3	Methods of purification of water: Water potability analysis, determination of sanitary quality	3	Chalk & Talk	Black Board
4.4	Microbes in air and Measurement of air contamination	2	Lecture	Black Board
4.5	Biogeochemical cycles -Nitrogen Cycle, Phosphorus Cycle	2	Chalk &Talk	Black Board
4.5	Nitrogen fixation	2	Lecture	Black Board

4.6	Microbes for alternate source of energy - Hydrogen producing bacteria - *Halobacteriumhalobium.*	2	Chalk & Talk	Black Board
UNIT -5 INDUSTRIAL MICROBIOLOGY				
5.1	Fermentation technology	1	Lecture	Black Board
5.2	Fermentor – Types of fermentor	2	Chalk & Talk	Black Board
5.3	Production of microbial products through fermentor	2	Chalk & Talk	Black Board
5.4	Production of Antibiotics (Penicillin, Streptomycin &Tetracyclines)	3	Lecture	Black Board
5.5	Organic acids (Citric acid & Acetic acid)	2	Chalk & Talk	Black Board
5.5	Solvents (Ethyl alcohol & Glycerol), Yeast (Brewer's and Baker's)	3	Lecture	Black Board
5.6	Single cell proteins (Bacterial proteins)	2	Chalk & Talk	Black Board

INTERNAL - UG

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assessment
	T1 10 Mks.	T2 10 Mks.	Quiz 5 Mks.	Assignment 5 Mks	OBT/PPT 5 Mks	35 Mks.	5 Mks.	40Mks.	
K1	2	2	-	-	-	4	-	4	10 %
K2	2	2	5	-	-	9	-	9	22.5 %

K3	3	3	-	-	5	11	-	11	27.5 %
K4	3	3	-	5	-	11	-	11	27.5 %
Non Scholastic	-	-	-	-	-		5	5	12.5 %
Total	10	10	5	5	5	35	5	40	100 %

CIA	
Scholastic	35
Non Scholastic	5
	40

EVALUATION PATTERN

SCHOLASTIC					NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	C6	CIA	ESE	Total
10	10	5	5	5	5	40	60	100

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Examine the culturing methods and	K1	PSO1, PSO2,

	phenotypic identification of microbes		PSO4 & PSO8
CO 2	Examine the taxonomical classification, reproduction and genetic recombination in bacteria.	**K1**	PSO1, PSO2 PSO4 PSO8
CO 3	Elaborate the morphologic properties and cultivation of viruses.	**K2**	PSO1, PSO2 PSO4 & PS08
CO 4	Determine the role of microbes in the environment.	**K3**	PSO1, PSO2 PSO4& PSO8
CO 5	Correlate the technology of fermentation with the microbial production industrial products	**K4**	PSO1, PSO2 PSO4, PSO8

Mapping of COs with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	PSO 11	PSO 12
CO1	3	3	2	3	2	2	2	3	2	2	2	2
CO2	3	3	2	3	2	2	2	3	2	2	2	2
CO3	3	3	2	3	2	2	2	3	2	2	2	2
CO4	3	3	2	3	2	2	2	3	2	2	2	2
CO5	3	3	2	3	2	2	2	3	2	2	2	2

Mapping of COs with POs

CO/ PSO	PO1	PO2	PO3	PO4
CO1	3	2	2	2
CO2	3	2	2	2
CO3	3	2	2	2
CO4	3	2	2	2
CO5	3	2	3	2

Note: ♦ Strongly Correlated – **3** ♦ Moderately Correlated – **2**

♦ Weakly Correlated -**1**

COURSE DESIGNER:

Dr. X. Devanya Rosaline

Forwarded By

Dr. A. TAMIL SELVI
Head, Dept. of Zoology
FATIMA COLLEGE (AUTONOMOUS)
MADURAI-625 018

HOD'S Signature & Name

NEW SYLLABUS

II B.Sc. Zoology

SEMESTER –IV

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
UAZO	19Z4CC10	Microbiology	Lecture	5	4

COURSE DESCRIPTION

This course deals with the study of microorganisms and its interaction with the environment.

COURSE OBJECTIVES

- To understand the fundamentals of the world of Microbes, distribution and their application for human welfare.
- To understand the structural similarities and differences among various microorganisms.
- To know various types of Culture media and the techniques for isolation of pure cultures of microbes.
- Comprehend the intricate interaction between viruses and host cells.

UNIT –I INTRODUCTION TO MICROBIOLOGY (15HRS.)

The historical development and scope of Microbiology -Sterilization and disinfections - physical and chemical methods - Culture media – Types -Culture techniques – Batch, Continuous, Synchronous and Fed-batch – Methods of culturing bacteria – Isolation of bacteria by Pure culture techniques. - Identification of Bacteria – Staining (Simple & Gram), Phenol red & Lipid hydrolysis Tests and Motility test.

Self-Study-Scope of Microbiology

UNIT –II BACTERIA (15 HRS.)

Outline classification of Bacteria according to Bergey's Manual -Morphology and Physiology of Bacteria – Nutrition (Autotrophic & Heterotrophic) and Growth –Bacterial respiration – (Aerobic & Anaerobic)- Bacterial reproduction- Conjugation, Recombination- Beneficial & Harmful role of Bacteria.

Self-Study-Economic importance.

UNIT –III VIRUSES (15 HRS.)

General characteristics of Viruses - Classification and Nomenclature of Viruses–Structure of viruses –DNA & RNA viruses - Shape of Viruses- Polyhedral(Adenovirus) Helical (TMV), Complex (T4 Bacteriophage) - Viral Multiplication – Lytic and Lysogenic Cycle - Viriods and Prions (Short notes only) – Transmission of Viruses in Plants, Animals & Man.

UNIT –IV MICROBES IN THE ENVIRONMENT (15 HRS.)

Bacteriology of Water- Microbes in Pond, lake, Sea and domestic water-methods of purification of water: Water potability analysis, determination of sanitary quality- Microbes in air and Measurement of air contamination - Biogeochemical cycles -Nitrogen Cycle, Phosphorus Cycle, Nitrogen fixation - Microbes for alternate source of energy - Hydrogen producing bacteria –*Halobacteriumhalobium.*

Self-Study-Biogeochemical cycles -Nitrogen Cycle

UNIT –V INDUSTRIAL MICROBIOLOGY (15 HRS.)

Fermentation technology – Fermentor – Types of fermentor – Production of microbial products through fermentor – Production of Antibiotics (Penicillin, Streptomycin &Tetracyclines), Organic acids (Citric acid & Acetic acid), Solvents (Ethyl alcohol & Glycerol), Yeast (Brewer's and Baker's), Single cell proteins (Bacterial proteins).

TEXT BOOK:

Anandhanarayanan.R and Panicker C.K., (2016).Text book of Microbiology, 8th Edition, Universities Press (India) Private Limited.

REFERENCES:

5. Pelczar, M.J., Chan, E.C.S and Krieig N.R.,(2008). Microbiology, 5th Edition, Tata McGraw Hill Edition. United States.
6. Tortora G.J, Funke B.R and Case C.L., (2009).Microbiology: An Introduction,11th Edition, United States.
7. Prescott L.M. Harley J.P and Klein D.A., (2010) Microbiology, 8th Edition. New Delhi.
8. Patel A.H. (2008).Industrial microbiology, Macmillan India LTD, Chennai.

Digital Open Educational Resources (DOER) :

6. https://libguides.wccnet.edu/oer-subjects/microbiology
7. https://library.fvtc.edu/Microbiology/OER
8. https://www.oercommons.org/browse?f.keyword=microbiology
9. http://oer2go.org/mods/en-boundless/www.boundless.com/microbiology/textbooks/boundless-microbiology-textbook/industrial-microbiology-17/index.html
10. https://www.merlot.org/merlot/viewMaterial.htm?id=484489821

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 INTRODUCTION TO MICROBIOLOGY				
1.1	The historical development and scope of Microbiology	2	Chalk & Talk	Black Board
1.2	Sterilization and disinfections - physical and chemical methods	2	Chalk &Talk	LCD
1.3	Culture media – Types	1	Lecture	PPT & White board
1.4	Culture techniques – Batch, Continuous, Synchronous and Fed-batch	2	Lecture	Smart Board
1.5	Methods of culturing bacteria	2	Lecture	Black Board
1.6	Isolation of bacteria by Pure culture techniques	1	Discussion	Black Board
1.7	Identification of Bacteria	2	Specimen	Microscope
1.8	Staining (Simple & Gram),	3	Discussio	Black

	Phenol red & Lipid hydrolysis Tests and Motility test.		n	Board
UNIT -2 BACTERIA				
2.1	Outline classification of Bacteria according to Bergey's Manual	2	Lecture	Black Board
2.2	Morphology and Physiology of Bacteria	4	Chalk & Talk	Black Board
2.3	Nutrition(Autotrophic & Heterotrophic) and growth	2	Chalk & Talk	Black Board
2.4	Bacterial respiration (Aerobic & Anaerobic)	3	Lecture	Black Board
2.5	Bacterial reproduction- Conjugation –Recombination	3	Chalk & Talk	Black Board
2.6	Beneficial & Harmful role of Bacteria.	1	Lecture	Black Board
UNIT -3 VIRUSES				
3.1	General characteristics of Viruses	2	Chalk &Talk	Black Board
3.2	Classification and Nomenclature of Viruses	2	Chalk & Talk	LCD
3.3	Structure of viruses –DNA & RNA viruses	2	Lecture	Smart Board
3.4	Shape of Viruses- Polyhedral(Adenovirus)	2	Lecture	Black Board
3.5	Helical (TMV), Complex (T4 Bacteriophage)	2	Lecture	Black Board
3.6	Viral Multiplication – Lytic & Lysogenic Cycle -	2	Discussio n	Black Board

3.7	Viriods and Prions	1	Lecture	Black Board
3.8	Transmission of Viruses in Plants, Animals & Man.	2	Discussio n	Black Board
UNIT -4 MICROBES IN THE ENVIRONMENT				
4.1	Bacteriology of Water	1	Lecture	Black Board
4.2	Microbes in Pond, lake, Sea and domestic water	3	Chalk &Talk	Black Board
4.3	Methods of purification of water: Water potability analysis, determination of sanitary quality	3	Chalk & Talk	Black Board
4.4	Microbes in air and Measurement of air contamination	2	Lecture	Black Board
4.5	Biogeochemical cycles -Nitrogen Cycle, Phosphorus Cycle	2	Chalk & Talk	Black Board
4.5	Nitrogen fixation	2	Lecture	Black Board
4.6	Microbes for alternate source of energy - Hydrogen producing bacteria - *Halobacteriumhalobium.*	2	Chalk & Talk	Black Board
UNIT -5 INDUSTRIAL MICROBIOLOGY				
5.1	Fermentation technology	1	Lecture	Black Board
5.2	Fermentor – Types of fermentor	2	Chalk & Talk	Black Board
5.3	Production of microbial products through fermentor	2	Chalk & Talk	Black Board
5.4	Production of Antibiotics (Penicillin, Streptomycin	3	Lecture	Black

	&Tetracyclines)			Board
5.5	Organic acids (Citric acid & Acetic acid)	2	Chalk & Talk	Black Board
5.5	Solvents (Ethyl alcohol & Glycerol), Yeast (Brewer's and Baker's)	3	Lecture	Black Board
5.6	Single cell proteins (Bacterial proteins)	2	Chalk & Talk	Black Board

INTERNAL - UG

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assessment
	T1 10 Mks.	T2 10 Mks.	Quiz 5 Mks.	Assignment 5 Mks	OBT/PPT 5 Mks	35 Mks.	5 Mks.	40Mks.	
K1	2	2	-	-	-	4	-	4	10 %
K2	2	2	5	-	-	9	-	9	22.5 %
K3	3	3	-	-	5	11	-	11	27.5 %
K4	3	3	-	5	-	11	-	11	27.5 %
Non Scholastic	-	-	-	-	-		5	5	12.5 %
Total	10	10	5	5	5	35	5	40	100 %

CIA	
Scholastic	35
Non Scholastic	5
	40

EVALUATION PATTERN

SCHOLASTIC					NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	C6	CIA	ESE	Total
10	10	5	5	5	5	40	60	100

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Examine the culturing methods and phenotypic identification of microbes	K1	PSO1, PSO2, PSO4 & PSO8
CO 2	Examine the taxonomical classification, reproduction and genetic recombination in bacteria.	K1	PSO1, PSO2 PSO4 PSO8
CO 3	Elaborate the morphologic properties and cultivation of viruses.	K2	PSO1, PSO2 PSO4 & PS08
CO 4	Determine the role of microbes in the environment.	K3	PSO1, PSO2 PSO4& PSO8
CO 5	Correlate the technology of fermentation with the microbial production industrial products	K4	PSO1, PSO2 PSO4, PSO8

Mapping of COs with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	PSO 11	PSO 12
CO1	3	3	2	3	2	2	2	3	2	2	2	2
CO2	3	3	2	3	2	2	2	3	2	2	2	2
CO3	3	3	2	3	2	2	2	3	2	2	2	2
CO4	3	3	2	3	2	2	2	3	2	2	2	2
CO5	3	3	2	3	2	2	2	3	2	2	2	2

Mapping of COs with POs

CO/ PSO	PO1	PO2	PO3	PO4
CO1	3	2	2	2
CO2	3	2	2	2
CO3	3	2	2	2
CO4	3	2	2	2
CO5	3	2	3	2

Note: ♦ Strongly Correlated – **3** ♦ Moderately Correlated – **2**

♦ Weakly Correlated -**1**

COURSE DESIGNER:
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HOD'S Signature & Name

OLD SYLLABUS

III B.Sc. Zoology

SEMESTER –V

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
UAZO	19Z5CC15	Lab - Biochemical Analysis	Practical	4	2

COURSE DESCRIPTION

This course introduces the students to the biochemical analytical experiments for Carbohydrates, Protein and Lipids by providing familiarization with the preparation of reagents, proper use of instrumentation and interpretation of the properties of the Biomolecules.

