ThiagarajarCollege

(An Autonomous Institution Affiliated to Madurai Kamaraj University)
Re-Accredited with A++ Grade by NAAC

B.Sc., Zoology

Prog Code : UZO

Syllabus 2020

Programme outcome-PO (Aligned with Graduate Attributes)- Bachelor of Science (B.Sc.,)

Scientific Knowledge and Critical Thinking

Apply the knowledge of Life Science, Physical and Chemical Science, Mathematics, statistics, Computer science and humanities for the attainment of solutions to the problems that come across in our day-to-day life/activities.

Problem Solving

Identify and analyze the problem and formulate solutions for problems using the principles of mathematics, natural sciences with appropriate consideration for the public health, safety and environmental considerations.,

Communication and Computer Literacy

Communicate the fundamental and advanced concepts of their discipline in written and oral form. Able to make appropriate and effective use of information and information technology relevant to their discipline

Life-Long Learning

Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Ethical, Social and Professional Understanding

Commitment to principles, codes of conduct and social responsibility in order to behave consistently with personal respect. Acquire the responsibility to contribute for the personal development and for the development of the community. Respect the ethical values, social responsibilities and diversity.

Innovative, Leadership and Entrepreneur Skill Development

Function as an individual, and as a member or leader in diverse teams and in multidisciplinary settings. Become an entrepreneur by acquiring technical, communicative, problem solving, intellectual skills.

THIAGARAJAR COLLEGE, MADURAI – 9.

(Re-Accredited with 'A' Grade by NAAC)

Department of Zoology

Vision

- To render exemplary quality education in Life Sciences and laboratory skills in order to produce generations of responsible, competent and employable graduates

Mission

- To provide a comprehensive set of courses in biological sciences that enhances the understanding, depth of knowledge and technical competency of the students.
- To prepare the students for entry-level research and teaching Positions in biological sciences.
- To provide an environment that fosters the development of appropriate scientific vocabulary, reasoning skills, effective oral and written communication abilities for students.
- To create a holistic understanding of the allied subjects through interdisciplinary learning.

Programme Educational Objectives (PEO)

The objectives of this programme is to equip/prepare the students to

PEO1	Appraise the taxonomy, diversity, relationship and evolution of animals.
PEO2	Elaborate the importance and interrelationship of basic, applied and advanced fields of life sciences.
PEO3	Create an awareness among the public on the importance and influence of animals on the environment, society, and development.
PEO4	Think methodically, independently and draw a logical conclusion for a biological/environmental problem.
PEO5	A new generation of zoologists, capable of excelling in careers of their choosing and nation building

Programme specific outcomes- B.Sc., Zoology

On the successful completion of B.Sc., Zoology the students will

PSO1	Comprehend the core concepts, methods and recent trends/updates/practices in different disciplines of life sciences.
PSO2	Explain how organisms function at the level of the gene, genome, cell, tissue, organ and organ-system.
PSO3	Interpret the complex evolutionary processes, behavioural pattern, physiological and biochemical processes of various animal
PSO4	Acquire theoretical basis and practical skills in the use of basic tools, technologies and methods common to different disciplines of life sciences like. Taxonomy, Physiology, Ecology, Cell biology, Genetics, Applied Zoology, Clinical science, Biochemistry, Biotechnology, Microbiology, Immunology etc.
PSO5	Develops empathy and love towards the animals. Apply the knowledge and understanding of various disciplines of life science to one's own life and work

THIAGARAJAR COLLEGE, MADURAI – 9.

(Re-Accredited with 'A++' Grade by NAAC)

Department of –Zoology and Microbiology

Bachelor of Science (B.Sc.,) Zoology (w.e.f. 2020batch onwards)

Programme Code-UZO

Semester – I

Course	Code No	Subject	Hrs/ Week	Cred	Total Hrs	Max Mark CA	Max Marks SE	Total
Part I	U20 TM11	Tamil	6	3	90	25	75	100
Part II	U20 EN11	English	6	3	90	25	75	100
Core 1	UZO20 C11	Invertebrata	4	4	60	25	75	100
Core 2	U ZO20C12	Cell Biology	4	4	60	25	75	100
Core lab 1	U ZO20CL11	Lab in Invertebrata	2	1	30	40	60	100
Generic Elective	UCH20 GE11	Organic Chemistry	4	4	60	25	75	100
Generic Elective lab	UCH20 GL21	Organic Chemistry lab	2	-	30	-	-	-
EVS		Environmental Science	2	2	30	15	35	50
TOTAL			**30**	**21**				

Semester II

Course	Code No	Subject	Hrs/ Week	Cred	Total Hrs	Max Mark CA	Max Marks SE	Total
Part I	U20 TM21	Tamil	6	3	90	25	75	100
Part II	U20 EN21	English	6	3	90	25	75	100
Core 3	UZO20 C21	Chordata	4	4	60	25	75	100
Core 4	U ZO20 C22	Evolution	4	4	60	25	75	100
Core lab 2	U ZO20 CL21	Lab in Chordata	2	1	30	40	60	100
Generic Elective	UCH20 GE21	Inorganic Chemistry (Chem)	4	4	60	25	75	100
Generic Elective lab	UCH20GL 21	Inorganic Chemistry lab (Chem)	2	-	30	-	-	-
	UCH20GL 21	Organic & Inorganic Chemistry lab(Chem)	-	2	30	40	60	100
AECC		Value Education	2	1	30	15	35	50
TOTAL			**30**	**22**				

Semester III

Course	Code No	Subject	Hrs/ Week	Cred	Total Hrs	Max Mark CA	Max Marks SE	Total
Part I	U20 TM31	Tamil	6	3	90	25	75	100
Part II	U20 EN31	English	6	3	90	25	75	100
Core 5	U ZO20 C31	Biochemistry	4	4	60	25	75	100
Core 6	U ZO20 C32	Biostatistics	4	4	60	25	75	100
Core lab 3	U ZO20 CL31	Lab in Biochemistry	2	1	30	40	60	100
Generic Elective	UBO20 GE31	Plant life forms	4	4	60	25	75	100
Generic Elective lab	UBO20GL 41	Plant life forms lab	2	-	30	40	60	100
NME1	UZO20NE 31	Apiculture	2	2	30	15	35	50
TOTAL			**30**	**21**				

Semester – IV

Course	Code No	Subject	Hrs/ Week	Cred	Total Hrs	Max Mark CA	Max Marks SE	Total
Part I	U20 TM41	Tamil	6	3	90	25	75	100
Part II	U20 EN41	English	6	3	90	25	75	100
Core 7	U ZO20 C41	Developmental Biology	4	4	60	25	75	100
Core 8	U ZO20 C42	Genetics	4	4	60	25	75	100
Core lab 4	U ZO20 CL41	Lab in Developmental Biology and Genetics	2	1	30	40	60	100
Generic Elective	UBO20 GE41	Plant Pathology (Bot.)	4	4	60	25	75	100
Generic Elective lab	UBO20GL 41	Plant Pathology lab(Bot.)	2	-	-	-	-	-
	UBO20GL 41	Plant life forms & Plant Pathology lab(Bot)	-	2	30	40	60	100
NMEII	U ZO20 NE51	Sericulture	2	2	30	**15**	**35**	50
TOTAL			**30**	**23**				

Semester V

Course	Code No	Subject	Hrs/ Week	Cred	Total Hrs	Max Mark CA	Max Marks SE	Total
Core 9	U ZO20 C51	Biotechnology	5	5	75	25	75	100
Core 10	U ZO20 C52	Molecular biology	5	5	75	25	75	100
Core 11	U ZO20 C53	Animal Physiology	5	5	75	25	75	100
Core lab 5	U ZO20 CL51	Lab in Biotechnology	2	1	30	40	60	100
Core lab 6	U ZO20 CL52	Lab in Molecular biology	2	1	30	40	60	100
Core lab 7	U ZO20 CL53	Lab in Animal Physiology	2	1	30	40	60	100
Core Elective	U ZO20 CE51(A/B)	Biophysics/ Wild life biology	5	5	75	25	75	100
SBE I	U ZO20 SE51A/B/C	Clinical Lab Tech. lab/ Poultry farming/IPR/Sericulture	2	2	30	15	35	50
TOTAL			**30**	**25**				
	UZO20IN	**Internship**		**2**		**15**	**35**	50

Semester – VI

Course	Code No	Subject	Hrs/ W	Cred	Total Hrs	Max Mark CA	Max Marks SA	Total
Core 12	U ZO20 C61	Immunology	5	5	75	25	75	100
Core 13	U ZO20 C62	Microbiology	5	5	75	25	75	100
Core 14	U ZO20 C63	Ecology	5	5	75	25	75	100
Core lab 8	U ZO20 CL61	Lab in Biotechnology	2	1	45	40	60	100
Core lab 9	U ZO20 CL62	Lab in Microbiology	2+1	2	45	40	60	100
Core Lab 10	U ZO20 CL63	Lab in Ecology	2+1	2	45	40	60	100
Core Elective II	U ZO20 CE61 A/B	Aquaculture/Entomology	5	5	75	25	75	100
SBE III	U ZO20 SE61 A/B/C	Bioinformatics lab/ Stem Cell Biology/ Forensic Science/Nanotechnology	2	2	30	15	35	50
Part V			**-**	1		**75**	**25**	100
TOTAL			**30**	**28**				

A) Consolidation of contact hours and credits: UG

Semester	Contact Hrs/ Week	Credits
I	30 hrs	21
II	30 hrs	22
III	30 hrs	21
IV	30 hrs	23
V	30 hrs	25
VI	30 hrs	27
Part – V	-	01
Total	180 hrs	140
V	Additional credit (Internship)	2

B) Curriculum Credits: Part wise

		No of papers	Credits per paper	Total credits
Part I	**Tamil**	**4**	**3**	**12**
Part II	**English**	**4**	**3**	**12**
Part III	**Core Theory**	**8+6**	**4/5**	**72**
	Core lab	**10**	**1**	**10**
	Core Elective	**2**	**5**	**10**
	Generic Elective Theory	**4**	**4**	**16**
	Generic Elective Theory	**2**	**2**	**4**
Part IV	**AECC**	**2**	**2**	**4**
	NME	**2**	**2**	**4**
	SEC	**2**	**2**	**4**
	VE	**1**	**1**	**1**
Part V (NSSNCC/Physical Education)				**1**
Grand total				**140**

Department of Zoology
(For those joined B. Sc., Zoology on or after June 2020)
Programme Code: UZO

Course Code	Course Title	Category	L	T	P	Credit
UZO20C51	**Biotechnology**	Core-9	5	-	-	5

Year	Semester	Int. Marks	Ext.Marks	Total
Third	V	25	75	100

Preamble

The course explains the basic concepts in biotechnology, its merits and demerits. The main focus is to expose students to the tools and techniques utilized in biotechnology, with an emphasis on the general aspects of gene cloning experiments. It also highlights the application of fermentation technology in the scaling up of biotechnological products.

Course Outcomes

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

	Course outcomes	Expected Proficiency	Proficiency Attained
CO1	Analyze the benefits and risk of biotechnology	60	70
CO2	Evaluate the appropriateness of regulations in biotechnology	60	60
CO3	Understand the strategies adopted in genetic engineering and animal biotechnology	70	60
CO4	Appreciate the applications of biotechnology.	70	70
CO5	Explain the techniques and tools underlying biotechnology	70	70

Mapping of Course Outcomes with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	M	-	S	M	M
CO2	L	M	L	M	S	S
CO3	S	S	L	S	S	S
CO4	S	S	-	S	S	M
CO5	S	S	-	S	M	M

Strong –S (+++), Medium –M (++), Low-L (+)

Mapping of Course Outcomes with Programme Specific Outcomes

.	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	L
CO2	S	L	M	S	M
CO3	S	-	S	S	L
CO4	S	L	S	S	S
CO5	S	-	S	S	M

Strong –S (+++), Medium –M (++), Low-L (+)

Blooms Taxonomy

	CA		End ofSemester
	First	**Second**	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%

Title of the Course: Biotechnology

Unit 1

Introduction- Concept and scope of biotechnology, Basic Tools for Gene Manipulation: Enzymes-restriction enzymes, ligase, DNA polymerases, reverse transcriptase, polynucleotide kinase, terminal transferase, Cloning vectors: Plasmids (pBR322, pUC), phage (lambda phage) and Cosmids.