COURSE OBJECTIVES

- Acquire skills in handling basic equipments
- Estimate the various biomolecules using standard protocols
- Critically analyze and interpret the results
- Design experiments to solve research problems

UNITS

CONTENT

10%

1. Laboratory biosafety guidelines

2. Preparation of solutions – Percentage, Normality, Molarity, Molality, ppm, preparation of working standard from stock solution.

3. Qualitative analysis of Carbohydrates: Barford's Test, Fehling's test, Seliwanoff's test and Iodine test.

4. Qualitative analysis of Proteins: Biuret test and Ninhydrin test.

5. Qualitative analysis of lipids: Saponification test, Iodine Absorption test, Salkowski's Test for Cholesterol and Dunstan's Test for Glycerol.

6. Estimation of Glucose by Anthrone method.

7. Estimation of Protein by Lowry's method.

8. Spotters- pH meter, ChromatographicChamber, Colorimeter, Spectrophotometer

REFERENCES:

1.Plummer, D.T. (2008).*An Introduction to Practical Biochemistry*. Tata McGraw- Hill Publication, New Delhi.

2. Wilson, K and Walker, J. (2008). *Practical Biochemistry*. Cambridge State University Press, U.K.

3. Boyer, R.F. (2012).*Modern Experimental Biochemistry*. Pearson Education, India.

DIGITAL OPEN EDUCATIONAL RESOURCES

1. http://www.oercommons.org/courses/biochemistry-3/view
2. https://louis.oercommons.org/curated-collections/52
3. https://libguides.wesleyan.edu/c.php?g=924060&p=6671362

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
CONTENT				
1	Laboratory biosafety guidelines	1	Lecture	LCD
2.1	Preparation of solutions -Percentage, Normality, Molarity	2	Chalk & Talk	Black Board
2.2	Preparation of solutions - Molality, ppm, preparation of working standard from stock	2	Chalk & Talk	Black Board

	solution.			
3.1	Qualitative analysis of Carbohydrates: Barford's Test, Fehling's test	1	Demonstration & hands on training	Black Board
3.2	Qualitative analysis of Carbohydrates: Seliwanoff's test and Iodine test.	1	Demonstration & hands on training	Black Board
4.1	Qualitative analysis of Proteins: Biuret test and Ninhydrin test.	1	Demonstration & hands on training	Black Board
5.1	Qualitative analysis of lipids - Saponification test, Iodine Absorption test	2	Demonstration & hands on training	Black Board
5.2	Qualitative analysis of lipids: Salkowski's Test for Cholesterol and Dunstan's Test for Glycerol.	1	Demonstration & hands on training	Black Board
6	Estimation of Glucose by Anthrone method.	1	Demonstration & hands on training	Green Board
7	Estimation of Protein by Lowry's method	2	Demonstration & hands on training	Green Board
8	Spotters- pH meter, Chromatographic Chamber, Colorimeter, Spectrophotometer	1	Specimen	LCD

CIA	
Scholastic	**35**
Non Scholastic	**5**
	40

EVALUATION PATTERN

MARKS		
CIA	ESE	Tota l
40	60	100

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Make use of the knowledge of basic principles of Biochemistry to carry out the biochemical experiments	K3	PSO1, PSO2, PSO4, PSO7 & PSO8
CO 2	Infer the outcome of the qualitative analytical tests of Biomolecules	K2	PSO1, PSO2, PSO4 & PSO8
CO 3	Estimate the biomolecules using standard protocols	K5	PSO1, PSO2, PSO4, PSO7 & PSO8
CO 4	Develop skills in handling basic equipments	K3	PSO1, PSO2, PSO4, PSO7 & PSO8
CO 5	Develop familiarity with the principles of Laboratory safety	K3	PSO1, PSO2, PSO4,PSO7 & PSO8

Mapping of COs with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	PSO 11	PSO 12
CO1	3	3	2	3	2	2	3	3	2	2	2	2

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

Mapping of COs with POs

CO/ PSO	PO1	PO2	PO3	PO4
CO1	3	2	3	2
CO2	3	2	3	2
CO3	3	3	3	2
CO4	3	3	3	2
CO5	3	3	2	3

Note: ♦ **Strongly Correlated – 3** ♦ **Moderately Correlated – 2**
♦ **Weakly Correlated -1**

COURSE DESIGNER:

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HOD'S Signature & Name

NEW SYLLABUS

III B.Sc. Zoology

SEMESTER –V

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
UAZO	**19Z5CC15**	**Lab - Biochemical Analysis**	**Practical**	**4**	**2**

COURSE DESCRIPTION

This course introduces the students to the biochemical analytical experiments for Carbohydrates, Protein and Lipids by providing familiarization with the preparation of reagents, proper use of instrumentation and interpretation of the properties of the Biomolecules.

COURSE OBJECTIVES

- Acquire skills in handling basic equipments
- Estimate the various biomolecules using standard protocols
- Critically analyze and interpret the results
- Design experiments to solve research problems

UNITS

CONTENT

1. Laboratory biosafety guidelines

2. Preparation of solutions – Percentage, Normality, Molarity, Molality, ppm, preparation of working standard from stock solution.

3. Qualitative analysis of Carbohydrates: Barford's Test, Fehling's test, Seliwanoff's test and Iodine test.

4. Qualitative analysis of Proteins: Biuret test, Sakaguchi test and Ninhydrin test.

5. Qualitative analysis of lipids: Saponification test, Iodine Absorption test, Salkowski's Test for Cholesterol and Dunstan's Test for Glycerol.

6. Separation of amino acids by circular paper chromatography.

7. Demonstration- Estimation of Glucose by Anthrone method.

8. Demonstration – Estimation of Protein by Lowry's method.

9. Spotters- pH meter, Chromatographic Chamber, Colorimeter, Spectrophotometer & Thin Layer Chromatography

REFERENCES:

1.Plummer, D.T. (2008).*An Introduction to Practical Biochemistry*. Tata McGraw- Hill Publication, New Delhi.

2. Wilson, K and Walker, J. (2008). *Practical Biochemistry*. Cambridge State University Press, U.K.

3. Boyer, R.F. (2012).*Modern Experimental Biochemistry*. Pearson Education, India.

DIGITAL OPEN EDUCATIONAL RESOURCES

4. http://www.oercommons.org/courses/biochemistry-3/view
5. https://louis.oercommons.org/curated-collections/52
6. https://libguides.wesleyan.edu/c.php?g=924060&p=6671362
7. https://bio.libretexts.org/learning_objectives/laboratory_experiments/Biochemistry_labs
8. https://www.encyclopedia.com/science/encylopedias-almanacs_transcripts-and maps/biochemicalanalysis

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
CONTENT				

1	Laboratory biosafety guidelines	1	Lecture	LCD
2.1	Preparation of solutions -Percentage, Normality, Molarity	2	Chalk & Talk	Black Board
2.2	Preparation of solutions - Molality, ppm, preparation of working standard from stock solution.	2	Chalk & Talk	Black Board
3.1	Qualitative analysis of Carbohydrates: Barford's Test, Fehling's test	1	Demonstration & hands on training	Black Board
3.2	Qualitative analysis of Carbohydrates: Seliwanoff's test and Iodine test.	1	Demonstration & hands on training	Black Board
4.1	Biuret test, Sakaguchi test and Ninhydrin test.	1	Demonstration & hands on training	Black Board
5.1	Qualitative analysis of lipids - Saponification test, Iodine Absorption test	2	Demonstration & hands on training	Black Board
5.2	Qualitative analysis of lipids: Salkowski's Test for Cholesterol and Dunstan's Test for Glycerol.	1	Demonstration & hands on training	Black Board
6	Demonstration of Glucose by Anthrone method.	1	Demonstration & hands on training	Green Board
7	Demonstration of Protein by Lowry's method	2	Demonstration & hands on training	Green Board
8	Spotters- pH meter, Chromatographic Chamber, Colorimeter, Spectrophotometer & Thin Layer Chromatography	1	Specimen	LCD

CIA	
Scholastic	**35**
Non Scholastic	**5**

	40

EVALUATION PATTERN

MARKS		
CIA	**ESE**	**Total**
40	**60**	**100**

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Make use of the knowledge of basic principles of Biochemistry to carry out the biochemical experiments	**K3**	PSO1, PSO2, PSO4, PSO7 & PSO8
CO 2	Infer the outcome of the qualitative analytical tests of Biomolecules	**K2**	PSO1, PSO2, PSO4 & PSO8
CO 3	Estimate the biomolecules using standard protocols	**K5**	PSO1, PSO2, PSO4, PSO7 & PSO8
CO 4	Develop skills in handling basic equipments	**K3**	PSO1, PSO2, PSO4, PSO7 & PSO8
CO 5	Develop familiarity with the principles of Laboratory safety	**K3**	PSO1, PSO2, PSO4,PSO7 & PSO8

Mapping of COs with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	PSO 11	PSO 12
CO1	3	3	2	3	2	2	3	3	2	2	2	2
CO2	3	3	2	3	2	2	2	3	2	2	2	2
CO3	3	3	2	3	2	2	3	3	2	2	2	2
CO4	3	3	2	3	2	2	3	3	2	2	2	2

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

Mapping of COs with Pos

CO/ PSO	PO1	PO2	PO3	PO4
CO1	3	2	3	2
CO2	3	2	3	2
CO3	3	3	3	2
CO4	3	3	3	2
CO5	3	3	2	3

Note: ♦ **Strongly Correlated – 3** ♦ **Moderately Correlated – 2**
♦ **Weakly Correlated -1**

COURSE DESIGNER:

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HOD'S Signature & Name

OLD SYLLABUS

III B.Sc. Zoology

SEMESTER – V

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
UAZO	19Z5CC16	Lab - Molecular Biology	Practical	4	2

COURSE DESCRIPTION

The course intends to provide hands on experience on techniques related to isolation and estimation of DNA, RNA and separation of phytoconstituents by paper chromatography and thin layer chromatography

COURSE OBJECTIVES

To gain practical skills to isolate, estimate and separate various biomolecules

EXPERIMENTS 10%

MOLECULAR BIOLOGY

1. Laboratory biosafety guidelines
2. Isolation of Genomic DNA from Bacteria.
3. Isolation of Genomic DNA from mammalian tissue.
4. Qualitative analysis of DNA
5. Isolation of RNA from Yeast.
6. Qualitative analysis of RNA
7. pH metry - Titration curve
8. Buffer preparation
9. Separation of phytoconstituents and amino acids - Ascending chromatography
10. Circular paper chromatography
11. Separation of amino acids - Thin Layer Chromatography

12. Plasmolysis
13. **Spotters:** DNA Double Helix Model, DNA Replication, Agarose Gel Electrophoresis, Polyacrylamide Gel Electrophoresis, Centrifuge

BIOSTATISTICS

1. Measures of central tendency & Measures of dispersion (problems)
2. Diagrammatic representation of data

ANIMAL BEHAVIOUR

1. Social behavior of animals – Ant
2. Geotactic and phototactic behavior of earthworms

REFERENCES:

1. Rajan S., Christy, S.R., (2011). E*xperimental procedures in Life Sciences*, Anjana Book House, Chennai.
2. Sinha J., Chatterjee A.K., Chattopadhyay P., (2015). *Advanced Practical Zoology*, Books and Allied (P) Ltd., Calcutta.
3. Tembhare D.B., (2008). *Techniques in Life Sciences*, 1st ed., Himalaya Publishing House Pvt. Ltd., Mumbai.
4. Dutta A., (2009). *Experimental Biology Lab manual*, Narosa Publishing House, New Delhi.
5. Plummer T.D., (1990). *An Introduction to Practical Biochemistry*, 4th ed., McGraw Hill Book Company, Europe.
6. Palanivelu P., (2004). *Analytical Biochemistry and Separation Techniques – A laboratory manual for B.Sc and M.Sc students*, 3rd ed., Kalaimani Printers, Madurai.
7. Wilson K and Walker J., (2013). *Principles and Techniques of Biochemistry and Molecular Biology*, 7th ed., Cambridge University Press, New York.
8. Boyer R., (2000). *Modern Experimental Biochemistry*, 3rd ed., Pearson Education Inc.
9. Wilson K and Kenneth H.G., (1992). *A Biologists Guide to Principles and Techniques of Practical Biochemistry*, 3rd ed., Cambridge University Press, Cambridge, UK.