Unit-2

Steps in gene cloning, Transformation and transfection, selection of recombinant bacteria- insertional inactivation of antibiotic resistant gene and blue white screening. Genomic and cDNA library preparation. Screening by colony hybridization and functional screening, Human genome project- introduction and ethical issues.

Unit 3:

Animal cell culture: Equipments-CO_2 incubator, inverted microscope, biosafety cabinet, culture-ware and storage devices. Culture Techniques- primary and continuous, adherent and suspension cultures; basic composition of animal cell culture media. Cryopreservation of animal cell lines and applications of animal cell culture. Transgenic animals - somatic nuclear transfer and its advantages. Applications of knock-out mice and transgenic animals as bio-factories.

Unit 4

Fermenter- parts - types of fermentation (Batch and continuous), Principle and applications of: Southern blotting, Western blotting, DNA Finger Printing, DNA sequencing: Maxam & Gilbert Method, Sanger's method. Introduction to Next Generation Sequencing (Illumina platform) and DNA micro array.

Unit 5:

Genetically modified organisms as biocontrol agents (baculo-virus), Biopesticides in managing resistance in crops (*cry* and *cyt* toxins) Bioremediation- Oil degrading bacteria (*Pseudomonas putida*), biofertilizers-cereal crops with *nif* genes, Gene therapy. Ethical issues and risks of GMO.

Text Books

1. Dubey R.C. 2009. A text book of Biotechnology. S. Chand & Company, New Delhi
2. Satyanarayana U. (2010) Biotechnology. Books and Allied (P) Ltd., Kolkata.

Reference books

1. Brown, T.A. 2006. Gene Cloning & DNA Analysis: An introduction.Vedn. Blackwell publishing USA.
2. Glick, R and Pasternak , J 1994. Molecular Biotechnology.Panima Publishing Corporation, New Delhi.
3. Balasubramanian, D., Bryce, C.F.A ., Dharmalingam,K., Green,Y., Jeyaraman.K 2004. Concepts in Biotechnology. Universities (P) ltd. Hyderabad.
4. .Jogdand,S.N (2005) Environmental Biotechnology, Himalaya Publishing House pvt Ltd. Mumbai.
5. Chawla, H.S.2000 Introduction to Biotechnology, Oxford & IBH Publishing Co. Pvt.Ltd.New Delhi.
6. Mitra,S.1996 Genetic Engineering Principles and Practice Macmillan India Ltd. India
7. Trehen, K.2002. Biotechnology, New Age International (P) Ltd. New Delhi
8. Trevan, M.D., Boffey,S., Goulding,K.H and Stanbury,P. 1990, Gene Biotechnology – Himalaya Publishing House, New Delhi.

Course designers Dr.P.Suresh. Associate Professor
Dr. Poornima Kkani, Assistant Professor

Thiagarajar College (Autonomous):: Madurai – 625 009DepartmentofZoology

(For those joined B.Sc Zoology on or after June2020)

ProgrammeCode-UZO

CourseCode	CourseTitle	Category	L	T	P	Credit
UZO20 CL51	**Lab in Biotechnology**	Corelab 5	-	-	2	1

Year	Semester	Int.Marks	Ext.Marks	Total
Third	V	40	60	100

Preamble

Illustrate the creative use of modern tools and techniques for manipulation and analysis of genomic sequences. Expose the students to the application of recombinant DNA technology in biotechnological research.

CourseOutcomes

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

	Course outcomes	Expected Proficiency	Proficiency Attainment
CO1	Explain the concept of genetic engineering and biotechnology.	70	70
CO2	Adoptgeneticengineeringtechniquesinbasicandappliedexperimental biology.	70	60
CO3	Demonstrate nucleic acid and Protein isolation and separation technique.	70	70
CO4	Demonstrate molecular cloning, DNA amplification techniques.	60	70
CO5	Identify and work on the instruments associated with biology	70	70

Mapping of Course Outcomes with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	**S**	**S**	**-**	**S**	**S**	**M**
CO2	**S**	**M**	**L**	**S**	**S**	**M**
CO3	**S**	**L**	**-**	**S**	**M**	**L**
CO4	**S**	**L**	**-**	**S**	**M**	**M**
CO5	**S**	**M**	**M**	**M**	**L**	**M**

Mapping of Course Outcomes with Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**S**	**M**	**---**	**M**	**L**
CO2	**M**	**M**	**L**	**S**	**M**
CO3	**M**	**M**	**---**	**S**	**M**
CO4	**M**	**M**	**L**	**S**	**M**
CO5	**L**	**M**	**M**	**M**	**L**

S-Strong M-Medium L-Low

Title of the Course: Lab in Biotechnology

1. Isolation of Genomic DNA
2. Isolation of Plasmid DNA
3. Restriction digestion analysis
4. Agarose gel electrophoresis of DNA
5. SDS-PAGE
6. Demonstration of cloning
7. Transformation–Demonstration
8. Cell immobilization technique
9. Western blotting–demonstration
10. Demonstration of PCR

Reference books

1. Sambrook, J., Fritsch, E.F. and Maniatis, T. 1989. Molecular Cloning – A lab manual. Vol.III– Second Edition CSHPress, Cold springharbor.
2. Ausubel,F.M.1997.ShortProtocoslinMolecularBiology, SecondEdition,JohnWiley&Sons.Harvard Medical School.
3. Brown, T.A. 1998. Molecular Biology Lab Fax II Gene analysis, Second Edition,AcademicPress, UK.
4. Glover, D.M. and Hames, B.D. 1995. DNA cloning – A practical approach, Vol. 1 w- 4,IRCPress.
5. Janarthanan,S.andVincent,S.2007.PracticalBiotechnology:Methodsandpr otocols,UniversityPress.
6. Swami,P.M.2009.LabManualofBiotechnology.RastogiPublications,Meerut.

Coursedesigners. Dr.Poornima Kkani Assistant Professor

Thiagarajar College (Autonomous):: Madurai – 625 009
Department of Zoology
(For those joined B.Sc., Zoology or after June 2020)
Programme Code:UZO

Course Code	Course Title	Category	L	T	P	Credit
UZO20C52	Molecular biology	Core - 10	5	--	--	5

L-Lecture. T-Tutorial. P-Practicals

Year	Semester	Int. Marks	Ext.Marks	Total
Third	V	25	75	100

Preamble

The course will provide knowledge on the structure and functions of DNA and RNA

Course outcomes

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

#	Course Outcome	Expected Proficiency (%)	Expected Attainment (%)
CO1	Describe the basic chemical nature and structure of DNA & RNA	70	70
CO2	Expound the mechanism of DNA replication, DNA repair process and the enzymes involved	60	70
CO3	Elucidate the process of transcription of genetic message from DNA	70	60
CO4	Explicate the translation of genetic code into peptide chains	70	60
CO5	Illustrate the concept of recombination and gene expression in prokaryotes	70	60

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	L	-	S	L	L
CO2	S	M	-	S	M	L
CO3	S	M	-	S	M	L
CO4	S	M	-	S	L	L
CO5	M	L	L	M	M	L

Mapping of COs with PSOs

S – Strong M - Moderate L - Low

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	M	S	-
CO2	S	S	S	S	-
CO3	S	-	S	M	-
CO4	S	L	L	S	-
CO5	M	M	M	M	-

Blooms Taxonomy

	CA		End ofSemester
	First	**Second**	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%

Course Title: Molecular Biology

Unit I

DNA: Genetic material - Griffith experiment and Chase experiment; chemical composition, Chargaff's rule – Watson and Crick model; RNA - Genetic material – Gierer and Schramm experiment; Genetic and non genetic RNA; Chemical composition, structure of mRNA, tRNA and rRNA.

Unit II

Replication: Semiconservative mode of replication, Meselson and Stahl experiment; Mechanism of replication - origin of replication, initiation, elongation and termination
DNA repair: photoreactivation, nucleotide excision and SOS repair

Unit III

Transcription: Initiation – recognition of promoters, regulation by sigma factor, formation of open complex, elongation and termination - rho dependent, rho independent.

Unit IV

Translation: Initiation – binding of ribosomes and formation of initiation complex, Elongation – peptide formation – translocation – EF – Termination – Peptide termination – Releasing factors

Unit V

Genetic recombination in bacteria: Transformation, conjugation and transduction – generalized and specialized, types of plasmids
Regulation of gene expression in prokaryotes: lac operon, and trp operon

Text Book:

1. Malacinski, G.M. 2015Freifelders Essentials of Molecular Biology IV Edn. Narosa Publishing House, New Delhi.
2. Asokan,P,2005Molecular Biology.ChinnaaPublications,TamilNadu,India

Reference Books:

1. Alberts, B., Johnson, A., Lewis, J., Raff, M., Robersts, K. and Walter, P. 2002. Molecular Biology of the Cell, IVEdn. Garland Publishing, Inc.,
2. Cooper, GM and Hawman RE. 2013. Cell a Molecular Approach VI Edn. Sinauer
3. Griffiths, A.J.F., Lewontin, R.C., Gelbart, W.M. and Miller, J.H. 2002. Modern Genetic Analysis. II Edn., W.H. Freeman and Company, New York.
4. Hardin J., Bertoni, G.P. and Lewis, J. 2011 Becker's World of the Cell VIII Edn. Pearson Education Inc., New York
5. Karp G. 2013. Cell and Molecular Biology Concepts and Experiments. John Wiley & Sons, Inc., New York.
6. Krebs, J.E., Goldstein, E.S., Kilpatrick, S.T. 2011 Lewin's Genes X, Jones and Bartlett
7. Lodish, H., Berk, A., Zipursky, S.L., Matsudara, P., Baltimore, D. and Darnell, J. 2016. Molecular Cell Biology, VIII Edn. W.H.Freeman and Company, New York.
8. Watson, J.D., N.H.Hopkins, J.W.Roberts, J.A.Steitz and A.M.Weiner, 2022. Molecular Biology of the Gene, VII Edn. Pearson Education Inc., New York.
9. Wolfe, L.S., 1993. Molecular and Cellular Biology, Wadsworth publishing company, California.

Course designers: Dr.Rm. Murugappan, Associate Professor

Dr.N. Arun Nagendran, Associate Professor

Thiagarajar College (Autonomous): Madurai – 625 009Departmentof Zoology
(ForthosejoinedB.Sc., ZoologyonorafterJune2020)

ProgrammeCode-UZO

CourseCode	CourseTitle	Category	L	T	P	Credit
UZO20CL52	**Labin MolecularBiology**	Corelab6	-	-	2	1

L-Lecture. T-Tutorial. P-Practicals

Year	Semester	Int.Marks	Ext.Marks	Total
Third	V	40	60	100

Preamble

Competence in the broad scientific theory and application oftechniques associated withmolecularbiologyand microbial genetics.