DIGITAL OPEN EDUCATIONAL RESOURCES

1. https://www.oercommons.org/authoring/2459-conditioning-animals-learning-behaviour-ecology-en/view
2. https://www.oercommons.org/authoring/2442-adaptation-vampirism-ecology-environment-the-virtu/view

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
MOLECULAR BIOLOGY				
1.1	Laboratory biosafety guidelines	4	Lecture & Demonstration	Blackboard & Specimen
1.2	Isolation of Genomic DNA from Bacteria.	4	Demonstration	Specimen
1.3	Isolation of Genomic DNA from mammalian tissue.	4	Demonstration	Specimen
1.4	Qualitative analysis of DNA	4	Demo	Calf Thymus DNA
1.5	Isolation of RNA from Yeast.	4	Demo	Specimen
1.6	Qualitative analysis of RNA	4	Demo	Specimen
1.7	pH metry - Titration curve	4	Hands on training	Buffers & Fruit Juices
1.8	Buffer preparation	2	Hands on training	Buffers
1.9	Separation of phytoconstituents and amino acids - Ascending	4	Hands on training	Calf Thymus DNA

	chromatography			
1.10	Circular paper chromatography	4	Hands on training	Tissue sample
1.11	Separation of amino acids - Thin Layer Chromatography	4	Hands on training	Std. RNA, tissue sample
1.12	Plasmolysis	4	Hands on training	Agarose gel electrophoretic unit
1.13	**Spotters:** DNA Double Helix Model, DNA Replication, Descending Chromatography, Colorimeter, Centrifuge	2	Observation	Models, equipments, Microscope
BIOSTATISTICS & ANIMAL BEHAVIOUR				
2.1	Measures of central tendency & Measures of dispersion (problems)	2	Hands on training	Specimen
2.2	Diagrammatic representation of data	2	Hands on training	MS - Excel
2.3	Social behavior of animals	4	Hands on training	Specimen
2.4	Geotactic and phototactic behavior of earthworms	4	Hands on training	Specimen

CIA	
Scholastic	**35**
Non Scholastic	**5**
	40

EVALUATION PATTERN

MARKS		
CIA	ESE	Tota l
40	60	100

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSE D
CO 1	Estimate the pH of different samples	K2	PSO 2
CO 2	Infer the color changes in DNA and RNA estimation	K2	PSO 2 PSO 7
CO 3	Compute the Rf value for paper chromatography	K3	PSO 2
CO 4	Demonstrate the genomic DNA isolation, DNA estimation and chromatography	K3	PSO 2
CO 5	Solve the presence of nucleic acid in the given sample	K3	PSO 2

Mapping of COs with PSOs

CO/ PSO	PS O1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	PSO 11	PSO 12
CO1	2	3	2	2	2	2	2	2	2	2	2	2

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

Mapping of COs with POs

CO/ PSO	PO1	PO2	PO3	PO4
CO1	2	2	2	2
CO2	2	2	2	2
CO3	2	2	2	2
CO4	2	2	2	3
CO5	2	2	2	2

Note: ♦ Strongly Correlated – **3** ♦ Moderately Correlated – **2**

♦ Weakly Correlated -**1**

COURSE DESIGNER:
Dr. J. Asnet Mary

Forwarded By

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Head, Dept. of Zoology
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NEW SYLLABUS

III B.Sc. Zoology

SEMESTER – V

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CR
UAZO	19Z5CC16	Lab - Molecular Biology	Practical	4	

COURSE DESCRIPTION

The course intends to provide hands-on experience on techniques related to isolation and estimation of DNA, RNA and separation of phytoconstituents by paper chromatography and thin-layer chromatography

COURSE OBJECTIVES

To gain practical skills to isolate, estimate and separate various biomolecules

EXPERIMENTS

MOLECULAR BIOLOGY

1. Laboratory biosafety guidelines.
2. Micropipetting techniques and calculations.
3. Isolation of Genomic DNA from mammalian tissue.
4. Estimation of DNA by DPA method.
5. Isolation of RNA from Yeast.
6. Estimation of RNA by Orcinol method.
7. Isolation of UV mutants using colony plate – Replica plating.
8. Setting up of Southern blotting.
9. Chemical mutagenesis.
10. Genotoxicity assay.
11. **Spotters:** DNA Double Helix Model, DNA Replication, Agarose Gel Electrophoresis, SDS-PAGE.

BIOSTATISTICS

1. Calculation of Measures of central tendency & Measures of dispersion using neem leaves
2. Diagrammatic representation of data

ANIMAL BEHAVIOUR

1. Social behavior of animals – Ant
2. Geotactic and phototacticbehavior of earthworms

REFERENCES:

1. Rajan S., Christy, S.R., (2011). E*xperimental procedures in Life Sciences*, Anjana Book House, Chennai.
2. Sinha J., Chatterjee A.K., Chattopadhyay P., (2015). *Advanced Practical Zoology*, Books and Allied (P) Ltd., Calcutta.
3. Tembhare D.B., (2008). *Techniques in Life Sciences*, 1st ed., Himalaya Publishing House Pvt. Ltd., Mumbai.
4. Dutta A., (2009). *Experimental Biology Lab manual*, Narosa Publishing House, New Delhi.
5. Plummer T.D., (1990). *An Introduction to Practical Biochemistry*, 4th ed., McGraw Hill Book Company, Europe.
6. Palanivelu P., (2004). *Analytical Biochemistry and Separation Techniques – A laboratory manual for B.Sc and M.Sc students*, 3rd ed., Kalaimani Printers, Madurai.
7. Wilson K and Walker J., (2013). *Principles and Techniques of Biochemistry and Molecular Biology*, 7th ed., Cambridge University Press, New York.
8. Boyer R., (2000). *Modern Experimental Biochemistry*, 3rd ed., Pearson Education Inc.
9. Wilson K and Kenneth H.G., (1992). *A Biologists Guide to Principles and Techniques of Practical Biochemistry*, 3rd ed., Cambridge University Press, Cambridge, UK.

DIGITAL OPEN EDUCATIONAL RESOURCES

3. https://www.oercommons.org/authoring/2459-conditioning-animals-learnin

g-behaviour-ecology-en/view

4. https://www.oercommons.org/authoring/2442-adaptation-vampirism-ecology-environment-the-virtu/view
5. https://statisticsbyjim.com/basics/measures-central-tendency-mean-median-mode/
6. https://userpages.umbc.edu/~jwolf/method1.htm
7. https:///www.chemsafetypro.com/Topics?CRA?mutagenecity_and_Genotoxicity.html

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
MOLECULAR BIOLOGY				
1.1	Laboratory biosafety guidelines	4	Lecture & Demonstration	Blackboard & Specimen
1.2	Micropipetting techniques and calculations	4	Demonstration	Micropipettes
1.3	Isolation of Genomic DNA from mammalian tissue.	4	Demonstration	Specimen
1.4	Estimation of DNA by DPA method	4	Demo	Calf Thymus DNA
1.5	Isolation of RNA from Yeast.	4	Demo	Specimen
1.6	Estimation of RNA by Orcinol method.	4	Demo	Specimen
1.7	Isolation of UV mutants using colony plate – Replica plating.	4	Hands on training	Bacteria, Laminar air flow

1.8	Setting up of Southern blotting.	2	Hands on training	Buffers
1.9	Chemical mutagenesis	4	Hands on training	Bacteria, chemicals, Laminar air flow
1.10	Genotoxicity assay	4	Hands on training	Tissue sample
1.13	**Spotters:** DNA Double Helix Model, DNA Replication, Agarose Gel Electrophoresis, SDS-PAGE.	2	Observation	Models, equipments, Agarose gel electrophoretic unit, PAGE unit
BIOSTATISTICS & ANIMAL BEHAVIOUR				
2.1	Calculation of Measures of central tendency & Measures of dispersion using neem leaves	2	Hands on training	Neem leaves
2.2	Diagrammatic representation of data	2	Hands on training	MS - Excel
2.3	Social behavior of animals	4	Hands on training	Specimen
2.4	Geotactic and phototacticbehavior of earthworms	4	Hands on training	Specimen

CIA	
Scholastic	**35**
Non Scholastic	**5**
	40

EVALUATION PATTERN

MARKS		
CIA	ESE	Total
40	60	100

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Estimate the pH of different samples	K2	PSO 2
CO 2	Infer the color changes in DNA and RNA estimation	K2	PSO 2 PSO 7
CO 3	Compute the Rf value for paper chromatography	K3	PSO 2
CO 4	Demonstrate the genomic DNA isolation, DNA estimation and chromatography	K3	PSO 2
CO 5	Solve the presence of nucleic acid in the given sample	K3	PSO 2

Mapping of COs with PSOs

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12
CO1	2	3	2	2	2	2	2	2	2	2	2	2
CO2	2	3	2	2	2	2	2	2	2	2	2	2
CO3	2	2	2	2	2	2	2	2	2	2	2	2
CO4	2	2	2	2	2	2	2	2	2	2	2	2

CO 5	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**

Mapping of COs with POs

CO/ PSO	PO1	PO2	PO3	PO4
CO1	2	2	2	2
CO2	2	2	2	2
CO3	2	2	2	2
CO4	2	2	2	3
CO5	2	2	2	2

Note: ♦ Strongly Correlated – **3** ♦ Moderately Correlated – **2**

♦ Weakly Correlated -**1**

COURSE DESIGNER:

Dr. J. AsnetMaryForwarded

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FATIMA COLLEGE (AUTONOMOUS)
MADURAI-625 018

By

HOD'S Signature & Name

OLD SYLLABUS

III B.Sc.Zoology

SEMESTER –V

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
UAZO	19Z5ME2	Animal Behaviour	Lecture	5	5

COURSE DESCRIPTION

Students gain knowledge on learning, behaviour and biorhythm in animal.

COURSE OBJECTIVES

- Acquire fundamental knowledge on the behavioural concept in animals
- Understand the environment, social and reproductive behaviour in animals
- Summarize the phenomenon behind the molecular basis of biological rhythm including circadian.

UNITS

UNIT I – INTRODUCTION TO ANIMAL BEHAVIOUR (15 HRS.)

3%

Origin, history and scope of Ethology.Contribution of Karl Von F ı Pavlov, Konrad Lorenz, NikoTinbergen.Causes - Proximate and ultimate. Types - Innate and Acquired, Instinctive and Motivated behaviour. Pattern of behaviour - Stereotyped Behaviours (Orientation, Reflexes); Individual Behavioural patterns; Instinct vs. Learnt behaviour.

Self-Study - Origin, history and scope of Ethology

UNIT II – LEARNING AND MEMORY (15 HRS.)

Types of learning - Physiology and phylogeny of learning - trial and error

learning, Imprinting, habituation. Classical conditioning: - Pavlov's experiment; Operant learning – Skinner's experiment, insight, Instrumental conditioning, association learning and reasoning.

UNIT III – SOCIAL AND REPRODUCTIVE BEHAVIOUR - (15 HRS.)

7%

Social Behaviour - Communication and the senses; Altruism; Insects' society with Honey bee as example; Foraging in honey bee and advantages of the waggle dance. Sexual Behaviour: Courtship and signal: *Hilara sartor* (Balloon fly) and ♂ Stickleback's zigzag dance. Asymmetry of sex - Sexual dimorphism, Mate choice, Intra-sexual selection (male rivalry), Inter-sexual selection (female choice), Sexual conflict in parental care.

Self-Study - Insects' society with Honey bee as example

UNIT IV – NEURAL AND HORMONAL CONTROL OF BEHAVIOUR(15 HRS.)

Role of pheromones in reproductive behaviour. Communication - Chemical, visual, light and audio. Ecological aspects of behaviour - Habitat selection, food selection, anti-predator defence, aggression, host parasite relations.

Self-Study - Host parasite relations

UNIT V – BIOLOGICAL RHYTHM (15 HRS.)

Types and characteristics of biological rhythms: Short- and Long- term rhythms, Circadian rhythms, Tidal rhythms and Lunar rhythms. Concept of synchronization and masking - Photic and non-photic zeitgebers. Circannual rhythms; Photoperiod and regulation of seasonal reproduction in vertebrates - Role of melatonin.

UNIT –VI DYNAMISM (Evaluation Pattern-CIA only) (HRS.)

REFERENCES:

1. Arumugam, N and P. Natarajan, (2018).Animal Behaviour – Ethology.SarasPublication.Nagercoil
2. Jay. C. Dunlap, Jennifer. J.Loros, Patricia J. DeCoursey (ed). (2004). Chronobiology Biological Timekeeping: Sinauer Associates, Inc.Publishers, Sunderland, MA, USA

3. Saunders, D.S., C.G.H. Steel, X., (2002) Insect Clocks Afopoulou (ed.)R.D. Lewis. (3rdEd) Barens and Noble Inc. New York, USA
4. Vinod Kumar (2002) Biological Rhythms: Narosa Publishing House, Delhi/ Springer-Verlag, Germany.

DIGITAL OPEN EDUCATIONAL RESOURCES

1. **https://www.oercommons.org/authoring/2459-conditioning-animals-learning-behaviour-ecology-en/view**
2. **https://www.oercommons.org/browse?f.keyword=animal-behaviour**
3. **https://www.psychologytoday.com/intl/basics/animal-behavior**
4. **https://seaworld.org/animals/all-about/training/animal-behavior-and-learning/**
5. **https://www.nature.com/subjects/animal-behaviour**

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 INTRODUCTION TO ANIMAL BEHAVIOUR				
1.1	Origin, history and scope of Ethology	2	Chalk & Talk	Black Board
1.2	Contribution of Karl Von Frish, Ivan Pavlov, Konrad Lorenz, Niko Tinbergen.	1	Lecture	Black Board
1.3	Contribution of Konrad Lorenz, Niko Tinbergen	1	Lecture	PPT & White board
1.4	Causes of behaviour: Proximate and ultimate	1	Lecture	Smart Board

1.5	Types of Behaviour: Innate and Acquired	2	Lecture	Black Board
1.6	Instinctive and Motivated behaviour.	1	Discussion	Google classroom
1.7	Pattern of behaviour: Stereotyped Behaviours (Orientation, Reflexes)	3	Lecture	Black Board
1.8	Individual Behavioural patterns	2	Lecture	Black Board
1.9	Instinct vs. Learnt behaviour	2	Lecture	Black Board
UNIT -2 LEARNING AND MEMORY				
2.1	Types of learning	1	Lecture	Green Board Charts
2.2	Physiology and phylogeny of learning	2	Chalk & Talk	Green Board
2.3	Trial and error learning, Imprinting, habituation.	2	Chalk & Talk	Black Board
2.4	Classical conditioning: - Pavlov's experiment	2	Chalk & Talk	LCD
2.5	Operant learning – Skinner's experiment	4	Lecture	PPT
2.6	Insight - Instrumental conditioning, association learning and reasoning.	4	Lecture	PPT
UNIT -3 SOCIAL AND REPRODUCTIVE BEHAVIOUR				

3.1	Social Behaviour: Concept of Society; Communication and the senses	3	Lecture	Black Board
3.2	Altruism; Insects' society with Honey bee as example	2	Discussio n	Black Board
3.3	Foraging in honey bee and advantages of the waggle dance	2	Chalk &Talk	Black Board
3.4	Sexual Behaviour: Courtship and signal: Hilara sartor (Balloon fly) and ♂ Stickleback's zigzag dance.	3	Chalk & Talk	LCD
3.5	Asymmetry of sex, Sexual dimorphism, Mate choice	2	Lecture	PPT
3.6	Intra-sexual selection (male rivalry), Inter-sexual selection (female choice)	1	Lecture	PPT/LCD
3.7	Sexual conflict in parental care.	2	Lecture	PPT & White board
UNIT -4 NEURAL AND HORMONAL CONTROL OF BEHAVIOUR				
4.1	Motivation: Role of hormones	2	Discussio n	Black Board
4.2	Aggregation	1	Lecture	PPT
4.3	Role of pheromones in reproductive behaviour	3	Chalk & Talk	Black Board