CourseOutcomes

On thecompletionof thecoursethestudentwillbeableto

	Courseoutcomes	Proficiency Expected %	Expected Attainment%
CO1	Familiarizewithtechniquesassociatedwithmolecularbiology	70	70
CO2	Estimatenucleicacids inasample	70	70
CO3	Isolatemutantcolonies	70	70
CO4	Illustratevariousmethodsinmicrobial growth control	70	70
CO5	Listandsummarisetheprocedureofexperimentscarriedoutinthe laboratorynotebook	70	70

MappingofCourseOutcomes (COs) withProgramme Outcomes (POs)

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	L	M	M	S
CO2	M	M	---	M	M
CO3	---	M	S	M	L
CO4	M	L	S	M	M
CO5	S	---	M	S	L

MappingofCourseOutcomes (COs)withProgramme SpecificOutcomes(PSOs)

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	L	M	M	S
CO2	M	M	---	M	M
CO3	---	M	S	M	L
CO4	M	L	S	M	M
CO5	S	---	M	S	L

Course Title : Lab in Molecular Biology

1. EstimationofDNA and RNA
2. Determinationofmeltingcurveof DNA
3. UVirradiationandphotoreactivation.
4. Isolationofpetitemutants
5. Isolationofphage
6. Isolationofmutant coloniesbyGradient platemethod.
7. Isolation ofmutantcolonies byReplicaplatemethod.
8. Isolationof auxotrophicmutants
9. IsolationofLac-and Lac+colonies
10. AMEStest

ReferenceBooks:

1. Ausubel, F.M., Roger, B., Robert E.Kingston, David A. Moore, Seidman J.G., John A. Smithand Kelvin, S. 1992. Short Protocols in Molecular Biology, Third Edition, John Wiley & SonsInc.,NewYork.

2. Berger, S.L. and Kimmel, R. 1995. Guide to Molecular Cloning Techniques, Academic Press,Inc.,NewYork.USA

3. Brown,T.A.1998.Molecular BiologyLab;GeneAnalysis,AcademicPress,London.

4. Carson,S.,Miller,H.B., Witherow,D.S., Srougi,M.C., 2019. Molecular Biology Techniques: a Class laboratory manual. Elsevier, Academic Press, London, UK.

5. Malov,S.R.1990.ExperimentalTechniquesinBacterialGenetics,JonesandBartlettPublishers, Boston.USA

6. Miller, J.H. 1992. A Short Course in Bacterial Genetics: A Lab Manual &Hand Book for *E.coli* andrelated Bacteria.Cold springHarbor Labpress, ColeSpringHarbar

7. Rajamanickam, C.2001 Experimental protocols in basic molecular biology, Osho ScientificPublications,Madurai.

8. Sambrook,I.,Fritsch,E.F.andManiatis,T.1989.SecondEdition,MolecularCloning1,2,3-ALaboratoryManual, ColdSpringLaboratoryPress,USA

Course designers: Dr.Rm. Murugappan, Associate Professor
Dr.N. Arun Nagendran, Associate Professor

Thiagarajar College (Autonomous):: Madurai – 625 009
Department of Zoology
(For those joined B. Sc., Zoology on June 2020)
ProgrammeCode-UZO

Course Code	Course Title	Category	L	T	P	Credit
UZO20C53	**Animal Physiology**	Core 11	5	-	-	5

L-Lecture. T-Tutorial. P-Practicals

Year	Semester	Int. Marks	Ext.Marks	Total
Third	V	25	75	100

Preamble

Animal Physiology is an exciting study of the coordinated functioning of the different organ systems in maintaining body homeostasis. The course aims at giving an overview of the physiological mechanisms of various organ systems and provide a comparative knowledge of how such functions happen in different classes of organisms.

Course Outcomes

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

	Course outcomes	Proficiency Expected %	Expected Attainment%
CO1	Explain the process of feeding, digestion & compare various types of nutrition	70	60
CO2	Summarize the mechanism of breathing, respiration & circulation	60	60
CO3	Elucidate the physiology of nervous & muscular systems	60	60
CO4	Recognize the excretory organs of different animals & relate osmoregulation with excretion	60	70
CO5	Appreciate the role of hormones in maintaining homeostasis.	60	60

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	M	-	M	L	-
CO2	S	M	-	M	L	-
CO3	S	M	-	M	L	-
CO4	S	M	L	M	L	-
CO5	S	M	-	M	-	-

Mapping of Course Outcomes (COs) with Programme Specific Outcomes (PSOs)

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	-
CO2	S	S	S	S	-
CO3	S	S	S	S	-
CO4	S	S	S	S	-
CO5	S	S	L	S	-

Blooms Taxonomy

	CA		End ofSemester
	First	**Second**	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%

Course Title : ANIMAL PHYSIOLOGY

Unit I

Nutrition and its significance; Autotrophs and heterotrophs- saprophytic, parasitic & holozoic nutrition; types of feeding – filter, deposit, bulk, ram & suction feeding; Intracellular, extracellular, digestion. Human digestive system – Anatomy –Mechanism of Digestion and absorption of carbohydrates, proteins and lipids - hormonal regulation of digestion.

Unit II

Respiration: Respiratory organs in different groups of animals; respiratory pigments – haemoglobin, hemocyanin, hemerythrin, chlorocruion. Types of respiration in frog – buccal, cutaneous and pulmonary respiration. Anatomy of human respiratory system - Mechanism of breathing - physiology of respiration – alveolar gaseous exchange.

Circulation: types of circulatory systems - open & closed; blood – composition and functions; Mechanism of blood clotting; Blood vessels - veins, arteries and capillaries – Structure of human heart - cardiac cycle – origin and conduction of heart beat.

Unit III

Nervous system: structure and types of neuron – CNS and PNS of humans - conduction of nerve impulse- reflex action – structure of human brain.

Muscular system – Types of muscle – ultra structure of skeletal muscle - Mechanism of muscle contraction – Neuromuscular junction and its significance.

Unit IV

Types of excretion – ammonotelism, ureotelism, uricotelism; excretory organs - green glands &coxal gland (arthropods), flame cells (platyhelminthes), Renette cells (nematodes), organ of Bojanus&Kebers organ (molluscs).

Human excretory system - structure of human kidney – Structure of Nephron – Mechanism of urine formation.

Osmoregulation – stenohaline and euryhaline animals – osmoregulation in freshwater and marine teleost.

UNIT V

Thermoregulatory mechanism in poikilotherms - Thermoregulation in man. Hormones – types & classification based on chemical nature - peptide hormones & steroid hormones; Endocrine glands – pituitary, thyroid, adrenal and parathyroid - Mechanism of hormone action.

Text Books:

1. S C Rastogi, 2019. Essentials of Animal Physiology", New Age international Publishers
2. Verma, P.S., Tyagi, B.S, Agarwal, V.K. 2000. Animal Physiology, S.Chand Publishers

References books

1. Randal,D.J., Burggren,W,W.,French,KandEckert,R 2002.Animal Physiology: Mechanisms and Adaptations", , 5th ed., W.H.Freeman and company, New York.
2. Knut Schmidt-Nielsen 2002. Animal Physiology: Adaptation and Environment, , Cambridge University Press.
3. Vander,A.J.,Sherman and Luciano 2003 Human Physiology: The Mechanisms of Body Function. Mc-Graw Hill education, (2003).
4. William S.Hoar, 2003. General And Comparative Physiology, 3rd edition, Phi learning private limited.

Course Designers: Dr.C.Ravi, Associate Professor
Mrs.U.Soundarya, Associate Professors

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Thiagarajar College (Autonomous):: Madurai – 625 009

Department of Zoology

(For those joined B. Sc., Zoology on June 2020)

ProgrammeCode-UZO

Course Code	Course Title	Category	L	T	P	Credit
UZO20CL53	**Lab in Animal Physiology**	Core Lab7	-	-	2	1

Year	Semester	Int. Marks	Ext.Marks	Total
Third	V	40	60	100

Preamble

The course aims to create curiosity amidst students through real time analysis of physiological parameters and observation of internal organs of animal models.

Course Outcomes

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

	Course outcomes	Proficiency Expected %	Proficiency Attained %
CO1	Perform dissection on cockroach & fish	70	70
CO2	Recognize the influence of temperature & pH on salivary amylase activity	60	70
CO3	Estimate the important haematological parameters	60	60
CO4	Appreciate the respiratory physiology of fish	60	60
CO5	Assess the vital health parameters such as BMI & blood pressure	60	60

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	L	-	M	L	-
CO2	S	S	-	M	L	-
CO3	S	S	L	M	L	-
CO4	S	-	-	M	L	-
CO5	S	S	M	S	M	L

Mapping of Course Outcomes (COs) with Programme Specific Outcomes (PSOs)

	PSO1	PsO2	PsO3	PsO4	PsO5
CO1	S	S	M	S	-
CO2	S	M	M	S	-
CO3	S	M	M	S	-
CO4	S	M	M	S	-
CO5	S	M	M	S	-

Course Title : Lab in Animal Physiology

1. Digestive system of cockroach
2. Influence of temperature on salivary amylase activity
3. Influence of pH on salivary amylase activity
4. Gut content analysis of fish
5. Impact of temperature on the opercular activity of fresh water fish
6. Determination of Oxygen consumption by freshwater fish
7. Mounting of haemin crystals
8. Total RBC count
9. Estimation of haemoglobin – Sahli's method
10. Blood Pressure measurement
11. Determination of heart rate – Normal vs Physical activity
12. Qualitative analysis of nitrogenous wastes
13. Calculation of BMI

Reference books:

1. Gupte, S. 2014. The short textbook of medical laboratory for technicians. Jaypee Brothers Medical Publishers Pvt. Ltd., New Delhi.
2. Rajan, S. and Christy, R.S. 2015. Experimental Procedures in Life Sciences. CBS Publishers and Distributors Pvt. Ltd., New Delhi.
3. Verma, P.S. and Srivastava, P.C. 2018. Advanced Practical Zoology. S. Chand and Company Ltd., New Delhi.
4. Ramink Sood.2009. Medical Laboratory Technology- Methods & Interpretation. 6th ed., Jaypee Brothers , New Delhi .

Course Designer:

Dr.C.Ravi, Assistant Professor
Mrs.U.Soundarya, Assistant Professor

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Department of Zoology

(For those joined B. Sc., Zoology on June 2020)

ProgrammeCode-UZO

Course Code	Course Title	Category	L	T	P	Credit
UZO20CE51A	**Biophysics**	Core Elective -A	5	-	-	5

Year	Semester	Int. Marks	Ext.Marks	Total
Third	V	25	75	100

Preamble

This course will lay theoretical foundation applied to physical approaches to biological systems. The knowledge gap in understanding the physical principles underlying biological phenomenon is addressed.

Course Outcomes

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

	Course outcomes	Expected Proficiency %	Proficiency Attained %
CO1	Gain knowledge on the physical nature of light and its importance in biology	60	70
CO2	Understand the principles of thermodynamics	60	60
CO3	Acquire knowledge on the working principles of an array of instrumentation used in life sciences	60	60
CO4	Appreciate Physico chemical mechanisms involved in energy synthesis	60	60
CO5	Understand the physical principles namely kinetics and diffusion properties	60	60

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	-	-	-	M	-
CO2	S	M	-	M	-	M
CO3	S	S	L	S	-	L
CO4	S	-	-	S	L	-
CO5	M	-	-	M	L	-

Mapping of Course Outcomes (COs) with Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	-	-	S	M
CO2	S	-	-	S	-

CO3	**S**	**-**	**-**	**S**	**-**
CO4	**M**	**-**	**-**	**S**	**-**
CO5	**M**	**-**	**-**	**M**	**-**

Blooms Taxonomy

	CA		End ofSemester
	First	**Second**	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%

Course Title : Biophysics

Unit-I -Introduction to Biophysics

Spectrum of Light, Interaction of light with matter, Brownian motion, Einstein relation - Stoke's law and terminal velocity, Bragg's law, factors affecting chemical shifts, Fick's law, Diffusion equation

Unit-II –Thermodynamics

Entropy, Enthalpy, Gibbs free energy, Activation energy and transition states, Equilibrium reactions, Exothermic and Endothermic reactions, Boiling point elevation and Freezing point depression, Laws of thermodynamics.