4.4	Communication: Chemical, visual, light and audio.	3	Chalk & Talk	LCD
4.5	Ecological aspects of behaviour: Habitat selection, food selection, anti-predator defenses, aggression,	4	Lecture	PPT & White board
4.6	Host parasite relations	2	Discussion	Black Board
UNIT -5 BIOLOGICAL RHYTHM				
5.1	Types and characteristics of biological rhythms	2	Discussion	Black Board
5.2	Short- and Long- term rhythms;	2	Lecture	PPT/LCD
5.3	Circadian rhythms; Tidal rhythms and Lunar rhythms	2	Chalk & Talk	Black Board
5.4	Concept of synchronization and masking; Photic and non-photic zeitgebers	3	Lecture	Green Board
5.5	Circannual rhythms	2	Lecture	PPT
5.6	Photoperiod and regulation seasonal reproduction of vertebrates	3	Lecture	PPT
5.7	Role of melatonin	1	Lecture	LCD

INTERNAL – UG

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assessment
	T1 10 Mks.	T2 10 Mks.	Quiz 5 Mks.	Assignment 5 Mks	OBT/PPT 5 Mks	35 Mks.	5 Mks.	40Mks.	
K1	2	2	-	-	-	4	-	4	10 %
K2	2	2	5	-	-	9	-	9	22.5 %
K3	3	3	-	-	5	11	-	11	27.5 %
K4	3	3	-	5	-	11	-	11	27.5 %
Non Scholastic	-	-	-	-	-		5	5	12.5 %
Total	10	10	5	5	5	35	5	40	100 %

CIA	
Scholastic	**35**
Non Scholastic	**5**
	40

EVALUATION PATTERN

SCHOLASTIC	NON - SCHOLASTIC	MARKS

C1	C2	C3	C4	C5	C6	CIA	ESE	Tota l
10	10	5	5	5	5	40	60	100

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Outline the scope and history of Ethology	K1	PSO1, PSO3, PSO4 & PSO6
CO 2	Explain the types of learning	K2	PSO1, PSO4 & PSO10
CO 3	Summarize the methods adopted by the animals in mate selection.	K2	PSO1,PSO3, PSO4 PSO8 & PSO10
CO 4	Discuss the various parameters controlling the behaviour in context to nerve and hormone	K6	PSO1, PSO3 PSO4 PSO6& PSO8
CO 5	Recall the types and features of biological rhythm	K1	PSO1, PSO3, PSO4 PSO8 & PSO10

Mapping of COs with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	PSO 11	PSO 12
CO1	3	2	1	3	2	2	2	2	2	2	2	2

CO2	2	2	2	3	2	2	2	2	2	3	2	2
CO3	3	2	1	3	2	2	2	2	2	3	2	2
CO4	3	2	1	3	2	2	2	2	2	2	2	2
CO5	3	2	1	3	2	2	2	3	2	3	2	2

Mapping of COs with POs

CO/ PSO	PO1	PO2	PO3	PO4
CO1	2	2	1	1
CO2	2	2	1	1
CO3	2	2	1	1
CO4	2	2	1	1
CO5	2	2	1	1

Note: ♦ Strongly Correlated – **3** ♦ Moderately Correlated – **2** ♦ Weakly Correlated -**1**

COURSE DESIGNER:
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NEW SYLLABUS

III B.Sc.Zoology

SEMESTER –V

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
UAZO	19Z5ME2	Animal Behaviour	Lecture	5	5

COURSE DESCRIPTION

Students gain knowledge on learning, behaviour and biorhythm in animals.

COURSE OBJECTIVES

- Acquire fundamental knowledge on the behavioural concept in animals
- Understand the environment, social and reproductive behaviour in animals
- Summarize the phenomenon behind the molecular basis of biological rhythm including circadian.

UNITS

UNIT I – INTRODUCTION TO ANIMAL BEHAVIOUR (15 HRS.)

Origin, history and scope of Ethology.Contribution of Karl Von Frish, Ivan Pavlov, Konrad Lorenz, NikoTinbergen.Causes - Proximate and ultimate. Types - Innate and Acquired, Instinctive and Motivated behaviour. Patterns of behaviour - Stereotyped Behaviours (Orientation, Reflexes); Hormonal regulation of behaviour, Ethogram.

Self-Study - Origin, history and scope of Ethology

UNIT II – LEARNING AND MEMORY (15 HRS.)

Types of learning - Physiology and phylogeny of learning - trial and error learning, Imprinting, habituation. Classical conditioning: - Pavlov's experiment; Operant learning – Skinner's experiment, insight, Instrumental conditioning, association learning and reasoning.

UNIT III – SOCIAL AND REPRODUCTIVE BEHAVIOUR - (15 HRS.)

Social Behaviour - Communication and the senses; Altruism; Insects' society with Honey bee as an example; Foraging in honey bee and advantages of the waggle dance. Sexual Behaviour: Courtship and signal: *Hilarasartor* (Balloon fly) and ♂ Stickleback's zigzag dance. Reproductive behaviour – Strategies and mating systems; Selection – Intra-sexual & Inter-sexual; Matingbehaviour in Penguins.

Self-Study - Insects' society with Honey bee as an example

UNIT IV – NEURAL AND ECOLOGICAL ASPECTS OF BEHAVIOUR (15 HRS.)

Role of pheromones in reproductive behaviour. Communication - Chemical, visual, light and audio. Ecological aspects of behaviour - Habitat selection, food selection, anti-predator defence, aggression, host-parasite relations.

Self-Study – Host-parasite relations

UNIT V – BIOLOGICAL RHYTHM (15 HRS.)

Types and characteristics of biological rhythms: Short- and Long-term rhythms, Circadian rhythms, Tidal rhythms and Lunar rhythms. Concept of synchronization and masking - Photic and non-photic zeitgebers.Circannual rhythms; Photoperiod and regulation of seasonal reproduction in vertebrates - Role of melatonin.

UNIT –VI DYNAMISM (Evaluation Pattern-CIA only) (HRS.)

REFERENCES:

1. Arumugam, N and P. Natarajan, (2018). Animal Behaviour – Ethology.SarasPublication.Nagercoil
2. Jay. C. Dunlap, Jennifer. J.Loros, Patricia J. DeCoursey (ed). (2004). Chronobiology Biological Timekeeping: Sinauer Associates, Inc.Publishers, Sunderland, MA, USA
3. Saunders, D.S., C.G.H. Steel, X., (2002) Insect Clocks Afopoulou (ed.)R.D. Lewis. (3rdEd) Barens and Noble Inc. New York, USA
4. Vinod Kumar (2002) Biological Rhythms: Narosa Publishing House, Delhi/ Springer-Verlag, Germany.

DIGITAL OPEN EDUCATIONAL RESOURCES

1. https://www.oercommons.org/authoring/2459-conditioning-animals-learning-behaviour-ecology-en/view
2. https://www.oercommons.org/browse?f.keyword=animal-behaviour
3. https://www.psychologytoday.com/intl/basics/animal-behavior
4. https://seaworld.org/animals/all-about/training/animal-behavior-and-learning/
5. https://www.nature.com/subjects/animal-behaviour

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 INTRODUCTION TO ANIMAL BEHAVIOUR				
1.1	**Origin, history and scope of Ethology**	2	Chalk & Talk	Black Board
1.2	Contribution of Karl Von Frish, Ivan Pavlov, Konrad Lorenz, Niko Tinbergen.	1	Lecture	Black Board
1.3	Contribution of Konrad Lorenz, Niko Tinbergen	1	Lecture	PPT & White board
1.4	Causes of behaviour: Proximate and ultimate	1	Lecture	Smart Board
1.5	Types of Behaviour: Innate and Acquired	2	Lecture	Black Board
1.6	Instinctive and Motivated behaviour.	1	Discussion	Google classroom
1.7	Pattern of behaviour: Stereotyped Behaviours (Orientation, Reflexes)	3	Lecture	Black Board

1.8	Hormonal regulation of behaviour	2	Lecture	Black Board
1.9	Ethogram	2	Lecture	Black Board
UNIT -2 LEARNING AND MEMORY				
2.1	Types of learning	1	Lecture	Green Board Charts
2.2	**Subtopics**: Physiology and phylogeny of learning	2	Chalk & Talk	Green Board
2.3	**subtopics**: trial and error learning, Imprinting, habituation.	2	Chalk & Talk	Black Board
2.4	Classical conditioning: - Pavlov's experiment	2	Chalk & Talk	LCD
2.5	Operant learning – Skinner's experiment	4	Lecture	PPT
2.6	Insight - Instrumental conditioning, association learning and reasoning.	4	Lecture	PPT
UNIT -3 SOCIAL AND REPRODUCTIVE BEHAVIOUR				
3.1	Social Behaviour: Concept of Society; Communication and the senses	3	Lecture	Black Board
3.2	Altruism; Insects' society with **Honey bee as** example	2	Discussio n	Black Board
3.3	Foraging in honey bee and advantages of the waggle dance	2	Chalk & Talk	Black Board
3.4	Sexual Behaviour: Courtship and signal: Hilarasartor (Balloon	3	Chalk & Talk	LCD

	fly) and ♂ Stickleback's zigzag dance.			
3.5	Strategies and mating systems	2	Lecture	PPT
3.6	Intra-sexual selection, Inter-sexual selection (	2	Lecture	PPT/LCD
3.7	Mating behaviour in Penguins.	1	Lecture	PPT & White board
UNIT -4 NEURAL AND HORMONAL CONTROL OF BEHAVIOUR				
4.1	Motivation: Role of hormones	2	Discussion	Black Board
4.2	Aggregation	1	Lecture	PPT
4.3	Role of pheromones in reproductive behaviour	3	Chalk & Talk	Black Board
4.4	Communication: Chemical, visual, light and audio.	3	Chalk & Talk	LCD
4.5	Ecological aspects of behaviour: Habitat selection, food selection, anti-predator defenses, aggression,	4	Lecture	PPT & White board
4.6	host parasite relations	2	Discussion	Black Board
UNIT -5 BIOLOGICAL RHYTHM				
5.1	Types and characteristics of biological rhythms	2	Discussion	Black Board
5.2	Short- and Long- term rhythms;	2	Lecture	PPT/LCD
5.3	Circadian rhythms; Tidal	2	Chalk &	Black Board

	rhythms and Lunar rhythms		Talk	
5.4	Concept of synchronization and masking; Photic and non-photic zeitgebers	3	Lecture	Green Board
5.5	Circannual rhythms	2	Lecture	PPT
5.6	Photoperiod and regulation seasonal reproduction of vertebrates	3	Lecture	PPT
5.7	Role of melatonin	1	Lecture	LCD

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assessment
	T1 10 Mks.	T2 10 Mks.	Quiz 5 Mks.	Assignment 5 Mks	OBT/PPT 5 Mks	35 Mks.	5 Mks.	40Mks.	
K1	2	2	-	-	-	4	-	4	10 %
K2	2	2	5	-	-	9	-	9	22.5 %
K3	3	3	-	-	5	11	-	11	27.5 %
K4	3	3	-	5	-	11	-	11	27.5 %
Non Scholastic	-	-	-	-	-		5	5	12.5 %
Total	10	10	5	5	5	35	5	40	100 %

CIA	
Scholastic	35
Non Scholastic	5

	40

EVALUATION PATTERN

SCHOLASTIC					NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	C6	CIA	ESE	Total
10	10	5	5	5	5	40	60	100

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Outline the scope and history of Ethology	K1	PSO1, PSO3, PSO4 & PSO6
CO 2	Explain the types of learning	K2	PSO1, PSO4 & PSO10
CO 3	Summarize the methods adopted by the animals in mate selection.	K2	PSO1,PSO3, PSO4 PSO8 & PSO10
CO 4	Discuss the various parameters controlling the behaviour in context to nerve and hormone	K6	PSO1, PSO3 PSO4 PSO6& PSO8
CO 5	Recall the types and features of biological rhythm	K1	PSO1, PSO3, PSO4 PSO8 & PSO10

Mapping of COs with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	PSO 11	PSO 12

CO1	3	2	1	3	2	2	2	2	2	2	2	2
CO2	2	2	2	3	2	2	2	2	2	3	2	2
CO3	3	2	1	3	2	2	2	2	2	3	2	2
CO4	3	2	1	3	2	2	2	2	2	2	2	2
CO5	3	2	1	3	2	2	2	3	2	3	2	2

Mapping of COs with POs

CO/ PSO	PO1	PO2	PO3	PO4
CO1	2	2	1	1
CO2	2	2	1	1
CO3	2	2	1	1
CO4	2	2	1	1
CO5	2	2	1	1

Note: ♦ Strongly Correlated – **3** ♦ Moderately Correlated – **2** ♦ Weakly Correlated -**1**

COURSE DESIGNER:
Dr. N. NagaraniForwarded By

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HOD'S Signature & Name

OLD SYLLABUS

III B.Sc. Zoology

SEMESTER –VI

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
UAZO	19Z6CC19	Lab - Immunology	Practical	3	2

COURSE DESCRIPTION

The overall objective of this course is to provide the undergraduate students of Zoology an experience of exploring immunological principles through experimentation and to introduce the procedures, basic techniques and instruments used in the clinical laboratories**.**

COURSE OBJECTIVES

- Acquire skills in handling basic equipments
- Estimate the various biomolecules using standard protocols
- Critically analyze and interpret the results
- Design experiments to solve research problems

IMMUNOLOGY

4%

1. Virtual dissection and onscreen display of lymphoid organs of mouse.

2. Separation of serum and plasma.

3. Separation of lymphocytes from peripheral blood and counting in Haemocytometer.

4. ABO blood grouping in man.

5. Single radial immunodiffusion.

6. Rheumatoid factors – Demo.

Spotters: Lymphoid organs- thymus, spleen, lymph nodes and Bone marrow, Ig – Models.

EMBRYOLOGY

Spotters: Embryonic stages of Chick (24 or 48 hrs); Mammalian Sperm and Ovum, Stages of Human embryo and Placenta of goat.