Unit-III –Physical Techniques related to biology

X- Ray diffraction, NMR spectroscopy, Atomic force Microscopy, Bomb Calorimeter, FTIR, Atomic Absorption Spectroscopy, Mass Spectrometry, HPLC

Unit- IV – Bioenergetics

Formation of ATP from Glucose, Energy transduction through mitochondrial membrane, Chemiosmotic theory, Free radicals in Biology, Electron carriers- NAD, FAD, FMN, Phosphate as the energy currency of the Cell

Unit-V -Kinetics

Determination of order of reactions, MM equation, Line Weaver Burk Plot, Kinetics of reversible enzyme inhibition, Electrochemical potential by Nernst equation, Action potential, Zeta potential.

Text Books:

1. Pattabhi V and Gautham N 2002 Biophysics, NarosaPublishmg House, New Delhi,
2. Narayanan P 2000 Essentials of Biophysics , New Age International (P) Ltd. Publishers, New Delhi.
3. Wilson K and Walker J, 2005 Principles and Techniques of Biochemistry and Molecular Biology, 6th Edition, Cambridge University Press,

Reference Books:

1. Thomas E. C , 1993 Proteins Structure and Molecular Properties, W.H. freeman and Company, New York,.
2. Kumar P 2014.Fundamental Techniques of Biophysics and Molecular Biology . Pathfinder Publications, New Delhi.
3. Spragg S.E. 1980. Physical Behavior of macromolecules with biological functions, John willey and sons. New York
4. Berg, J M., Tymoczko, J L., Gatto Jr., Gregory J., Stryer L, 2019. Biochemistry, 9th ed, W.H. freeman and Company, New York
5. Freifelder D, 2005. Applications to Biochemistry and Molecular Biology, 2nd Edition, W.H. Freeman and Company, New York

Course Designer: Dr. T S Ramyaa Lakshmi Assistant professor
Dr.C.Binu Ramesh Assistant professor

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Department of Zoology
(For those joined B. Sc., Zoology on or after June 2020)
Programme Code-UZO

Course Code	Course title	Category	L	T	P	Credit
UZO20CE51B	WILDLIFE BIOLOGY	Core Elective-B	5	-	-	5

L-Lecture. T-Tutorial. P-Practicals

Year	Semester	Int. Marks	Ext. Marks	Total
THIRD	V	25	75	100

Preamble

The course aims to impart the broad concept of wildlife management, including, laws, policies and conservation methodologies, sustainable use, or control of wildlife and its habitats, methods to safeguard sustainable relationships between wildlife and other human interests. The course strives to provide methods for estimating wildlife population and a snapshot of different animal behavioural patterns.

Course Outcomes

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

	Course outcomes	Expected proficiency	Expected attainment
CO1	Understand the role and importance of wildlife and its status	70	70
CO2	Comprehend scientific methodologies/measures adopted for wildlife conservation	70	60
CO3	Be aware of various legislations and different organizations involved in wildlife conservation	70	60
CO4	Become skilled in different population estimation techniques	70	70
CO5	Appreciate unique behavioural patterns among animals	70	60

Mapping of COs with POs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**S**	**M**	**M**	**S**	**S**
CO2	**S**	**S**	**M**	**S**	**S**
CO3	**S**	**S**	**S**	**S**	**M**
CO4	**S**	**S**	**S**	**S**	**S**
CO5	**S**	**S**	**M**	**S**	**S**

Strong –S (+++) Medium-M (++) Low-L (+)

Mapping of Course Outcomes with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	M	S	S	S	S
CO2	S	M	S	S	S	S
CO3	M	S	M	S	S	S
CO4	S	S	M	S	S	S
CO5	S	S	S	S	S	S

Strong –S (+++) Medium-M (++) Low-L (+)

Blooms Taxonomy

	CA		End ofSemester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%

COURSE TITLE-WILDLIFE BIOLOGY

UNIT - I: Scope and importance of wildlife in India

Definition of Wildlife: Causes of wildlife depletion; Economic importance (ecological, scientific, ethical, aesthetic, game and commercial values) and needs of wildlife conservation. Wildlife categories – IUCN Red list, Red data book, Extinct, Endangered, Threatened and Vulnerable. Human-animal Conflicts: causes and control measures.

UNIT - II Wildlife conservation strategies:

Mega diversity nations - Biodiversity hotspots in India: Western Ghats, Eastern Himalayas. Scopes and importance of conservation methods – In-situ (Wildlife Sanctuaries, National Parks and Biosphere reserves) and Ex-situ (Zoological Parks, Botanical garden and Gene bank). Captive breeding of wild animals: management, prospects and problems. Ecotourism-Definition & principles- case study of Bandipura wildlife sanctuary.

UNIT - III Wildlife management & legislation:

Organizations involved in Wildlife Conservation: Role and contribution of Government (IUCN, NWAP, Zoological survey of India and Botanical survey of India) and Non-government (WWF, ATREE, BNHS and WPSI) organizations.Wildlife protection Act (1972) of India, Wildlife (protection) Act- Schedules I to VI. Wildlife trade and regulations; Biodiversity Act 2000; Anti-poaching operations –Village Forest Council (VFC).

UNIT - IV Population estimation & animal census:

Basic concepts and applications - Direct count (block count, transect methods, Point counts, visual encounter survey, waterhole survey). Indirect count (Call count, track and signs, pellet count, pugmark, camera trap, DNA finger printing and aerial photography). Use of GIS and remote sensing in wildlife conservation. Special conservation projects in India: Project Tiger, Elephant and Musk deer.

UNIT - V Animal Behaviour:

Ethology – Definitions, scope and importance. Instinctive behaviour-classical and modern concepts-fixed action pattern and ritualization; Learning-Imprinting-habituation. Analysis of behaviour pattern- taxis, kinesis and reflexes; Biological rhythms and bird migration; Types of animal communications; Courtship, display, sexual selection and parental care in mammals and birds; Social behaviour in animals - Honey bees, Elephants.

Text books

1) Mazumdar G.K. and Saha S (2017) Wildlife Biology: An Indian perspective.Phi Learning New Delhi.

2) Gibbs, J.P, Hunter, M.L and Sterling, E.J (2011) Problem-Solving in Conservation Biology and Wildlife Management John Wiley & Sons New York, NY.

Reference books

1) Dasmann R F (1981) Wildlife biology 2nd edn Wiley New York.

2) Lindenmayer, D and Burgman,M.A (2005.) Practical conservation biology Collingwood, Vic CSIRO Publications Australia.

3) Scott, J.P. (1972) Animal behavior. University of Chicago Press, Chicago, US.

4) Breland,K., Breland, M. and Bailey, B (2018) Animal behaviour: Storymakers, Inc., Houston. US.

COURSE DESIGNERS:
Dr.N.ARUN NAGENDRAN Associate Professor
Dr.T.RAJAGOPAL, Assistant Professor
Dr.C.BINU RAMESH, Assistant Professor
Mrs.U.SOUNDARYA, Assistant Professor

Thiagarajar College (Autonomous):: Madurai – 625 009

Department of Zoology

(For those joined B. Sc., Zoology on June 2020)

ProgrammeCode-UZO

CourseCode	CourseTitle	Category	L	T	P	Credit
UZO20SE51A	ClinicalLab Technology lab	SBE1 (A)	-	-	2	2

Year	Semester	Int.Marks	Ext.Marks	Total
Third	V	40	60	100

Preamble

Provideshandsontrainingto thestudentsonthe collection,transportandanalysesofclinical specimens.Makeawareofdosanddonot‟swhileanalysingthespecimens.

CourseOutcomes

Onthecompletionof thecoursethestudentwillbeableto

	Courseoutcomes	Expected Proficiency %	Proficiency Attained %
CO1	Applydifferent clinicallaboratorytechniquesforcollection andanalysis of body fluids	60	70
CO2	Exhibittechnicalskills inclinicalsampleanalysesaccordingtopre-established laboratorystandards	60	70
CO3	Listandadheretosafetyrulesandregulationsprescribedforsample acquisition,handlingandtesttobeadoptedfor analyses.	60	70
CO4	Chooseto work orestablish aclinical laboratory	60	70
CO5	Explainmethodsformicrobial culture,evaluatemicrobial contenttestingand sterilitytesting	60	70

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	M	--	S	M	S
CO2	S	S	S	S	S	S
CO3	S	L	S	S	S	S
CO4	M	S	S	M	M	S
CO5	S	S	L	S	M	S

Mapping of Course Outcomes with Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	---	S	S	M
CO2	M	---	S	S	M
CO3	---	M	S	S	M

CO4	**L**	**M**	**S**	**S**	**M**
CO5	**M**	**M**	**M**	**M**	**L**

Course Title : Clinical Lab Technology

1. Determination of Bleeding &Clotting time
2. Determination of ESR
3. Estimation of Blood Sugar(O-Toluidenemethod)
4. Estimation of blood Urea(Zaks method)
5. Estimation of serum Cholesterol
6. Estimationof serumbilirubin (Haslewood andKingmethod)
7. Urinesampleanalysistodetectsugar, Albumin,Ketonebodiesandbilesalts
8. Urine–Microbial CultureandSensitivity
9. SeparationofSerumproteinbyelectrophoresis
10. Semenanalysis –MotilityandTotal count.

ReferenceBooks

1. Collee, J.G., A.G.Fraser, B.P.Marmion and A.Simmons 2007. Mackie and McCartneyPracticalmedical Microbiology. Elsiever, New York.
2. RanjanKumarDe,2007. DiagnosticMicrobiology, (ForDMLTStudents)JaypeeBrotherspublishing, New Delhi.
3. Ashok,R.2000.Antimicrobialsin LaboratoryMedicine,B.I.Churchill Livingstone.NewDelhi.

Course Designer: Dr.M.Thiruvalluvan and Dr.C.Ravi

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(For those joined B. Sc., Zoology on or after June 2020)
Programme Code-UZO

Course Code	Course title	Category	L	T	P	Credit
UZO20SE51B	POULTRY FARMING	SBE 1(B)	2		-	2

L-Lecture. T-Tutorial. P-Practicals

Year	Semester	Int. Marks	Ext. Marks	Total
Third	V	15	35	50

Preamble

The course is designed to impart fundamentals of poultry farming. It also emphasizes on the different rearing and management practices involved in poultry farming.

Course outcomes

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

	Course outcomes	Expected proficiency	Expected attainment
CO1	Comprehend the importance of poultry, its types and variations	70	70
CO2	Compare different rearing systems for layers and broilers	70	70
CO3	Distinguish various rearing conditions and practices for layers and broilers	70	70
CO4	Realize the role of nutrition in poultry production	70	70
CO5	Identify different diseases, preventive measures and control	70	70

Mapping of Course Outcomes with Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	M	S	S
CO2	S	M	M	S	S
CO3	S	M	L	S	M
CO4	S	M	L	S	S
CO5	S	S	M	S	S

Strong –S (+++) Medium-M (++) Low-L (+)

Mapping of Course Outcomes with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	M	L	S	S	S
CO2	S	M	L	S	S	S
CO3	M	L	L	S	S	S
CO4	S	S	L	S	S	S
CO5	S	S	L	S	S	S

Strong –S (+++) Medium-M (++) Low-L (+)

Blooms taxonomy: Assessment Pattern

	CA		End ofSemester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%

Course Title: POULTRY FARMING

UNIT – I - Basics of Poultry

Present status of Indian poultry industry - Nutritive value of chicken and egg. External morphology of a fowl, Breeds of poultry- Broilers, Layers, Dual purpose, Game and Ornamental breeds. Rearing system- Deep litter system and cage system

UNIT-II - Poultry Management

Management of Broilers and Egg Layers – Chick rearing, grower, broiler and layer management-Housing and Equipment, Brooding, Lighting-feeding. Summer and winter management. Health care- Poultry diseases- prevention and control (any five- Ranikhet (Newcastle Disease), Fowl Pox,Tick Fever or Spirochaetosis, Fowl Cholera, Marek's disease), Vaccination

Text Books

1. Gnanamani, M.R (1998) Modern aspects of Commercial Poultry Keeping, Giri Publications, Madurai.

2. Gopalakrishnan C.A and Lal G.M M (1997), Livestock and Poultry enterprises for rural development, Vikash, New Delhi.

Reference books

1. Sreenivasaiah, P. V. (2015). Textbook of Poultry Science, Bio-green books, India
2. Rose, S. P. (1997). Principles of poultry science, CAB International, New York
3. Chauhan H.V.S. and Roy, S (1996) Poultry diseases, diagnosis and treatment New Age International,New Delhi,India

Course Designers: **Dr.C.Binu Ramesh,** Assistant Professor

Ms.U. Soundarya, Assistant Professor

Thiagarajar College (Autonomous):: Madurai – 625 009

Department of Zoology

(For those joined B. Sc., Zoology on or after June 2020)

Programme Code:UZO

CourseCode	Course Title	Category	L	T	P	Credit
UZO20SE51C	**Intellectual Property Rights**	**SBE1(C)**	2	-	-	2

Year	Semester	Int. Marks	Ext.Marks	Total
Third	V	15	35	50

Preamble

The course explains the basic concepts, patent, copyright and trademark in the field of biology. The main focus of the course is on thePatenting and copyrights of Biologicalmaterials like microbes, genes, traits, techniques etc. It also explains the need for the protection of industrial design, techniques, genesetc.

Course Outcomes

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

	Course outcomes	Expected Proficiency %	Proficiency Attained %
CO1	Elaborate the basics and importance of IPR, patent, copyright and trademark	70	70
CO2	Brief the fundamentals of patenting of biological and biotechnological products	70	70
CO3	Applyintellectual propertyrightsprinciples (copyright, patentsandtrademarks)torealproblemsandanalysethesocialimpactofintellectualpropertlawandpolicy.	70	70
CO4	Enlist the patenting agencies within the country and abroad.	70	70
CO5	Enlist the drafting procedure, able to work in patent office and stablish an office for consultation	60	70

Mapping of Course Outcomes with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	M	M	M	S	S
CO2	S	M	M	M	S	S
CO3	S	S	M	M	S	M
CO4	-	-	-	-	-	M
CO5	S	M	M	M	M	S

Strong –S (+++), Medium –M (++), Low-L (+)

Mapping of Course Outcomes with Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	L	---	---	M	M
CO2	M	---	---	L	M
CO3	S	---	---	S	M
CO4	L	---	---	M	L
CO5	L	---	---	L	M

Blooms Taxonomy

	CA		End ofSemester
	First	**Second**	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%

Title of the Course: Intellectual Property Rights

Unit-I

Intellectual Property Rights: concept, scope and economic importance. Types of intellectual property: origin and development. **Patent**: Patent Law, Patent Act 1970 with its amendment. Procedure for patent application and patent granting procedure. **Copyright**: Indian Copyright Act 1957 with its amendment; Ownership and duration of copyright; Need for protection of industrial design.

Unit-II

Trademark: Need for protection of trademarks, Indian Trademark Act 1999. **Patents of Biological materials in India**: Protection of plant varieties and farmers rights. Patenting - microbes, genes, traits, techniques. Plant and animal genetic protection right and implication of protection. WIPO, GATT, TRIP.

Text Book:

1. Raphael Miller, Michael H. Davis, 2000Intellectual Property: Patents, Trademarks and Copyright in a Nutshell, West Group Publishers .
2. e-book: www.icsi.edu. Intellectual Property Rights-Law and Practices,2014. Published by The Institute of Company Secretaries of India. New Delhi

Reference Books:

1. N.K. Acharya, 2001Textbook on intellectual property rights, Asia Law House.
2. K. Singh,2010. Intellectual Property rights on Biotechnology, BCIL, New Delhi (2010)
3. S. A. Stanley (2008) Bioethics, Wisdom educational service
4. F.K. Beier, R.S. Crespi, T. Straus, 1985.Biotechnology and Patent protection, Oxford and IBH Publishing Co. New Delhi,
5. U. Sathyanarayana2009. Biotechnology, Books and allied (p) Ltd, Kolkata.
6. B.D. Singh,2009. Biotechnology, Kalyani publishers, New Delhi.

Course designers : Dr.T.Rajagopal
Dr.RM.Murugappan
Dr.N.ArunNagendran

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Programme Code:UZO

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CourseCode	Course Title	Category	L	T	P	Credit
UMB19NE51	Sericulture	SBE1(D)	2	-	-	2

Year	Semester	Int.Marks	Ext.Marks	Total
Third	Fifth	15	35	50

Preamble

Elaborates on rearing of silkworms for the production of raw silk, comprises of food-plantcultivation to feed the silkwormsand reeling the cocoons for unwinding the silk filament forvalueadded benefits such as processingandweaving

CourseOutcomes

On the completion of the course the student will beableto

	Courseoutcomes	Expected Proficiency (%)	Expected Attainment (%)
CO1	Explainthe varioustechniquesinrearingsilkworm	70	70
CO2	Acquitwith theinfections andmethods toovercome thediseaseoccurrenceon silkwormrearing	7	
CO3	Spellthe lifecycle ofmulberrysilkworm	70	70
CO4	Ventureinto thesericultureindustryas an entrepreneur	70	70
CO5	Differentiatemulberryand non-mulberrysilkworm	70	70

Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	S	M	M	S	S	S
CO2	S	S	M	S	S	S
CO3	S	-	-	S	M	M
CO4	S	S	M	S	S	S
CO5	S	S	M	M	L	M

Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	---	---	M	S
CO2	M	M	S	M	---
CO3	M	---	---	M	M
CO4	L	----	---	S	M

CO5	**S**	**---**	**---**	**M**	**S**

Bloomstaxonomy:AssessmentPattern

	CA		End ofSemester
	First	**Second**	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%

Title of the Course: Sericutlure

Unit I:

General Introduction: History and sericulture industry in India. Classification of silkworm: mulberry & non-mulberry. **Biology of *Bombyx mori***: Morphology (egg, larva, pupa, adult and silk gland) and life cycle. **Grainage Technology**: Breeding station (P4, P3, P2 and P1), selection of seed cocoon rearer and storage of egg.

Unit II:

Rearing Technology: Rearing equipments, methods of rearing mulberry silkworm and harvesting of cocoons. **Reeling Technology**: Reeling (stifling, storage of cocoon, sorting of cocoon, cocoon riddling, cocoon boiling, brushing) and methods, raw silk. **Diseases of silkworm**: Causes, symptoms & control measures of Flacherie, Muscardine and Grasserie.

Textbooks:

1. Ganga,G and J. Sulochana Chetty 2010. Introduction to Sericulture, 2nd Ed. Published byOxford& IBH PublishingCo. Pvt.Ltd.
2. Shukla,G.S and Upadhyay,V.B 2008.Economic Zoology4th EdRastogi publications.NewDelhi

Reference Books

1. S.Omura,1980SilkwormRearingTechniquesintheTropics,Dr.JapanInternationalCooperationAgency.
2. S.R. Ullal and Narasimhanna,M.N. 1987. Handbook of Practical Sericulture, CSB,Bangalore.
3. Krishnaswami, S., Narasimhanna, M. N., Suryanarayan, S. K. Kumar Raj S.1988.Sericulture Manual onSilkworm Rearing, FAO,Oxford &IBh publishing co.pvt. Ltd.NewDelhi
4. HaungGuo Rui1998. SilkReeling,Oxford &IBHPublishingCo.Pvt. Ltd.NewDelhi.

Course designers: Dr.T.Rajagopal

Thiagarajar College (Autonomous):: Madurai – 625 009
Department of Zoology
(For those joined B. Sc., Zoology on or after June 2020)
Programme Code-UZO

Course Code	Course title	Category	L	T	P	Credit
UZO20 C61	IMMUNOLOGY	CORE-12	5	-	-	5

L-Lecture. T-Tutorial. P-Practicals

Year	Semester	Int. Marks	Ext. Marks	Total
THIRD	VI	25	75	100

Preamble

The study of immunology is about the human immune system which is the ultimate personalized defense mechanism for protection from any pathogens, and also its vital role in identifying and destroying potential cancerous cells. The study of immunology is important for the wellbeing and survival of human and animals. The cutting edge discoveries in immunology has led to key healthcare advances, including vaccination and cancer immunotherapy. Immunology is also fundamental to life sciences industry; the discipline is core to the development of modern antibody therapies, cellular therapies, small molecule drugs, vaccines and 'biologics' (therapuetic biomolecules). The present course in immunology is one such start to become an immunologist.

Course Outcomes

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

	Course outcomes	Expected proficiency %	Expected attainment %
CO1	Define the basic biology of the cells of the immune system, including their development and specific functions	70	70
CO2	Outline how the cells interact with each other in the formation of an immune response.	70	70
CO3	Infer/interpret the molecular basis by which the immune system identifies pathogens.	70	60
CO4	Perceive what occurs when there are failures of the immune system.	70	60
CO5	Become skilled at the experimental basis and reasoning that underlies the material in the course	70	70

Mapping of COs with Pos

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	M	S	S
CO2	S	M	M	S	S
CO3	S	M	L	S	M
CO4	S	M	L	S	S
CO5	S	S	M	S	S

Mapping of Course Outcomes with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	M	L	S	S	S
CO2	S	M	L	S	S	S
CO3	M	L	L	S	S	S
CO4	S	S	L	S	S	S
CO5	S	S	L	S	S	S

Strong –S (+++) Medium-M (++) Low-L (+)

Blooms taxonomy

	CA		End ofSemester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%

COURSE TITLE- IMMUNOLOGY

Unit I

History of Immunology: Contributions of Edward Jenner, Louis Pasteur, Elie Metchnikoff; Types of immunity: Innate-anatomic, physiologic, phagocytic, and inflammatory, Adaptive – antigenic specificity, diversity, Immunologic memory, self & nonself recognition. Humoral - Cell-mediated immunity; Cells of immune system: Granulocytes and agranulocytes, Macrophages, NK & Mast cells, APCs; Organs of immune system: Primary-Thymus & Bone marrow; Secondary – spleen –lymph nodes – GALT & MALT.

Unit II

Antigens – Haptens – Adjuvants – Epitopes –Antigens Vs Immunogens – Antigenic Peptides Antibodies: Immunoglobulins –structure, function and classes – IgG, IgA, IgM, IgD, IgE Characteristics-Isotypes, Allotypes, Idiotypes; Humoral immunity – Clonal selection theory (N.K. Jerne); kinetics of antibody response-primary and secondary, Antigen–Antibody interactions–Agglutination, Precipitation- Immunodiagnosis-ELISA and Westernblot; Monoclonal Antibody production by Hybridoma Technology.

Unit III

Complement factors – Classical – Alternate-Lectin pathways-biological functions. Cell mediated immunity – Cytokines – types – Network – Role in immune regulation. Hypersensitivity reaction – Type I, II, III, IV. Tolerance – definition – types - Autoimmunity– organ specific –Myasthenia gravis – Hashimoto's thyroiditis- Systemic-Rheumatoid arthritis- - Systemic lupus erythematosus (SLE).

Unit IV

Transplantation antigens-Erythrocyte antigens-MHC – HLA – Class I & Class II Antigens – Immunologic Basis of Graft Rejection -Allograft rejection –cells involved– GVHD – Prevention of graft rejection. Tumor Antigens –Immunity to tumor-Tumor evasion mechanisms-tumorimmunodiagnosis – Tumor therapy.

Unit V

Immunodeficiencies- Primary – B & T Cell deficiencies, combined, secondary- acquired – HIV/AIDS; Vaccines: Types- Attenuated – Killed – Purified proteins (Toxoid) – Recombinant Vaccines. Covid vaccines; Immunization schedule, Active & Passive immunization.