CLINICAL LABORATORY TECHNIQUES 6%

1. Laboratory biosafety guidelines
2. Preparation of stained blood film to study various types of blood cells.
3. Total W.B.C. & R.B.C. count
4. Differential leukocyte count
5. Qualitative analysis of urine for glucose- Benedict's Test.
6. Qualitative analysis of urine for albumin-Biuret Test.
7. Qualitative analysis of Ketone – Rothera's Test.
8. Qualitative analysis of urine for Urea -Urease Test.
9. Qualitative analysis of Creatinine- Jaffe's Test.
10. Field visit to clinical laboratory & report submission

REFERENCE BOOKS:

1. Hudson, L., Hay, F.C. (1986).*Practical Immunology*.3rd ed., Blackwell Publishing, London.

2. Garvey, J.S., Cremer, N.E., Sussdorf , D.H. (1983).*Methods in Immunology*.3rd ed., Benjamin / Cummins Publishing, London.

3. Stites, D.P., Terr, A.L., Parslow, T.G. (1994).*Basic and Clinical* Immunology.Prentice Hall Publishing, Canada.

4. Mukerjee, K.L. and Gosh, S. (2010). *Medical Laboratory Technology*.Volume II, McGraw Hill, New Delhi-17.

5. Harold Varley.(2005). *Practical Clinical Biochemistry*.4th ed. CBS Publishers Pvt Ltd, New Delhi-02.

DIGITAL OPEN EDUCATIONAL RESOURCES

1. https://bio.davidson.edu/courses/immunology/Bio307.html
2. https://www.oercommons.org/courses/clinical-immunology
3. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5633739/
4. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC379057/
5. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7904692/

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
IMMUNOLOGY				
1.1	Virtual dissection and onscreen display of lymphoid organs of mouse	1	Demonstration & hands on training	LCD, Online Virtual Dissection Tools
1.2	Separation of serum and plasma	1	Demonstration & hands on training	Black board
1.3	Separation& counting of lymphocytes	4	Demonstration & hands on training	Microscope
1.4	ABO blood grouping	1	Demonstration & hands on training	Teaching Kit PPT & White board
1.5	Single radial immunodiffusion	1	Demonstration & hands on training	Teaching Kit
1.6	Rheumatoid factors	1	Demonstration	Teaching Kit

1.7	Spotters: Lymphoid organs- thymus, spleen, lymph nodes and Bone marrow, Ig – Models.	1	Specimen & Models	Microscope
EMBRYOLOGY				
2	Spotters: Embryonic stages of Chick (24 or 48 hrs); Mammalian Sperm and Ovum, Stages of Human embryo and Placenta of goat.	1	Permanent Slides & Preserved Specimen	Microscope
CLINICAL LABORATORY TECHNIQUES				
3.1	Laboratory biosafety guidelines	1	Lecture	LCD
3.2	Preparation of stained blood film	1	Demonstration & hands on training	Microscope
3.3	Total W.B.C. & R.B.C. count	1	Demonstration & hands on training	Microscope
3.4	Differential leukocyte count	1	Demonstration & hands on training	Microscope
3.5	Qualitative analysis of urine for glucose- Benedict's Test	1	Demonstration & hands on training	Black Board
3.6	Qualitative analysis of urine for albumin-Biuret Test	1	Demonstration & hands on training	Black Board
3.7	Qualitative analysis of Ketone – Rothera's Test	1	Demonstration & hands on training	Black Board
3.8	Qualitative analysis of urine for Urea -Urease Test	1	Demonstration & hands on training	Black Board
3.9	Qualitative analysis of Creatinine- Jaffe's Test	1	Demonstration & hands on	Black Board

			training	
3.10	Field visit to clinical laboratory & report submission	-	On-site Learning	=

CIA	
Scholastic	**35**
Non Scholastic	**5**
	40

EVALUATION PATTERN

MARKS		
CIA	**ESE**	**Total**
40	**60**	**100**

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Relate the knowledge of basic principles of immunology to carry out the related experiments	**K1**	PSO1, PSO2 PSO4. PSO7 PSO8 & PSO10
CO 2	Acquire skills in handling basic equipments	**K2**	PSO1,PSO2 PSO4,PSO7 PSO8 & PSO10
CO 3	Infer the outcome of the experiments of Immunology	**K2**	PSO1, PSO2 PSO4, PSO7 PSO8 & PSO10
CO 4	Relate the biochemical properties of Glucose, Albumin & Ketone bodies	**K1**	PSO1, PSO2 PSO4, PSO8 &

	while performing the qualitative analytical tests for their detection in urine sample		PSO10
CO 5	Develop familiarity with the principles of Laboratory safety	**K3**	PSO1 PSO2 PSO4 PSO7 PSO8

Mapping of COs with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO1 0	PSO1 1	PSO1 2
CO1	3	3	2	2	2	2	3	3	2	3	2	2
CO2	3	3	2	2	2	2	3	3	2	3	2	2
CO3	3	3	2	2	2	2	3	3	2	3	2	2
CO4	3	3	2	2	2	2	3	3	2	2	2	2
CO5	3	3	2	2	2	2	3	3	2	2	2	2

Mapping of COs with POs

CO / PSO	PO 1	PO 2	PO 3	PO 4
CO 1	3	2	3	2
CO 2	3	2	3	2
CO 3	3	2	3	2
CO 4	3	2	3	2
CO 5	3	2	3	3

Note: ♦ Strongly Correlated – 3 ♦ Moderately Correlated – 2
♦ Weakly Correlated -1

COURSE DESIGNER:

Dr. A Tamil SelviForwarded By

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& Name

NEW SYLLABUS

III B.Sc. Zoology

SEMESTER –VI

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
UAZO	19Z6CC19	Lab - Immunology	Practical	3	2

COURSE DESCRIPTION

The overall objective of this course is to provide the undergraduate students of Zoology an experience of exploring immunological principles through experimentation and to introduce the procedures, basic techniques and instruments used in the clinical laboratories**.**

COURSE OBJECTIVES

- Acquire skills in handling basic equipments
- Estimate the various biomolecules using standard protocols
- Critically analyze and interpret the results
- Design experiments to solve research problems

IMMUNOLOGY

1. Laboratory biosafety guidelines
2. Virtual dissection and onscreen display of lymphoid organs of mouse.
3. Separation of serum and plasma.
4. Preparation of stained blood film to study various types of blood cells.
5. Separation of lymphocytes from peripheral blood and counting in Haemocytometer.
6. Total W.B.C. & R.B.C. count
7. Differential leukocyte count

8. ABO blood grouping in man.
9. Single radial immunodiffusion.
10. Rheumatoid factors – Demo.

Spotters: Lymphoid organs- thymus, spleen, lymph nodes and Bone marrow, Ig – Models, ELISA, Western Blot andFlowCytometry.

EMBRYOLOGY

Spotters: Embryonic stages of Chick (24 or 48 hrs); Mammalian Sperm and Ovum, Stages of Human embryo and Placenta of goat.

CLINICAL LABORATORY TECHNIQUES

1. Qualitative analysis of urine for glucose- Benedict's Test.
2. Qualitative analysis of Ketone – Rothera's Test.
3. Qualitative analysis of Creatinine- Jaffe's Test.
4. Field visit to clinical laboratory & report submission
5. Spotter – Amniocentesis, Pregnancy diagnostic Kit, Haemocytometer, Centrifuge and Semi Automated Analyzer

REFERENCE BOOKS:

1. Hudson, L., Hay, F.C. (1986).*Practical Immunology*.3rd ed., Blackwell Publishing, London.

2. Garvey, J.S., Cremer, N.E., Sussdorf , D.H. (1983).*Methods in Immunology*.3rd ed., Benjamin / Cummins Publishing, London.

3. Stites, D.P., Terr, A.L., Parslow, T.G. (1994).*Basic and Clinical* Immunology.Prentice Hall Publishing, Canada.

4. Mukerjee, K.L. and Gosh, S. (2010). *Medical Laboratory Technology*.Volume II, McGraw Hill, New Delhi-17.

5. Harold Varley.(2005). *Practical Clinical Biochemistry*.4th ed. CBS Publishers Pvt Ltd, New Delhi-02.

DIGITAL OPEN EDUCATIONAL RESOURCES

6. https://bio.davidson.edu/courses/immunology/Bio307.html
7. https://www.oercommons.org/courses/clinical-immunology
8. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5633739/
9. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC379057/
10. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7904692/

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
IMMUNOLOGY				
1.1	Laboratory biosafety guidelines	1	Lecture	LCD
1.2	Virtual dissection and onscreen display of lymphoid organs of mouse	1	Demonstration & hands on training	LCD, Online Virtual Dissection Tools
1.3	Separation of serum and plasma	1	Demonstration & hands on training	Black board
1.4	Preparation of stained blood film	1	Demonstration & hands on training	Microscope
1.5	Separation& counting of lymphocytes	4	Demonstration & hands on training	Microscope
1.6	Total W.B.C. & R.B.C. count	1	Demonstration & hands on training	Microscope
1.7	Differential leukocyte count	1	Demonstration & hands on training	Microscope
1.8	ABO blood grouping	1	Demonstration & hands on training	Teaching Kit PPT & White

				board
1.9	Single radial immunodiffusion	1	Demonstration & hands on training	Teaching Kit
1.10	Rheumatoid factors	1	Demonstration	Teaching Kit
1.11	Spotters: Lymphoid organs-thymus, spleen, lymph nodes and Bone marrow, Ig – Models, ELISA, Western Blot andFlowCytometry.	1	Specimen & Models	Microscope
EMBRYOLOGY				
2	Spotters: Embryonic stages of Chick (24 or 48 hrs); Mammalian Sperm and Ovum, Stages of Human embryo and Placenta of goat.	1	Permanent Slides & Preserved Specimen	Microscope
CLINICAL LABORATORY TECHNIQUES				
3.1	Qualitative analysis of urine for glucose- Benedict's Test	1	Demonstration & hands on training	Black Board
3.2	Qualitative analysis of Ketone – Rothera's Test	1	Demonstration & hands on training	Black Board
3.3	Qualitative analysis of Creatinine- Jaffe's Test	1	Demonstration & hands on training	Black Board
3.4	Amniocentesis, Pregnancy diagnostic Kit, Haemocytometer, Centrifuge & Semi Automated Analyser	1	Specimen & Models	Apparatus & LCD
3.5	Field visit to clinical laboratory & report submission	-	On-site Learning	=

CIA

Scholastic	**35**
Non Scholastic	**5**
	40

EVALUATION PATTERN

MARKS		
CIA	**ESE**	**Tota l**
40	**60**	**100**

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Relate the knowledge of basic principles of immunology to carry out the related experiments	**K1**	PSO1, PSO2 PSO4. PSO7 PSO8 & PSO10
CO 2	Acquire skills in handling basic equipments	**K2**	PSO1,PSO2 PSO4,PSO7 PSO8 & PSO10
CO 3	Infer the outcome of the experiments of Immunology	**K2**	PSO1, PSO2 PSO4, PSO7 PSO8 & PSO10
CO 4	Relate the biochemical properties of Glucose& Ketone bodies while performing the qualitative analytical tests for their detection in urine sample	**K1**	PSO1, PSO2 PSO4, PSO8 & PSO10
CO 5	Develop familiarity with the principles of Laboratory safety	**K3**	PSO1 PSO2 PSO4 PSO7 PSO8

Mapping of COs with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO10	PSO11	PSO12
CO1	3	3	2	2	2	2	3	3	2	3	2	2
CO2	3	3	2	2	2	2	3	3	2	3	2	2
CO3	3	3	2	2	2	2	3	3	2	3	2	2
CO4	3	3	2	2	2	2	3	3	2	2	2	2
CO5	3	3	2	2	2	2	3	3	2	2	2	2

Mapping of COs with POs

CO / PSO	PO 1	PO 2	PO 3	PO 4
CO 1	3	2	3	2
CO 2	3	2	3	2
CO 3	3	2	3	2
CO 4	3	2	3	2
CO 5	3	2	3	3

Note: ♦ **Strongly Correlated – 3** ♦ **Moderately Correlated – 2**
♦ **Weakly Correlated -1**

COURSE DESIGNER:

Dr. A Tamil SelviForwarded By

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HOD'S Signature & Name

OLD SYLLABUS

III B.Sc. Zoology

SEMESTER – VI

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/ WEEK	CREDITS
UAZO	19Z6CC20	Lab - Biotechnology	Practical	3	2

COURSE DESCRIPTION

Students gain hands-on experience and learn the theoretical basis of lab techniques common to a variety of biological disciplines such as biotechnology, Bioinformatics and Entomology and they will work in groups, learning how to collect, analyze, and present data while using the scientific method to conduct inquiry-based laboratory experiments.

COURSE OBJECTIVES

- Introductory laboratory course in current principles and techniques applicable to research problems in biotechnology, Bioinformatics and Entomology
- Learners can identify insects and able to group them into different taxa
- Learners gain knowledge handling biological database and retrieve information

UNITS

10%

UNIT – I BIOTECHNOLOGY

1. Laboratory biosafety guidelines
2. Isolation of protein from spinach leaves
3. Estimation of Total soluble proteins using Bradford method
4. Electrophoretic separation proteins
5. Isolation of genomic DNA from goat liver/Bacteria.
6. Isolation of Plasmid DNA by alkaline lysis method.
7. Electrophoretic separation of DNA.
8. Demonstration of PCR.
9. Spotters: Agarose gel electrophoresis, SDS-PAGE, pBR322, Spirulina and Insulin

UNIT-II ENTOMOLOGY

1. Collection and Preservation of Insects.

2. Spotters: Mouth parts of Cockroach & Honey bee; Life Cycle of Holometabolous (Butterfly) and Hemimetabolous Insects (Cockroach), Pests of Agricultural Importance – Rice Weevil, Rhinoceros Beetle.

UNIT- III BIOINFORMATICS

1. Sequence retrieval from GenBank

2. Pairwise alignment - BLAST

3. Molecular visualization of Proteins- RASMOL

REFERENCE BOOKS:

1. Rajan S., Christy, S.R., (2011) Experimental procedures in Life Sciences, Anjana Book House, Chennai.

2. Sinha J., Chatterjee A.K., Chattopadhyay P., (2015) Advanced Practical Zoology, Books and Allied (P) Ltd., Calcutta.

3. Tembhare D.B., (2008) Techniques in Life Sciences, 1st ed., Himalaya Publishing House

DIGITAL OPEN EDUCATIONAL RESOURCES

1. https://www.oercommons.org/courseware/lesson/15022/overview
2. https://www.oercommons.org/authoring/8657-biotechnology-resources/4/view
3. https://www.wileyindia.com/practical-biotechnology-principles-and-protocols.html
4. https://www.researchgate.net/publication/303997580_Principles_of_Biotechnology-Practical_Manual
5. https://www.apsnet.org/edcenter/disimpactmngmnt/labexercises/PlantBiotechnology/Pages/Activity5.aspx

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
BIOTECHNOLOGY				
1.1	Laboratory biosafety guidelines	3	PPT & Discussion	LCD
1.2	Isolation of protein from spinach leaves	3	Hands on training	Chemicals,Glasswares& Instruments
1.3	Estimation of Total soluble proteins using Bradford method	3	Hands on training	Chemicals,Glasswares& Instruments
1.4	Electrophoretic separation proteins	3	Demonstration	Chemicals,Glasswares& Instruments
1.5	Isolation of genomic DNA from goat liver.	3	Hands on training	Chemicals,Glasswares& Instruments
1.6	Isolation of Plasmid DNA by alkaline lysis method	3	Hands on training	Chemicals,Glasswares& Instruments
1.7	Electrophoretic separation of DNA	3	Hands on training	Chemicals,Glasswares& Instruments

1.8	Demonstration of PCR	3	Demonstration	Chemicals,Glassw ares& Instruments
1.9	Spotters: Agarose gel electrophoresis, SDS-PAGE, pBR322, Spirulina and Insulin	3	Demonstration	Specimens, Models,Print-Outs ,Bio-Visula Charts
ENTOMOLOGY				
2.1	Collection and Preservation of Insects.	3	Demonstration	Model and specimens
2.2	Spotters: Mouth parts of Cockroach & Honey bee;	3	Demonstration & Hands on training	Glass Slide,Microscope and chemicals etc.,
2.3	Spotters: Life Cycle of Holometabolous (Butterfly)and Hemimetabolous Insects (Cockroach)	3	Demonstration	Bio-Visual Charts,LCD
2.4	Spotters: Pests of Agricultural Importance – Rice Weevil, Rhinoceros Beetle.	3	Demonstration	Specimens, Models, Preserved Insect Box
BIOINFORMATICS				
3.1	Sequence retrieval from GenBank	3	Demonstration & Hands on training	LCD
3.2	Pairwise alignment - BLAST	3	Demonstration & Hands on training	LCD
3.3	Molecular visualization of Proteins- RASMOL	3	Demonstration & Hands on training	LCD

CIA	
Scholastic	**35**
Non Scholastic	**5**
	40

EVALUATION PATTERN

MARKS		
CIA	**ESE**	**Tota l**
40	**60**	**100**

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Acquire skills in handling basic equipments	**K1**	PSO1, PSO2, & PSO7
CO 2	Identify the insects	**K1**	PSO1, PSO2 & PSO4
CO 3	Estimate the various biomolecules using standard protocols	**K3**	PSO1, PSO2 & PSO7
CO 4	Identify and comment on the spotters Agarose gel electrophoresis, SDS-PAGE,	**K3**	PSO1, PSO2 PSO8 & PSO10

	pBR322, Spirulina and Insulin and Bioinformatics tools		
CO 5	Examine the features in mouth parts of Cockroach & Honey bee, Pests of Agricultural Importance – Rice Weevil, Rhinoceros Beetle	**K4**	PSO1 & PSO 4

Mapping of COs with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO1 0	PSO1 1	PSO1 2
CO1	3	3	2	2	2	2	3	2	2	2	2	2
CO2	3	2	2	3	2	2	2	2	2	2	2	2
CO3	3	3	2	2	2	2	3	2	2	2	2	2
CO4	3	3	2	2	2	2	2	2	2	3	2	2
CO5	3	2	2	3	2	2	2	2	2	2	2	2

Mapping of COs with POs

CO / PSO	PO 1	PO 2	PO 3	PO 4
CO 1	3	2	3	2
CO 2	3	2	2	2

CO 3	3	2	3	2
CO 4	3	2	3	2
CO 5	3	2	2	2

Note: ♦ **Strongly Correlated – 3** ♦ **Moderately Correlated – 2**
♦ **Weakly Correlated -1**

COURSE DESIGNER:

Dr. N. Malathi

Forwarded By

Dr. A. TAMIL SELVI
Head, Dept. of Zoology
FATIMA COLLEGE (AUTONOMOUS)
MADURAI-625 018

HOD'S Signature & Name

NEW SYLLABUS

III B.Sc. Zoology

SEMESTER – VI

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/ WEEK	CREDITS

UAZO	**19Z6CC20**	**Lab - Biotechnology**	**Practical**	**3**	**2**

COURSE DESCRIPTION

Students gain hands-on experience and learn the theoretical basis of lab techniques common to a variety of biological disciplines such as biotechnology, Bioinformatics and Entomology and they will work in groups, learning how to collect, analyze, and present data while using the scientific method to conduct inquiry-based laboratory experiments.

COURSE OBJECTIVES

- Introductory laboratory course in current principles and techniques applicable to research problems in biotechnology, Bioinformatics and Entomology
- Learners can identify insects and able to group them into different taxa
- Learners gain knowledge handling biological database and retrieve information

BIOTECHNOLOGY

1. Laboratory biosafety guidelines
2. Isolation of protein from spinach leaves
3. Estimation of Total soluble proteins using Bradford method
4. Electrophoretic separation proteins
5. Isolation of genomic DNA from goat liver/Bacteria.
6. Isolation of genomic DNA from plant
7. Isolation of Plasmid DNA by alkaline lysis method.
8. Electrophoretic separation of DNA.
9. Demonstration of PCR.
10. Spotters: pBR322, Spirulina, Insulin, Southern blotting, Northern blotting, UV transilluminator

UNIT-II ENTOMOLOGY

1. Collection and Preservation of Insects.

2. Spotters: Mouth parts of Cockroach & Honey bee; Life Cycle of Holometabolous (Butterfly) and Hemimetabolous Insects (Cockroach), Pests of Agricultural Importance – Rice Weevil, Rhinoceros Beetle.

UNIT- III BIOINFORMATICS

1. Sequence retrieval from GenBank

2. Pairwise alignment - BLAST

3. Molecular visualization of Proteins- RASMOL

REFERENCE BOOKS:

1. Rajan S., Christy, S.R., (2011) Experimental procedures in Life Sciences, Anjana Book House, Chennai.

2. Sinha J., Chatterjee A.K., Chattopadhyay P., (2015) Advanced Practical Zoology, Books and Allied (P) Ltd., Calcutta.

3. Tembhare D.B., (2008) Techniques in Life Sciences, 1st ed., Himalaya Publishing House

DIGITAL OPEN EDUCATIONAL RESOURCES

1. https://www.oercommons.org/courseware/lesson/15022/overview
2. https://www.oercommons.org/authoring/8657-biotechnology-resources/4/view
3. https://www.wileyindia.com/practical-biotechnology-principles-and-protocols.html
4. https://www.researchgate.net/publication/303997580_Principles_of_Biotechnology-Practical_Manual
5. https://www.apsnet.org/edcenter/disimpactmngmnt/labexercises/PlantBiotechnology/Pages/Activity5.aspx

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
BIOTECHNOLOGY				
1.1	Laboratory biosafety guidelines	2	PPT & Discussion	LCD

1.2	Isolation of protein from spinach leaves	3	Hands on training	Chemicals,Glassw ares& Instruments
1.3	Estimation of Total soluble proteins using Bradford method	3	Hands on training	Chemicals,Glassw ares& Instruments
1.4	Electrophoretic separation proteins	3	Demonstration	Chemicals,Glassw ares& Instruments
1.5	Isolation of genomic DNA from goat liver.	3	Hands on training	Chemicals,Glassw ares& Instruments
1.6	Isolation of genomic DNA from plant	3	Hands on training	Chemicals,Glassw ares& Instruments
1.7	Isolation of Plasmid DNA by alkaline lysis method	3	Hands on training	Chemicals,Glassw ares& Instruments
1.8	Electrophoretic separation of DNA	3	Hands on training	Chemicals,Glassw ares& Instruments
1.9	Demonstration of PCR	2	Demonstration	Chemicals,Glassw ares& Instruments
2.0	Spotters:pBR322, Spirulina, Insulin, Southern blotting, Northern blotting, UV transilluminator	2	Demonstration	Specimens, Models,Print-Outs ,Bio-Visula Charts
ENTOMOLOGY				
2.1	Collection and Preservation of Insects.	3	Demonstration	Model and specimens
2.2	Spotters: Mouth parts of Cockroach & Honey bee;	3	Demonstration & Hands on training	Glass Slide,Microscope and chemicals etc.,

2.3	Spotters: Life Cycle of Holometabolous (Butterfly)and Hemimetabolous Insects (Cockroach)	3	Demonstration	Bio-Visual Charts,LCD
2.4	Spotters: Pests of Agricultural Importance – Rice Weevil, Rhinoceros Beetle.	3	Demonstration	Specimens, Models, Preserved Insect Box
UNIT-III BIOINFORMATICS				
3.1	Sequence retrieval from GenBank	3	Demonstration & Hands on training	LCD
3.2	Pairwise alignment - BLAST	3	Demonstration & Hands on training	LCD
3.3	Molecular visualization of Proteins- RASMOL	3	Demonstration & Hands on training	LCD

Scholastic	**35**
Non Scholastic	**5**
	40

EVALUATION PATTERN

MARKS		
CIA	**ESE**	**Tota l**
40	**60**	**100**

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Acquire skills in handling basic equipments	**K1**	PSO1, PSO2, & PSO7
CO 2	Identify the insects	**K1**	PSO1, PSO2 & PSO4
CO 3	Estimate the various biomolecules using standard protocols	**K3**	PSO1, PSO2 & PSO7
CO 4	Identify and comment on the spotters Agarose gel electrophoresis, SDS-PAGE, pBR322, Spirulina and Insulin and Bioinformatics tools	**K3**	PSO1, PSO2 PSO8 & PSO10
CO 5	Examine the features in mouth parts of Cockroach & Honey bee, Pests of Agricultural Importance – Rice Weevil, Rhinoceros Beetle	**K4**	PSO1 & PSO 4

Mapping of COs with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO10	PSO11	PSO12
CO1	3	3	2	2	2	2	3	2	2	2	2	2
CO2	3	2	2	3	2	2	2	2	2	2	2	2
CO3	3	3	2	2	2	2	3	2	2	2	2	2
CO4	3	3	2	2	2	2	2	2	2	3	2	2
CO5	3	2	2	3	2	2	2	2	2	2	2	2

Mapping of COs with POs

CO / PSO	PO 1	PO 2	PO 3	PO 4
CO 1	3	2	3	2
CO 2	3	2	2	2
CO 3	3	2	3	2

CO 4	3	2	3	2
CO 5	3	2	2	2

Note: ♦ **Strongly Correlated – 3** ♦ **Moderately Correlated – 2**
♦ **Weakly Correlated -1**

COURSE DESIGNER:
Dr. N. Malathi

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MADURAI-625 018

HOD'S Signature & Name

OLD SYLLABU

II B.Sc. Zoology

SEMESTER –IV

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
UAZO	19Z4SB2	Mushroom Cultivation	Lecture	2	2

COURSE DESCRIPTION

Develop basic knowledge in mushroom cultivation and spawn production

COURSE OBJECTIVES

To understand the value of edible mushrooms, know the cultivation process and thereby increase the employability

UNITS

UNIT –I INTRODUCTION (6 HRS.)

Morphology of Mushrooms-Identification of mushrooms - Edible and poisonous mushrooms Nutritional and medicinal value of edible mushrooms- History of Mushroom cultivation – Present status of mushroom cultivation in India

Self-study- History of Mushroom cultivation – Present status of mushroom cultivation in India

10%

UNIT –II COMPOSTING (6 HRS.)

Methods of Composting- Spawn production - Spawning- casing- Cropping and harvesting; Mushrooms farm design Construction and insulation – Growing rooms – Ventilation systems- Seasonal growing – casing pasteurization chamber

UNIT –III CULTIVATION (6 HRS.)

Cultivation techniques of edible mushrooms - *Pleurotus citrinopileatus* (Oyster mushroom) and *Agaricus bisporus* (Button mushroom)-Processing , grading and preservation of Mushrooms

UNIT –IV DISEASES AND PESTS (6 HRS.)

Management of fungal, bacterial and viral diseases in mushroom; Competitors, pests and nematodes in mushrooms- Precautions to avoid insects, pests and diseases

UNIT –V ECONOMICS OF MUSHROOM CULTIVATION (6 HRS.)