Text Books:

1. Coico, R., Sunshine, G., &Benjamini, E., 2015 Immunology: A Short Course, Eighth edition. Wiley Blackwell, New York.

2. Punt J., Stranford S., Jones P.P & Owen JA 2019. Kuby Immunology, Eighth edition. W.H. Freeman and Company, New York.

Reference Books:

1. Abbas, A.K., Lichtmann A.H. and S. Pillai. 2021 Cellular and Molecular Immunology, tenth edition, Elsevier, New York.

2. Coleman, R.M., Lombard, M.F., & Sicard, N.E. 1992 Fundamental Immunology, second edition, Wm. C. Brown Publishers, USA.

3. Cruse, J.M. & Lewis. R.E. 1998. Atlas of Immunology. second edition, CRC Academic Press. New York.

4. Male, D.K., Peebles, Jr. R.S & Male V. 2021 Immunology Ninth edition, Philadelphia, Elsevier Ltd.

5. Shetty, N 1993Immunology – Introductory Text Book, second edition, Wiley Eastern Limited, New Delhi.

6. Roitt., Brostaff J. and Male D. 2001 Immunology VI edition, Mosby,London.

Course Designers: **Dr.M.Thiruvalluvan**
Dr.C.Binu Ramesh

Thiagarajar College (Autonomous):: Madurai – 625 009
Department of Zoology
(For those joined B. Sc., Zoology on or after June 2020)
Programme Code-UZO

Course Code	Course title	Category	L	T	P	Credit
UZO20CL61	LAB IN IMMUNOLOGY	CORE LAB-8	-	-	2	1

L-Lecture. T-Tutorial. P-Practicals

Year	Semester	Int. Marks	Ext. Marks	Total
THIRD	VI	40	60	100

Preamble
Brief the basic principles and procedures involved in imparting immunity. Provides hands on training on basic immunological techniques.

Course Outcomes
On the completion of the course the student will be able to

	Course outcomes	Expected proficiency	Expected attainment
CO1	Distinguish and display lymphoid organs	70	70
CO2	Demonstrate blood collection and serum separation	70	70
CO3	Distinguish various blood cells and their importance	70	70
CO4	Perform agglutination assays	70	70
CO5	Demonstrate animal handling techniques	70	70

Mapping of COs with POs

PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	**M**	**---**	**---**	**M**	**M**
CO2	**M**	**M**	**S**	**S**	**M**
CO3	**M**	**M**	**S**	**S**	**M**
CO4	**M**	**---**	**M**	**S**	**M**
CO5	**S**	**S**	**---**	**M**	**M**

S-Strong M-Medium L-Low

Mapping of Course Outcomes with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	**S**	**M**	**S**	**S**	**S**	**S**
CO2	**S**	**M**	**S**	**S**	**M**	**S**
CO3	**M**	**L**	**M**	**S**	**S**	**S**
CO4	**S**	**S**	**S**	**S**	**S**	**M**
CO5	**S**	**S**	**S**	**S**	**S**	**S**

Strong –S (+++) Medium-M (++) Low-L (+)

COURSE TITLE - LAB IN IMMUNOLOGY

Laboratory exercises

1) Virtual dissection and onscreen display of lymphoid organs of chick and mouse
2) Preparation of soluble, particulate and cellular antigens.
3) Demonstration of immunization routes, repetitive bleeding technique in fish and Separation and preservation of serum/complements.
4) Virtual demonstration of repetitive bleeding technique and injection routes in mouse, rat and rabbit.
5) Natural resistance by bacterial killing using unimmunized serum
6) Direct haemagglutination assay
7) Passive haemagglutination assay
8) Bacterial agglutination assay
9) WBC differential count with reference to innate and adaptive immunity.
10) Separation of lymphocytes from peripheral blood using density gradient centrifugation
11) T and B-lymphocytes and separation by nylon wool column method.
12) Cellular immunity – scale allograft rejection in fish.
13) Complement mediated haemolysis.

Reference books:

1. Hudson. L., Hay F.C., 1989 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. Michael R.D 2018 Immunological Techniques using Fish Model: A Laboratory Manual, Notion Press, Chennai, India

Course Designers: **Dr.M.Thiruvalluvan**
Dr.C.Binu Ramesh

Thiagarajar College (Autonomous):: Madurai – 625 009

Department of Zoology

(For those joined B. Sc., Microbiology on or after June 2020)

Programme Code:UZO

Course Code	Course Title	Category	L	T	P	Credit
UZO20C62	**Microbiology**	Core-13	5	-	-	5

Year	Semester	Int. Marks	Ext.Marks	Total
Third	VI	25	75	100

Preamble

The course explains the basic concepts, history on the development of microbiology. The main focus of the course is on the classification and biology of microbes - bacteria, viruses, fungi and algae. It also explains the significance of beneficial microbes and methods for the control of pathogenic microbes.

Course Outcomes

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

	Course outcomes	Expected Proficiency	Proficiency Attained
CO1	Recognize the fundamental concepts, history and development of microbiology.	70	70
CO2	Sketch the taxonomical classification,structural organization and importance of microbes(bacteria fungi and viruses).	70	60
CO3	Explain the epidemiology of infectious diseases in Human	70	70
CO4	Elaborate methods involved in isolation, growth and control of microbes,	60	60
CO5	Illustrate the importance and application of microbes in our day to day life.	70	60

Mapping of Course Outcomes with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	**S**	**M**	**-**	**S**	**S**	**M**
CO2	**S**	**-**	**-**	**S**	**M**	**L**
CO3	**S**	**S**	**-**	**M**	**S**	**L**
CO4	**S**	**S**	**-**	**S**	**M**	**L**
CO5	**S**	**L**	**-**	**S**	**S**	**M**

Strong –S (+++), Medium –M (++), Low-L (+)

Mapping of Course Outcomes with Programme Specific Outcomes

.	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**S**	**L**	**S**	**L**	**S**
CO2	**S**	**S**	**S**	**-**	**S**
CO3	**S**	**S**	**L**	**M**	**S**
CO4	**S**	**-**	**L**	**S**	**S**
CO5	**M**	**M**	**M**	**S**	**S**

Blooms Taxonomy

	CA		End ofSemester
	First	**Second**	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%

Title of the Course: Microbiology

Unit I

History and scope of Microbiology,Contributions of Louis Pasteur, Robert Koch, Edward Jenner, Paul Ehrlich, Alexander Fleming. Classification (Three and Five kingdom concept) and identification of Microorganisms. Sterilization methods - Physical and chemical methods, Pasteurization. Growth media –Natural, synthetic, complex, differential and selective.

Unit II

Outline classification for bacteria as per the second edition of Bergey's Manual of Systematic Bacteriology. Structural organization of bacteria – Size, shape and arrangement of bacterial cells - Ultrastructure of a bacterial cell, cell wall, cell membrane, nucleoid, capsule, flagella, fimbriae, spores and cysts;

Staining method,Phases of growth. Epidemiology of diseases caused by bacteria-Typhoid, Cholera, Pneumonia, Zoonotic diseases-Plague

Unit III

Outline classification of viruses - Characteristics of viruses; Morphology – Helical, polyhedral, enveloped, complex; Morphology and structure of TMV and Influenza virus. Virions and Prions. Epidemiology of infectious diseases caused by virus- AIDS, SARS, COVID-19, Rabies

Unit IV

Outline classification of Fungi (Alexopoulos and Mims). Distinguishing characteristics of Fungi – Filamentous, non-filamentous & dimorphic fungi; Morphology and structure of *Aspergillus niger* and *Saccharomyces cerevisiae*; Industrial uses of yeasts and molds. Epidemiology of infectious diseases caused by fungi -Ringworms, candidiasis.

Unit V

Food Microbiology–Spoilage process (souring, putrefaction, rancidity and soft rot) Food poisoning and Microbial toxins. Preservation of foods (Physical and Chemical agents).Microbial

products; Edible mushrooms, probiotics, cheese, curd ,wine, beer. Applied microbiology-Sewage Treatment, Biofertilizer (Rhizobium, Azolla).

Text Books

1. Pelczar, M.J., Chan E.C.S. and Kreig. N.R. 2009. Microbiology, 5th edition. McGraw-Hill. Book Co. Singapore
2. Tortora, G.J., Funke, B.R. and Case, C.L. 2009. Microbiology: An Introduction. 9th edition, Pearson Education, Singapore

Reference Books

1. Alcamo, I.E. 2001. Fundamentals of Microbiology, 6th edition, Addison wesley Longman, Inc. California
2. Alexopoulos, C.J., Mims , C.W. and Blackwell, M. 2000. Introductory Mycology. 5th edition, John Wiley & Sons. Chichester.
3. Atlas, R.A. and Bartha, R. 2000. Microbial Ecology. Fundamentals and Application, 4th edition Benjamin Cummings, New York.
4. Black, J.G.2005. Microbiology-principles and explorations, 6th edition. John Wiley & Sons, Inc. New York
5. Dubey, R.C. and Maheswari, D.K. 2010. A Text Book of Microbiology. 3rd edition S. Chand, New Delhi.
6. Frazier, W.C., and Westhoff, D.C. 2005. Food Microbiology,sixth edition, Tata McGraw Hill Publishing Ltd., New Delhi.
7. Johri, R.M., Latha,S and Sandhya S, 2010. A Textbook of Algae. 2nd edition, Wisdom Press, New Delhi.
8. Sharma,K, 2011. Textbook of Microbiology – Tools and Techniques. 1st edition, Ane Books Pvt. Ltd., New Delhi.
9. Madigan, M.T., Martinkl, J.M. and Parker, J. 2009. Brock Biology of Microorganisms, 12th edition, MacMillan Press, England.
10. Prescott, L.M., Harley, J.P. and Klein, D.A. 2008. Microbiology 7th edition, McGraw Hill, New York.
11. Schlegel, H.G. 2008. General Microbiology, 7th edition, Cambridge University Press,U.K.
12. Stanier, R.Y., Adelberg, E.A. and Ingram, J.L. 1991. General Microbiology, 5th edition, Prentice Hall of India Pvt. Ltd., New Delhi.

Course designers :Dr.RM.Murugappan, Associate Professor

Dr.M.Thiruvalluvan, Associate Professor

Thiagarajar College (Autonomous):: Madurai – 625 009

Department of Zoology

(For those joined B. Sc., Zoology on or after June 2020)

Programme Code:UZO

Course Code	Course Title	Category	L	T	P	Credit
UZO20CL62	**Lab in Microbiology**	Core Lab-9	-	1	2	1

Year	Semester	Int. Marks	Ext.Marks	Total
Third	VI	40	60	100

Preamble

Provide hands on training in microbiology laboratory techniques. The students will learn do and do not's in the laboratory. Students will be trained in preparing different media for culturing microorganisms. Explain different methods to identify, differentiate bacteria and fungi, their growth control methods

Course Outcomes

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

	Course outcomes	Expected Proficiency	Proficiency Attained
CO1	Demonstrate an overview of the instruments, glasswares chemicals and media used in microbiology	70	80
CO2	Possess the basic microbial techniques for isolation, culture and enrichment of bacteria and fungi..	80	60
CO3	Comprehend the various methods for identification of unknown microorganisms.	70	70
CO4	Interpret the Microbiology techniques in research or internship activities.	70	60
CO5	Develops basic skills necessary to work in the microbiology laboratory or start a clinical lab.	70	60

Mapping of Course Outcomes with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	**S**	**S**	**L**	**S**	**-**	**S**
CO2	**S**	**S**	**-**	**S**	**M**	**S**
CO3	**S**	**S**	**L**	**S**	**S**	**S**
CO4	**S**	**S**	**-**	**S**	**S**	**S**
CO5	**S**	**S**	**L**	**S**	**S**	**S**

Strong –S (+++), Medium –M (++), Low-L (+)

Mapping of Course Outcomes with Programme Specific Outcomes

.	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	-	S	S	M
CO2	S	-	M	S	M
CO3	S	M	M	S	M
CO4	S	L	S	S	M
CO5	S	S	M	S	S

Strong –S (+++), Medium –M (++), Low-L (+)

Title of the Course: Lab in Microbiology

General Microbiology

1. Equipment's needed for microbiology laboratory,
2. Laboratory safety and precautions.
3. Sterilization methods – moist heat, dry heat, filtration and radiation.
4. Preparation of culture media –solid (Selective and differential)and liquid
5. Aseptic transfer of microorganisms
6. Isolation of microbes from soil -serial dilution and enumeration
7. Staining methods- Bacteria- Simple, Gram and Spore staining
8. fungal staining – Slide culture technique
9. Bacterial motility-Hanging drop method
10. Biochemical test –IMViC TEST, Oxidase and catalase
11. Methylene Blue Reductase test –Milk quality
12. Water Quality analyses-MPN test.
13. Determination of minimum inhibitory concentration
14. Determination of Minimum bactericidal concentration

Reference Books

1. Cappuccino,J.H and Sherman, N.,2012. Microbiology – A Laboratory Manual. 7th Edition, Dorling Kindersley (India) Pvt. Ltd., New Delhi.