Economics of mushroom cultivation – Fixed costs, variable costs- Economics of canned products - Mushroom Export- Extension training and entrepreneurship - Mushroom Recipies

TEXT BOOKS

1.Jana B.L., (2014). *Mushroom culture*. Agrotech publishing company. Udaipur

2. Nita B., (2009). *Hand book on Mushrooms*. Oxford & IBH Publishers, New Delhi.

REFERENCES

1. Marimuthu T.,Krishnamoorthy A.S., Sivaprakasam K., & Jayarajan R., (1991).*OysterMushrooms.* Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore.
2. Swaminathan M., (1990).*Food and Nutrition.* Bappco, The Bangalore Printing and Publishing Co. Ltd., Bangalore.
3. Tewari, Pankaj K.S.C.,(1988). *Mushroom cultivation.* Mittal Publications, Delhi.
4. Muthusamy A.D., &YesurajaI., (1999).*Mushroom Culture.* TNAU Publishers, New Delhi.
5. TripathiD.P.,(2005). *Mushroom Cultivation.* Oxford & IBH Publishers New Delhi

Digital Open Educational Resources (DOER) :

1. https://nios.ac.in/online-course-material/vocational-courses/certificate-in-mushroom-production-revised-(618).aspx
2. https://agrimoon.com/wp-content/uploads/Mashroom-culture.pdf
3. http://nsdl.niscair.res.in/jspui/bitstream/123456789/599/1/mushroom%20cultivation%20-%20Formatted.pdf
4. http://www.fao.org/3/i0522e/i0522e.pdf

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 INTRODUCTION				
1.1	Identification of mushrooms	1	Chalk & Talk	Black Board
1.2	Edible and poisonous mushrooms	1	Chalk & Talk	LCD
1.3	Morphology of Mushrooms	4	Lecture	PPT & White board
1.4	Nutritional and medicinal value of edible mushrooms	1	Lecture	Smart Board
1.5	History of Mushroom cultivation	1	Lecture	Black Board
1.6	Present status of mushroom cultivation in India	1	Discussion	Google classroom
UNIT -2 COMPOSTING				
2.1	Methods of Composting	1	Lecture	Green Board Charts
2.2	Spawn production - Spawning- casing- Cropping and	2	Chalk & Talk	Green Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
	harvesting			
2.3	Mushrooms farm design Construction and insulation	1	Lecture	PPT & White board
2.4	Growing rooms – Ventilation systems- Seasonal growing – casing pasteurization chamber	2	Lecture	Smart Board
UNIT -3 CULTIVATION				
3.1	Cultivation techniques of edible mushrooms - *Pleurotus citrinopileatus* (Oyster mushroom)	2	Lecture	Smart Board
3.2	*Agaricus bisporus* (Button mushroom)-	2	Lecture	Black Board
3.3	Processing, grading and preservation of Mushrooms	2	Chalk &Talk	Black Board
UNIT -4DISEASES AND PESTS				
4.1	Management of fungal, bacterial	1	Chalk & Talk	Green Board
4.2	viral diseases in mushroom	1	Chalk &Talk	Black Board
4.3	Competitors, pests and nematodes in mushrooms	2	Chalk & Talk	Green Board
4.4	Precautions to avoid insects, pests and diseases	2	Lecture	PPT &White board
UNIT -5ECONOMICS OF MUSHROOM CULTIVATION				
5.1	Economics of mushroom cultivation – Fixed costs, variable costs	2	Lecture	Green Board Charts

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
5.2	Economics of canned products	1	Chalk & Talk	Green Board
5.3	Mushroom Export	1	Lecture	PPT & White board
5.4	Extension training and entrepreneurship	1	Discussion	Google classroom
5.5	Mushroom Recipies	1	Discussion	Google classroom

INTERNAL - UG

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assessment
	T1 10 Mks.	T2 10 Mks.	Quiz 5 Mks.	Assignment 5 Mks	OBT/PPT 5 Mks	35 Mks.	5 Mks.	40Mks.	
K1	2	2	-	-	-	4	-	4	10 %
K2	2	2	5	-	-	9	-	9	22.5 %
K3	3	3	-	-	5	11	-	11	27.5 %
K4	3	3	-	5	-	11	-	11	27.5 %
Non Scholastic	-	-	-	-	-		5	5	12.5 %
Total	10	10	5	5	5	35	5	40	100 %

CIA	
Scholastic	**35**
Non Scholastic	**5**
	40

EVALUATION PATTERN

SCHOLASTIC					NON - SCHOLASTIC	MARKS		
C1	**C2**	**C3**	**C4**	**C5**	**C6**	**CIA**	**ESE**	**Total**
10	**10**	**5**	**5**	**5**	**5**	**40**	**60**	**100**

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO1	State the prospects of mushroom cultivation	**K1**	PSO1, PSO2, PSO4, PSO9 &PSO11
CO2	Devise a plan for mushroom production unit	**K4**	PSO1,PSO2&PSO 9
CO3	Outline the techniques in cultivation, grading & processing of edible mushrooms	**K2**	PSO1&PSO9
CO4	Identify and manage Insect-Pests and diseases affecting mushrooms.	**K2**	PSO1&PSO9

CO5	Prepare a business plan for small scale enterprise	**K4**	PSO1&PSO9

Mapping of COs with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	PSO 11
CO1	3	3	2	3	3	3	2	3	3	2	3
CO2	3	3	2	3	3	3	2	3	3	2	3
CO3	3	3	2	3	3	3	2	3	3	2	3
CO4	3	3	2	3	3	3	2	3	3	2	3
CO5	3	3	2	3	3	3	2	3	3	2	3

Mapping of COs with POs

CO/ PSO	PO1	PO2	PO3	PO4
CO1	3	3	3	3
CO2	3	3	3	3
CO3	3	3	3	3
CO4	3	3	3	3
CO5	3	3	3	3

Note: ♦ Strongly Correlated – **3** ♦ Moderately Correlated – **2**
♦ Weakly Correlated -**1**

COURSE DESIGNER:
Dr. V. Bharathy

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HOD'S Signature & Name

NEW SYLLABUS

II B.Sc. Zoology

SEMESTER –IV

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
UAZO	19Z4SB2	Mushroom Cultivation	Lecture	2	2

COURSE DESCRIPTION

Develop basic knowledge in mushroom cultivation and spawn production

COURSE OBJECTIVES

To understand the value of edible mushrooms, know the cultivation process and thereby increase the employability

UNITS

UNIT –I INTRODUCTION (6 HRS.)

Morphology of Mushrooms-Identification of mushrooms - Edible and poisonous mushrooms Nutritional and medicinal value of edible mushrooms- History of Mushroom cultivation – Present status of mushroom cultivation in India

Self-study- History of Mushroom cultivation – Present status of mushroom cultivation in India

UNIT –II CULTIVATION (6 HRS.)

Compost – Materials for compost preparation - Methods of Composting- Characteristics of compost - Spawning – Methods, Types, Storage –Spawn running- Casing - Cropping and Harvesting; Mushrooms farm design Construction and insulation – Growing rooms – Ventilation systems- Seasonal growing -casing pasteurization chamber

UNIT –III CULTIVATION (6 HRS.)

Cultivation techniques of edible mushrooms -*Pleurotuscitrinopileatus*(Oyster mushroom) and *Agaricus bisporus*(Button mushroom)-Processing , grading and preservation of Mushrooms

UNIT –IV DISEASES AND PESTS (6 HRS.)

Management of fungal, bacterial and viral diseases in mushroom; Competitors, pests and nematodes in mushrooms- Precautions to avoid insects, pests and diseases

UNIT –V ECONOMICS OF MUSHROOM CULTIVATION (6 HRS.)

Economics of mushroom cultivation – Fixed costs, variable costs- Economics of canned products - Mushroom Export- Extension training and entrepreneurship - Mushroom Recipies

TEXT BOOKS

1.Jana B.L., (2014). *Mushroom culture*. Agrotech publishing company. Udaipur

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9. Muthusamy A.D., &YesurajaI., (1999).*Mushroom Culture.* TNAU Publishers, New Delhi.
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6. https://agrimoon.com/wp-content/uploads/Mashroom-culture.pdf
7. http://nsdl.niscair.res.in/jspui/bitstream/123456789/599/1/mushroom%20cultivation%20-%20Formatted.pdf
8. http://www.fao.org/3/i0522e/i0522e.pdf
9. http://www.nanard.org/search-result.aspx?S=mushroom

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 INTRODUCTION				
1.1	Identification of mushrooms	1	Chalk & Talk	Black Board
1.2	Edible and poisonous mushrooms	1	Chalk & Talk	LCD
1.3	Morphology of Mushrooms	1	Lecture	PPT & White board
1.4	Nutritional and medicinal value of edible mushrooms	1	Lecture	Smart Board
1.5	History of Mushroom cultivation	1	Lecture	Black Board
1.6	Present status of mushroom cultivation in India	1	Discussion	Google classroom
UNIT -2 CULTIVATION TECHNIQUE				
2.1	Compost – Materials for compost preparation Methods of Composting- Characteristics of compost	1	Lecture	Green Board Charts
2.2	Spawning – Methods, Types, Storage –Spawn running	1	Chalk & Talk	Green Board
2.3	Casing - Cropping -Harvesting;	1		
2.4	Mushrooms farm design Construction and insulation– Growing rooms	1	Lecture	PPT & White board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
2.5	Ventilation systems- Seasonal growing -casing pasteurization chamber	2	Lecture	Smart Board
UNIT -3 EDIBLE MUSHROOM CULTIVATION				
3.1	Cultivation techniques of edible mushrooms -*Pleurotuscitrinopileatus*(Oyster mushroom)	2	Lecture	Smart Board
3.2	*Agaricus bisporus*(Button mushroom)-	2	Lecture	Black Board
3.3	Processing, grading and preservation of Mushrooms	2	Chalk &Talk	Black Board
UNIT -4DISEASES AND PESTS				
4.1	Management of fungal, bacterial	1	Chalk & Talk	Green Board
4.2	viral diseases in mushroom	1	Chalk &Talk	Black Board
4.3	Competitors, pests and nematodes in mushrooms	2	Chalk & Talk	Green Board
4.4	Precautions to avoid insects, pests and diseases	2	Lecture	PPT &White board
UNIT -5ECONOMICS OF MUSHROOM CULTIVATION				
5.1	Economics of mushroom cultivation – Fixed costs, variable costs	2	Lecture	Green Board Charts
5.2	Economics of canned products	1	Chalk & Talk	Green Board
5.3	Mushroom Export	1	Lecture	PPT & White board
5.4	Extension training and entrepreneurship	1	Discussion	Google classroom
5.5	Mushroom Recipes	1	Discussion	Google classroom

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assessment
	T1 10 Mks.	T2 10 Mks.	Quiz 5 Mks.	Assignment 5 Mks	OBT/PPT 5 Mks	35 Mks.	5 Mks.	40Mks.	
K1	2	2	-	-	-	4	-	4	10 %
K2	2	2	5	-	-	9	-	9	22.5 %
K3	3	3	-	-	5	11	-	11	27.5 %
K4	3	3	-	5	-	11	-	11	27.5 %
Non Scholastic	-	-	-	-	-		5	5	12.5 %
Total	10	10	5	5	5	35	5	40	100 %

CIA	
Scholastic	35
Non Scholastic	5
	40

EVALUATION PATTERN

SCHOLASTIC					NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	C6	CIA	ESE	Total
10	10	5	5	5	5	40	60	100

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO1	State the prospects of mushroom cultivation	**K1**	PSO1, PSO2, PSO4, PSO9 &PSO11
CO2	Devise a plan for mushroom production unit	**K4**	PSO1,PSO2&PSO 9
CO3	Outline the techniques in cultivation, grading & processing of edible mushrooms	**K2**	PSO1&PSO9
CO4	Identify and manage Insect-Pests and diseases affecting mushrooms.	**K2**	PSO1&PSO9
CO5	Prepare a business plan for small scale enterprise	**K4**	PSO1&PSO9

Mapping of COs with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	PSO 11
CO1	3	3	2	3	3	3	2	3	3	2	3
CO2	3	3	2	3	3	3	2	3	3	2	3
CO3	3	3	2	3	3	3	2	3	3	2	3
CO4	3	3	2	3	3	3	2	3	3	2	3
CO5	3	3	2	3	3	3	2	3	3	2	3

Mapping of COs with POs

CO/ PSO	PO1	PO2	PO3	PO4
CO1	3	3	3	3
CO2	3	3	3	3
CO3	3	3	3	3
CO4	3	3	3	3
CO5	3	3	3	3

Note: ♦ Strongly Correlated – **3** ♦ Moderately Correlated – **2**
♦ Weakly Correlated -**1**

COURSE DESIGNER:
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OLD SYLLABUS

III B.Sc. Zoology

SEMESTER –VI

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
UAZO	19Z6ME4	Clinical Laboratory Techniques	Lecture	5	5

COURSE DESCRIPTION

This course provides current knowledge and upgraded skills in clinical laboratory techniques.

COURSE OBJECTIVES

- To perform routine clinical laboratory procedures within acceptable quality control parameters in urine analysis, Haematology, analysis of stool, sputum and semen.
- Perform laboratory testing with accuracy.
- Able to interpret clinical procedures and laboratory test data accurately.

UNITS

UNIT –I LABORATORY SAFETY AND STERILIZATION (15HRS.)

Common laboratory accidents – Universal work precautions (UWP) for lab personnel - good laboratory practice - Sterilization: sterilization by heat – cold – ultra violet radiation – Ionizing radiations – Filtration – chemical sterilization - Laboratory instruments: Light microscope and centrifuge.

Self-study – Laboratory instruments: Light microscope and centrifuge

2%

UNIT –II ANALYSIS OF URINE (15 HRS.)

Composition of urine - Collection and preservation - Physical parameter: Colour, Odour, pH, Density - Chemical parameters: Sugar, Albumin, bile salts, bile pigment, urea, uric acid, creatinine and Ketone bodies and their clinical significances - Pregnancy tests – Gestational diabetes - Abnormal constituents (Proteinuria – Polyuria – Hematuria – Glycosuria).

Self-study – Composition of urine 2%

UNIT –III HEMATOLOGY (15 HRS.)

Blood**:** collection of blood & lab procedure- types of anaemia - bleeding time- clotting time - Total count of RBC & WBC - Differential count of WBC- blood grouping – haemostasis- bleeding disorder of man - Haemolytic disease of new born, Platelet count, reticulocytes count, Absolute Eosinophil count.

Self-study – Blood grouping

UNIT –IV ANALYSIS OF STOOL AND SPUTUM (15 HRS.)

Faeces**:** Specimen collection – microscopic examination – ova, cysts occult blood, parasitic infestation – amoebic dysentery – Physical and chemical examination of stool - Stool Culture and sensitivity. Sputum**:** Macroscopic & Microscopic examination of sputum - AFB staining - Sputum culture.

6%

UNIT –V SEMEN ANALYSIS (15 HRS.)

Semen: Collection of semen - Semen analysis – motility, total count – abnormality. STD: AIDS, syphilis, gonorrhea. Amniocentesis**:** Need-procedure for collection- Karyotype studies. Safe disposal of bio medical wastes – incineration.