Course designers : Dr.RM.Murugappan
Dr.M.Thiruvalluvan

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Programme Code: UZO

Course Code	Course Title	Category	L	T	P	Credit
UZO20C63	**Ecology**	Core-14	5	-	-	5

Year	Semester	Int. Marks	Ext.Marks	Total
Third	VI	25	75	100

Preamble

The course explains the basic concepts of ecology and various ecosystems. It provides a broad exposure on contemporary environmental issues faced due to human interference like environmental pollution and other climate change issues. It also sheds light on the sustainable practices to mitigate problems and steps undertaken by the government to reduce environmental concerns.

Course Outcomes

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

	Course outcomes	Expected Proficiency	Proficiency Attained
CO1	Define environment and its various components	70	70
CO2	Differentiate population, community and its inter dependence	70	70
CO3	Explain various ecosystems, its abiotic and biotic components	70	70
CO4	Advocate the usefulness of natural resources and its limitations	70	60
CO5	Reflect about the causes of environmental pollution and national policies to protect environment.	60	60

Mapping of Course Outcomes with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	**M**	**-**	**-**	**M**	**M**	**L**
CO2	**M**	**M**	**-**	**M**	**M**	**-**
CO3	**M**	**M**	**-**	**S**	**M**	**-**
CO4	**S**	**M**	**-**	**S**	**S**	**-**
CO5	**S**	**S**	**-**	**S**	**M**	**M**

Strong –S (+++), Medium –M (++), Low-L (+)

Mapping of Course Outcomes with Programme Specific Outcomes

.	PSO1	PSO1	PSO1	PSO1	PSO1
CO1	**S**	**M**	**S**	**S**	**S**
CO2	**S**	**L**	**S**	**S**	**S**
CO3	**S**	**L**	**M**	**S**	**M**
CO4	**S**	**-**	**-**	**S**	**S**
CO5	**S**	**-**	**-**	**S**	**M**

Strong –S (+++), Medium –M (++), Low-L (+)

Blooms Taxonomy

	CA		End ofSemester
	First	**Second**	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%

Title of the Course: Environmental Biology

Unit I

Scope of Ecology, Components of environment - Atmosphere, hydrosphere, lithosphere and biosphere. Concept of Ecosystem and its Abiotic and Biotic components, Importance of limiting factors, carrying capacity, Energy flow, food chain, Ecological pyramids and food web. Ecological niche, biogeochemical cycles - carbon and nitrogen cycle.

Unit II

Population ecology: Characteristics, size and density, Factors affecting population density and dispersion. Population growth and regulations. Community ecology: characteristics and its interdependence (intra and inter specific interactions - Neutralism, symbiosis, commensalism, mutualism, antagonism, parasitism and predatism). Ecological succession – types, patterns and its significance. Ecotone and edge effect.

Unit III

Aquatic ecosystem: Physico-chemical characteristics and biotic communities of – Freshwater (pond), marine and estuarine habitats.

Terrestrial ecosystem: Physico-chemical characteristics and biotic factors of various biomes- Desert, wetland, tropical rainforests and tundra.

Unit IV

Natural resources management: **Land Sources** – land degradation, man induced landslide, soil erosion and desertification. **Water Sources** – Use and misuse of surface and ground water, floods, benefits and problems from dams, **Forest Sources** – Utilization and exploitation: deforestation, timber extraction, mining and its effects on forest. **Energy resources** - Growing energy needs, renewable and non-renewable energy sources and use of alternative energy sources. Use of Remote Sensing and GIS in Natural Resource Management.

Unit V

Environmental Pollution and its impact: acid rain, eutrophication, nuclear winter, ozone depletion and acidification (land and aquatic). Global warming and climate change. Effects of *El nino& La- nina-* an overview of Intergovernmental Panel on Climate Change (IPCC). Global initiatives to address environmental issues - Kyoto protocol and Earth summit. Green technologies for sustainable development. Environmental regulations in India (EPA and EIA)

Text Books

1. Bhatia, A.L.,(2010) Text book of Environmental Biology, I.K. International Publishing House Pvt.Ltd., Delhi.
2. Verma P.S.andAggarwal,V.K.(2010) Environmental biology (Principles of Ecology). S.Chand publishers, New Delhi

Reference Books

1. Atlas, R.A. and Bartha, R. 2000. Microbial Ecology, Fundamentals and Application, Benjamin Cummings, New York
2. Briggs, D., Smithson, P., Addison, K. and Atkinson. K. 1997. Fundamentals of Physical Environment. II edn. Routledge. UK.
3. Kumaraswamy, K., Alagappa Moses, A. and Vasanthy, M. 2001. Environmental Studies. Bharathidasan University Publication, Tiruchirappalli.
4. Mackenzie, N., Ball, A.S. and Virdee, S.R. 1999. Instant notes in Ecology. Viva Books pvt. Ltd. New Delhi.
5. Odum, E.P. 1996. Fundamentals of Ecology. Nataraj Publishers, Dehradun.
6. Sapru R.K.2001. Environment Management in India, Vol. I & Vol. II Ashish publishers house, New Delhi.
7. Stiling, P. 2004. Ecology – Theories and applications. Prentice Hall of India Pvt. Ltd., New Delhi.
8. Yogendra, N. and Srivastava, N. 1998. Environmental Pollution, Ashish Publishing House. New Delhi.

Course designers : **Dr.P.Suresh,** Associate Professor
Dr.PoornimaKkani,Assistant Professor

Thiagarajar College (Autonomous):: Madurai – 625 009
Department of Zoology
(For those joined B. Sc., Zoology on or after June 2021
Programme Code: UZO

CourseCode	Course Title	Category	L	T	P	Credit
UZO20CL63	**Lab in Ecology**	CoreLab	-	-	2	1

Year	Semester	Int. Marks	Ext.Marks	Total
Third	VI	40	60	100

Preamble

This course gives the student an opportunity to go for real time sampling in an ecosystem and understand its various components. It helps the students in depicting the flow of energy in a food chain through the ecological pyramid construction. The students are exposed to various hands on skills required to access the water quality and evaluate the extent of pollution using various physico chemical and biological methods. This lab will enable the students to do a survey of biodiversity in an ecosystem.

Course Outcomes

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

	Course outcomes	Expected Proficiency	Proficiency Attained
CO1	Graphically represent the energy flow and inter-relationship of species in an ecosystem	70	60
CO2	Undertake a survey and sampling in a natural ecosystem.	70	60
CO3	Assess the water quality of an aquatic environment.	70	70
CO4	Evaluate the pollution level in different. ecosystems	70	60
CO5	Identify the pollution indicators.	60	60

Mapping of Course Outcomes with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	**S**	**L**	**-**	**M**	**-**	**-**
CO2	**S**	**S**	**M**	**S**	**M**	**M**
CO3	**S**	**S**	**M**	**S**	**M**	**M**
CO4	**S**	**S**	**M**	**S**	**M**	**M**
CO5						

Strong –S (+++), Medium –M (++), Low-L (+)

Mapping of Course Outcomes with Programme Specific Outcomes

.	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**S**	**-**	**M**	**S**	**M**
CO2	**S**	**-**	**S**	**S**	**M**
CO3	**S**	**-**	**S**	**S**	**M**

CO4	**S**	**-**	**L**	**S**	**M**
CO5	**S**	**-**	**-**	**S**	**M**

Strong –S (+++), Medium –M (++), Low-L (+)

Title of the Course: Lab in ecology

1.Tracing food chain and construction of Ecological Pyramids.
2. Sampling and distribution pattern of insect species in a grassland ecosystem
3. Estimation of Dissolved Oxygen in water samples.
4. Estimation of free carbon di oxide in water samples.
5. Determination of alkalinity and turbidity in water samples.
6. Measurement of primary productivity in an ecosystem.
7. Estimation Biological Oxygen demand of an aquatic ecosystem.
8. Morphometric studies of a pond.
9. Identification of Pollution indicators.
10. A study on the effect of eutrophication.
11. Survey of soot and dust pollution in Madurai city.
12. Survey of biodiversity in a forest ecosystem and calculation of diversity indices

References

1. Kumaraswamy, K., Alagappa Moses, A. and Vasanthy, M. 2001. Environmental Studies. Bharathidasan University Publication,Tiruchirappalli.

2. Stiling, P. 2004. Ecology – Theories and applications. Prentice Hall of India Pvt. Ltd., NewDelhi.

Thiagarajar College (Autonomous):: Madurai – 625009
Department ofZoology
(For those joined B. Sc., Zoology on or after June 2020)
Programme Code:UZO

Course Code	Course Title	Category	L	T	P	Credit
U ZO20 CE51	**Entomology**	Core Elective	5	-		5

Year	Semester	Int. Marks	Ext.Marks	Total
Third	Sixth	25	75	100

Preamble

Provides a comprehensive insight on the basic and applied aspects of Entomology

Course Outcomes

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

	Course outcomes	Expected Proficiency%	Expected Attainment%
CO1	Discuss the morphology based variation and diversity among all insect groups	70	70
CO2	Emphasize and compare the structural and functional aspects of insects	70	70
CO3	Explain the trophic interaction of insects with their host plants their management and tools of control	70	70
CO4	Apply/Utilize natural enemies for the control of insect pests	60	60
CO5	Appear for competitive examinations and/ or become an entrepreneur,	60	50

Mapping of Course Outcomes with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	-	M	M	M	L
CO2	S	-	M	S	M	-
CO3	S	L	-	M	M	L
CO4	S	S	-	M	S	M
CO5	S	-	S	S	-	-

Mapping of Course Outcomes with Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	-
CO2	S	M	S	S	-
CO3	S	M	S	S	-
CO4	S	M	S	S	M
CO5	S	S	M	S	M

S- Strong M -MediumL-Low

Blooms Taxonomy

	CA		End ofSemester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%

Course Title : Entomology

Unit I

General characters of Insects- Salient features (up to order level): **Apterygote orders**- Protura, Thysanura; **Neopterousexopterygote orders: Paleopterous orders**- Ephemeroptera, Odonata; **Orthopteroid orders:** Orthoptera, Isoptera; **Hemipteroidorders** – Anopleura, Hemiptera; **Endopterygote orders:** Coleoptera, Diptera, Lepidoptera, Hymenoptera.

Unit II

External morphology: The integument, structure of head (segmentation of the head, appendages, mouthparts). Thorax (tergum, sternum, epiproct, paraproct, legs, wings, wing coupling mechanism) and abdomen-abdominal segments-gills, spiracle, median caudal filament, cercus- external genitalia).

Endocrine system: Neurosecretory cells, Corpora cardiaca, corpora allata, thoracic glands, Ecdysone, Juvenile hormone, Weissman gland.Metamorphosis: complete and incomplete metamorphosis, Role of Juvenile hormone (JH) and molting hormone in metamorphosis in insects. Anatomical and functional aspects of male reproductive system-Testis,Vas deferens,(accessory gland) seminal vesicle, ejaculatory ducts, aedeagus and female reproductive system of insects-Terminal filament, Germarium, female accessory gland, spermatheca; Ovariole-Types-Panoistic and Meroistic .