TEXT BOOK:

Sood R. (2009) *Medical Laboratory Technology: Methods and Interpretations* Vol 1, 6th ed., Jaypee Brothers Medical Publishers, New Delhi.

REFERENCES:

1. J. E. Park, (2007) *Text Book of Preventive Medicine*, Benansider Bhanot – Napier Town.
2. Kanai L. Mukherjee, (1988) *MedicalLaboratoryTechnology, vol. I*, Tata McGraw Hill PublishingCompany Ltd., New Delhi.
3. Kanai L. Mukherjee, (1988) *MedicalLaboratoryTechnology, vol. II* Tata McGraw Hill PublishingCompany Ltd., New Delhi
4. Kanai L. Mukherjee, (1990)*MedicalLaboratoryTechnology, vol. III*, Tata McGraw Hill PublishingCompany Ltd., New Delhi
5. Monica Cheesbrough, (1998). *Medical Laboratory manual of tropical countries*.
6. Manual of Basic Techniques for a Healthy Laboratory – Published by WHO in 1980 Academic Publishers, Calcutta – 700 073.

DIGITAL OPEN EDUCATIONAL RESOURCES

1. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5667583/
2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3735139/
3. https://www.ncbi.nlm.nih.gov/books/NBK302/
4. https://www.ncbi.nlm.nih.gov/books/NBK560808/
5. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4317545/

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 LABORATORY SAFETY AND STERILIZATION				
1.1	Common laboratory accidents – Universal work precautions (UWP) for lab personnel	4	Chalk & Talk	Black Board
1.2	good laboratory practice	3	Chalk	LCD

			&Talk	
1.3	Sterilization: sterilization by heat – cold – ultra violet radiation – Ionizing radiations	4	Lecture	PPT
1.4	Filtration – chemical sterilization.	4	Lecture	Black Board
1.5	Laboratory instruments: Light microscope and centrifuge		Discussion	
UNIT - 2 ANALYSIS OF URINE				
2.1	Composition of urine - Collection and preservation	2	Chalk &Talk	Black Board
2.2	Physical parameter: Colour, Odour, pH, Density	2	Chalk & Talk	LCD
2.3	Chemical parameters: Sugar, Albumin, bile salts, bile pigment, urea	3	Lecture	PPT
2.4	uric acid, creatinine and Ketone bodies and their clinical significances	3	Lecture	Black Board
2.5	Pregnancy tests – Gestational diabetes	2	Chalk & Talk	Black Board
2.6	Abnormal constituents (Proteinuria – Polyuria – Hematuria – Glycosuria)	3	Chalk & Talk	LCD
UNIT -3 HEMATOLOGY				
3.1	Blood**:** collection of blood & lab procedure	2	Chalk & Talk	Black Board
3.2	types of anaemia	2	Chalk & Talk	LCD
3.3	bleeding time- clotting time	2	Chalk & Talk	Smart Board

3.4	Total count of RBC & WBC - Differential count of WBC- Blood grouping	2	Lecture	Black Board
3.5	haemostasis- bleeding disorder of man - Haemolytic disease of newborn	2	Chalk & Talk	Black Board
3.6	Platelet count, reticulocytes count, Absolute Eosinophil count	3	Chalk &Talk	LCD
UNIT -4 ANALYSIS OF STOOL AND SPUTUM				
4.1	Faeces**:** Specimen collection	2	Chalk & Talk	Black Board
4.2	microscopic examination – ova, cysts occult blood, parasitic infestation	2	Chalk &Talk	LCD
4.3	amoebic dysentery	1	Lecture	PPT
4.4	Physical and chemical examination of stool	3	Lecture	Smart Board
4.5	Stool Culture and sensitivity	2	Chalk & Talk	Black Board
4.6	Sputum**:** Macroscopic and Microscopic examination of sputum	3	Chalk & Talk	LCD
4.7	AFB staining Sputum culture	2	Chalk & Talk	Black Board
UNIT -5 SEMEN ANALYSIS				
5.1	Semen: Collection of semen	3	Chalk & Talk	Black Board
5.2	Semen analysis – motility, total count and abnormality	3	Chalk & Talk	LCD
5.3	STD: AIDS, syphilis, gonorrhea	3	Lecture	PPT
5.4	Amniocentesis**:** Need, procedure for collection and Karyotype studies	3	Lecture	Smart Board

5.5	Safe disposal of bio medical wastes – incineration	3	Lecture	Black Board

INTERNAL - UG

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assessment
	T1 10 Mks.	T2 10 Mks.	Quiz 5 Mks.	Assignment 5 Mks	OBT/PPT 5 Mks	35 Mks.	5 Mks.	40Mks.	
K1	2	2	-	-	-	4	-	4	10 %
K2	2	2	5	-	-	9	-	9	22.5 %
K3	3	3	-	-	5	11	-	11	27.5 %
K4	3	3	-	5	-	11	-	11	27.5 %
Non Scholastic	-	-	-	-	-		5	5	12.5 %
Total	10	10	5	5	5	35	5	40	100 %

CIA	
Scholastic	**35**
Non Scholastic	**5**
	40

EVALUATION PATTERN

SCHOLASTIC					NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	C6	CIA	ESE	Total
10	10	5	5	5	5	40	60	100

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	List the different sterilization methods followed in clinical laboratory.	K1	PSO2
CO 2	Explain the collection method and techniques used in laboratory for urine analysis.	K2	PSO2
CO 3	Outline the method of blood collection and related analysis.	K2	PSO2
CO 4	Find the way to process clinical specimens safely according to established procedures.	K3	PSO8
CO 5	Utilize the knowledge of karyotyping in detection of congenital malformations.	K3	PSO1

Mapping of COs with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	PSO 11	PSO 12
CO1	2	3	2	2	2	2	2	2	2	2	2	2
CO2	2	3	2	2	2	2	2	2	2	2	2	2
CO3	2	3	2	2	2	2	2	2	2	2	2	2
CO4	2	2	2	2	2	2	2	3	2	2	2	2
CO5	3	2	2	2	2	2	2	2	2	2	2	2

Mapping of COs with POs

CO/ PSO	PO1	PO2	PO3	PO4
CO1	2	2	2	2
CO2	2	2	3	2
CO3	2	2	3	2
CO4	2	2	2	2
CO5	2	2	3	2

Note: ♦ Strongly Correlated – **3** ♦ Moderately Correlated – **2**

♦ Weakly Correlated -**1**

COURSE DESIGNER:
Dr. S. Barathy

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NEW SYLLABUS

III B.Sc. Zoology

SEMESTER –VI

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
UAZO	19Z6ME4	Clinical Laboratory Techniques	Lecture	5	5

COURSE DESCRIPTION

This course provides current knowledge and upgraded skills in clinical laboratory techniques.

COURSE OBJECTIVES

- To perform routine clinical laboratory procedures within acceptable quality control parameters in urine analysis, Haematology, analysis of stool, sputum and semen.
- Perform laboratory testing with accuracy.
- Able to interpret clinical procedures and laboratory test data accurately.

UNITS

UNIT –I LABORATORY SAFETY AND STERILIZATION (15HRS.)

Common laboratory accidents – Universal work precautions (UWP) for lab personnel - good laboratory practice – Sterilization - sterilization by heat – cold – ultra violet radiation – Ionizing radiations – Filtration – chemical sterilization - Laboratory instruments - Light microscope and centrifuge.

Self-study – Laboratory instruments: Light microscope and centrifuge

UNIT –II ANALYSIS OF URINE (15 HRS.)

Composition of urine - Collection and preservation - Physical parameter: Colour, Odour, pH, Density - Chemical parameters: Sugar (Benedict's test) Albumin (Bence Jones protein test), bile salts, bile pigment, urea, uric acid, creatinine and Ketone bodies (Nitroprusside test) and their clinical significances - Pregnancy tests – Gestational diabetes - Abnormal constituents (Proteinuria – Polyuria – Hematuria – Glycosuria).

Self-study – Composition of urine

UNIT –III HEMATOLOGY (15 HRS.)

Blood**:** collection of blood & lab procedure- types of anaemia - bleeding time- clotting time - Total count of RBC & WBC - Differential count of WBC – Erythrocyte sedimentation rate- blood grouping – haemostasis- bleeding disorder of man - Haemolytic disease of new born, Platelet count, reticulocytes count, Absolute Eosinophil count.

Self-study – Blood grouping

UNIT –IV ANALYSIS OF STOOL AND SPUTUM (15 HRS.)

Faeces**:** Specimen collection – microscopic examination – ova, cysts occult blood, parasitic infestation – amoebic dysentery – Physical and chemical examination of stool - Stool Culture and sensitivity. Sputum**:** Macroscopic & Microscopic examination of sputum - AFB staining - Sputum culture.

UNIT –V SEMEN ANALYSIS (15 HRS.)

Semen: Collection of semen - Semen analysis – motility, total count – abnormality. Cryopreservation. STD: AIDS, syphilis, gonorrhea. Prenatal Diagnosis – Amniocentesis, Chorion villus sampling, Fetoscopy -Need-procedure for collection- Karyotype studies.Safe disposal of bio medical wastes – incineration.

TEXT BOOK:

Sood R. (2009) *Medical Laboratory Technology: Methods and Interpretations* Vol 1, 6th ed., Jaypee Brothers Medical Publishers, New Delhi.

REFERENCES:

1. J. E. Park, (2007) *Text Book of Preventive Medicine*, BenansiderBhanot – Napier Town.
2. Kanai L. Mukherjee, (1988) *MedicalLaboratoryTechnology, vol. I*, Tata McGraw Hill PublishingCompany Ltd., New Delhi.
3. Kanai L. Mukherjee, (1988) *MedicalLaboratoryTechnology, vol. II* Tata McGraw Hill PublishingCompany Ltd., New Delhi
4. Kanai L. Mukherjee, (1990)*MedicalLaboratoryTechnology, vol. III*, Tata McGraw Hill PublishingCompany Ltd., New Delhi
5. Monica Cheesbrough, (1998). *Medical Laboratory manual of tropical countries*.
6. Manual of Basic Techniques for a Healthy Laboratory – Published by WHO in 1980 Academic Publishers, Calcutta – 700 073.

DIGITAL OPEN EDUCATIONAL RESOURCES

1. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5667583/
2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3735139/
3. https://www.ncbi.nlm.nih.gov/books/NBK302/
4. https://www.ncbi.nlm.nih.gov/books/NBK560808/
5. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4317545/

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 LABORATORY SAFETY AND STERILIZATION				
1.1	Common laboratory accidents – Universal work precautions (UWP) for lab personnel	4	Chalk & Talk	Black Board
1.2	good laboratory practice	3	Chalk &	LCD

			Talk	
1.3	Sterilization: sterilization by heat – cold – ultra violet radiation – Ionizing radiations	4	Lecture	PPT
1.4	Filtration – chemical sterilization.	4	Lecture	Black Board
1.5	Laboratory instruments: Light microscope and centrifuge		Discussion	
UNIT - 2 ANALYSIS OF URINE				
2.1	Composition of urine - Collection and preservation	2	Chalk &Talk	Black Board
2.2	Physical parameter: Colour, Odour, pH, Density	2	Chalk & Talk	LCD
2.3	Chemical parameters: Sugar (Benedict's test), Albumin (Bence Jones protein test), bile salts, bile pigment, urea	3	Lecture	PPT
2.4	uric acid, creatinine and Ketone bodies (Nitroprusside test) and their clinical significances	3	Lecture	Black Board
2.5	Pregnancy tests – Gestational diabetes	2	Chalk &Talk	Black Board
2.6	Abnormal constituents (Proteinuria – Polyuria – Hematuria – Glycosuria)	3	Chalk & Talk	LCD
UNIT -3 HEMATOLOGY				
3.1	Blood**:** collection of blood & lab procedure	2	Chalk & Talk	Black Board
3.2	types of anaemia	2	Chalk & Talk	LCD
3.3	bleeding time- clotting time	2	Chalk & Talk	Smart Board

3.4	Total count of RBC & WBC - Differential count of WBC- Erythrocyte sedimentation rate -Blood grouping	2	Lecture	Black Board
3.5	haemostasis- bleeding disorder of man - Haemolytic disease of newborn	2	Chalk & Talk	Black Board
3.6	Platelet count, reticulocytes count, Absolute Eosinophil count	3	Chalk &Talk	LCD
UNIT -4 ANALYSIS OF STOOL AND SPUTUM				
4.1	Faeces**:** Specimen collection	2	Chalk & Talk	Black Board
4.2	microscopic examination – ova, cysts occult blood, parasitic infestation	2	Chalk &Talk	LCD
4.3	amoebic dysentery	1	Lecture	PPT
4.4	Physical and chemical examination of stool	3	Lecture	Smart Board
4.5	Stool Culture and sensitivity	2	Chalk & Talk	Black Board
4.6	Sputum**:** Macroscopic and Microscopic examination of sputum	3	Chalk & Talk	LCD
4.7	AFB staining Sputum culture	2	Chalk & Talk	Black Board
UNIT -5 SEMEN ANALYSIS				
5.1	Semen: Collection of semen	3	Chalk & Talk	Black Board
5.2	Semen analysis – motility, total count and abnormality , cryopreservation.	3	Chalk & Talk	LCD
5.3	STD: AIDS, syphilis, gonorrhea	3	Lecture	PPT
5.4	Prenatal diagnosis –	3	Lecture	Smart

	Amniocentesis, Chorion villus sampling, Fetoscopy -Need, procedure for collection and Karyotype studies			Board
5.5	Safe disposal of bio medical wastes – incineration	3	Lecture	Black Board

INTERNAL - UG

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assessment
	T1 10 Mks.	T2 10 Mks.	Quiz 5 Mks.	Assignment 5 Mks	OBT/PPT 5 Mks	35 Mks.	5 Mks.	40Mks.	
K1	2	2	-	-	-	4	-	4	10 %
K2	2	2	5	-	-	9	-	9	22.5 %
K3	3	3	-	-	5	11	-	11	27.5 %
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