Unit III

Structure of Digestive system, physiology of digestion. Feeding patterns and guilds- types of host range and selection. Fat body. Structure of Circulatory system, haemocyte types and function. Respiration-trachea system general structure and types; Excretion in Aquatic, Terrestrial and parasitic insects-Malpighian tubules, labial kidney.

Unit IV

Household pests- Housefly (*Musca domestica*), Cockroach (*Periplanataamericana*), Termites (*Odontotermesobesus*)

Agricultural pests- The Rice stem borer (*Scirpophagainsertulus)*, Cotton boll worm (*Helicoverpaarmigera*), Sugarcane shoot borer (*Chiloinfuscatellus*)

Cattle. Pests-The horse fly(*Tabanusstriatus*), The cattle fly(*Hippoboscamaculata*)

The eye fly (*Siphunculinafunicola)*

Unit V

Pest Management: concept, Methods: Physical, chemical, biological and pest management tools, , Biological control: Parasitic- Egg,larval, pupal and egg-larval parasitoids, microbial control: Bt, NPV,GV and entomopathogenic fungi-*Metarhiziumanisopliae* and *Beauveria bassiana*, Pheramonal control of insect pests**; Case study**: IPM in Cotton and Paddy

Text books:

1. David, B.V. 2001 Elements of Economic Entomology (Revised and Enlarged), Popular book depot, Chennai-600 015.

2. Tembhare, D.B. 2017. Modern Entomology. Himalaya Publishing House, Pune.India

Reference books

1. David, B.V. & Ramamurthy, V.V. 2016Elements of Economic Entomology 8th Edition. Brillion Publishing, India
2. Prasad,T.V. 2019 Handbook of Entomology (4th Edition). New Vishal Publications, India

Course Designers: **Dr.P.Suresh,**Associate Professor
Dr.C.Balasubramaninan Associate Professor

Thiagarajar College (Autonomous):: Madurai – 625 009
Department of Zoology
(For those joined B. Sc., Zoology on or after June 2020)
Programme Code-UZO

Course Code	Course title	Category	L	T	P	Credit
UZO20CE61	AQUACULTURE	Core Elective-II	5	-	-	5

L-Lecture. T-Tutorial. P-Practicals

Year	Semester	Int. Marks	Ext. Marks	Total
SIXTH	VI	25	75	100

Preamble

The course aims to provide students with a broad-based foundation in science together with extensive subject knowledge in the discipline of aquaculture including different production systems, establishment, nutrition and culture methodologies with special reference to fish and prawn.

Course Outcomes

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

	Course outcomes	Expected proficiency	Expected attainment
CO1	Understand and apply basic scientific principles in the area of aquaculture	70	70
CO2	Employ scientific methodologies such as experimentation and data analysis in aquaculture	70	70
CO3	Critically analyse, interpret and evaluate information relevant to aquaculture.	70	70
CO4	Appreciate the multidisciplinary nature of aquaculture and engage positively with people and ideas beyond their own discipline.	70	70
CO5	Become skilled at the experimental basis and reasoning that underlies the material in the course	70	70

Mapping of COs with POs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	M	S	S
CO2	S	M	M	S	S
CO3	S	M	L	S	M
CO4	S	M	L	S	S
CO5	S	S	M	S	S

Strong –S (+++) Medium-M (++) Low-L (+)

Mapping of Course Outcomes with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	M	L	S	S	S
CO2	S	M	L	S	S	S
CO3	M	L	L	S	S	S
CO4	S	S	L	S	S	S
CO5	S	S	L	S	S	S

Strong –S (+++) Medium-M (++) Low-L (+)

Blooms taxonomy

	CA		End ofSemester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%

COURSE TITLE- AQUACULTURE

Unit I: Aquaculture systems

Aquaculture concept, Significance of aquaculture compared to other agricultural systems and commercial fisheries. Types of aquaculture – Freshwater, Brackish and Mariculture. Extensive, intensive, semi-intensive aquaculture. Finfish culture, Monosex and Monoculture, Polyculture/Composite culture-advantages of polyculture -fish culture in paddy fields- pokkali culture- cage and pen culture - integrated fish culture.

Unit II: Freshwater Aquaculture- Fish and Prawn culture

Site selection – elementary survey –design and construction of fish and prawn ponds (stocking pond and rearing pond), Pond preparation-Drying, elimination of pests and predators. Preparation of nursery and stocking ponds.Manuring, Production of plankton. Stocking and acclimatization. Use of hapa. Stocking density. Harvesting methods. Candidate species for freshwater culture- Catlacatla (Catla), Labeorohita (Rohu) and *Cirrhinuscirrhosus* (Mrigal) Prawn culture- *Macrobrachiumrosenbergii*

Unit III: Marine Aquaculture and types

Brackish water and Mariculture-Oyster culture, Shrimp culture (*Peneaus monodon*), Crab and Lobster fattening, mussel culture, Culture of macroalgae (*Kappaphycusalvarezii*) and microalgae (*Chlorella saliana*)

Unit IV: Diseases of Aquaculture and management

Fish disease management: Common bacterial, viral, fungal, protozoan and crustacean diseases, their symptoms and treatment. Control of aquatic weeds, predatory and weed fish control. Feeds for cultivable species – natural, supplementary and artificial feeds. Anaesthetic drugs, Antiseptics, Antimicrobials and vaccines.

Unit V: Marketing and value addition

Harvesting and transport -marketing the fish to local markets and for export. Quality control and norms of MPEDA for export of fishes- HACCP concept; Fish preservation-canning and freezing method. By-products and value added products of fishes

Text Books

1) Ackefors, H., Huner, J.V., &Konikoff, M. 1994. Introduction to the General Principles of Aquaculture (1st ed.). CRC Press.
2) Arumugam N. 2019 Aquaculture, Saras Publication Tamilnadu India

Reference Books

1) Jingran, V. G. 1983 Fish and fisheries of India, Hindustan pub. corp. New Delhi.

2) Prakash, C. 2020. Aquatic Health and Aquaculture (1st ed.). CRC Press,USA

3) Athithan, S. 2020. Coastal Aquacultures and Mariculture (1st ed.). CRC Press,USA

4)Hute, M. and Kahn, H. 2000 Textbook of fish culture, Blackwell Scientific Publication, Australia.

5) Srinivasulu, M., Reddy, K.R.S., Rao, S. 1999 Text book of Aquaculture, Discovery Publishing House New Delhi.

6) Santhanam, R., Sukumaran, N. and Natarajan, 1990.A manual of fresh water aquaculture,

Oxford and IBH Publishing Co Pvt.Ltd., Mumbai.

7) Rath, R.K. 2000 Freshwater Aquaculture. Scientific Publishers, (India).

8) Bandyopadhyay, B.K. 2022. Freshwater Aquaculture: A Functional Approach (With Intricate Informations on Integration of Fish with other Crops, Diversifications of Suitable Alternatives of Indian Major Carp Culture Practices and Sewage-fed Aquaculture) (1st ed.). CRC Press.USA.

Course Designer:

Dr.C.Ravi Assistant Professor

Dr.C.BinuRamesh,Assistant Professor

Thiagarajar College (Autonomous):: Madurai – 625009
Department ofZoology
(For those joined B. Sc., Zoology on or after June 2020)
Programme Code:UZO

Course Code	Course Title	Category	L	T	P	Credit
U ZO20SE61 A	**Bioinformatics Lab**	SBE2(A)	-	-	2	2

Year	Semester	Int. Marks	Ext.Marks	Total
Third	Sixth	40	60	100

Preamble

Provides hands on training on basic *in silico* analyses. Elaborates how bioinformatic tools can be utilized in biomedical research.

Course Outcomes

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

	Course outcomes	Expected Proficiency %	Expected Attainment %
CO1	Explain the concepts and work on bioinformatic tools	70	70
CO2	Elaborate evolutionary relationship between different species	70	70
CO3	Validate the structure of a protein, drug design	70	70
CO4	Retrieve nucleic acid and protein sequences from databases	60	60
CO5	Work in a life science division of software, pharmaceutical industry	60	50

Mapping of Course Outcomes with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	M	S	M	-	S
CO2	S	M	S	M	L	M
CO3	S	M	S	M	L	L
CO4	S	S	S	M	L	L
CO5	S	S	S	S	L	S

Mapping of Course Outcomes with Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	M

CO2	**S**	**S**	**S**	**S**	**M**
CO3	**S**	**M**	**S**	**S**	**M**
CO4	**S**	**L**	**S**	**S**	**L**
CO5	**S**	**L**	**M**	**S**	**S**

S- Strong M -MediumL-Low

Title of the Course: Lab in Bioinformatics

1. Sequence retrieval and analyses
2. Database (homology) searches using different types ofBLAST
3. Phylogenetic treeconstruction
4. Identification of Motif(eMotif)\
5. Identification of restriction sites using NEBcutter.
6. Identification of protein cleavage site using pepcuttertool.
7. Protein structure prediction-Secondary and tertiary (HomologyModelling)
8. 3D visualization of structures using Rasmol and discovery studioviewer.
9. Molecular docking using Arguslab andHex.

Reference books.

1. Pevsner, 2009. Bioinformatics and Functional Genomics. Wiley DreamtechIndia Ltd., NewDelhi.
2. Claverie,JandNotredame,C.,2003.BioinformaticsAbeginner"sguide.Wiley PublishingInc.India.
3. Mani,KandVijayaraj,N., 2004. Bioinformatics a practical approach. Aparna Publishers,Coimbatore.

Course Designers :Dr.RM.Murugappan, Associate Professor

Dr.Poornimakkani,Associate Professor

Thiagarajar College (Autonomous):: Madurai – 625 009
Department of Zoology
(For those joined in or after June 2020)
Programme Code UZO

Course Code	Course Title	Category	L	T	P	Credit
UZO20SE61C	Forensic Science	SBE2(C)	2	-	-	2

Year	Semester	Int. Marks	Ext.Marks	Total
Third	Sixth	15	35	50

Preamble

The course explains the various concepts and importance of forensic science. Demonstrate knowledge and understanding of some of the links between forensic science and the legal system.

Course outcomes

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

#	Course Outcome	Expected Proficiency-%	Expected Attainment%
CO1	Spell the history and development of forensic science	70	70
CO2	Organisation of forensic laboratories, its functions and special areas of forensic science	60	70
CO3	Explain the basics of crime scene examination, documentation and process of crime investigation	60	60
CO4	Explain the fundamental concepts in physical, chemical and biological methods of crime investigation	70	60
CO5	Make use of biological evidence for crime investigation	60	70

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	M	-	-	S	L	M
CO2	-	-	-	L	-	S
CO3	S	S	M	S	S	S
CO4	S	M	S	S	S	S
CO5	S	S	M	S	S	S

Mapping of COs with PSOs

	PO1	PO2	PO3	PO4	PO5
CO1	L	M	M	H	--
CO2	M	H	M	H	--
CO3	M	L	M	H	--
CO4	--	L	M	H	H
CO5	M	L	L	H	H

Strong –S (+++) Medium-M (++) Low-L (+)

Blooms taxonomy

	CA		End ofSemester
	First	**Second**	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%

Title of the Course: Foresnsic Science

Unit I

Introduction to forensic Science –Development of Forensic science in India - Organization and functions of Forensic laboratory; Special areas of forensic science; Physical evidences - their classification and significance - Crime Scene examinations - documentation of crime scene- recognition, collection, preservation and transportation of physical evidence for laboratory examinations. Fundamentals of crime scene photography; Tool marks - identification - restoration of field off/erased marks.

Unit II

Foot and tyre impressions - examination of foot and tyre prints. Finger prints - Finger print patterns and classification; Toxicology - classification and toxicological investigation of poison death; Examination of biological fluids - blood, seminal and saliva stains, forensic characterization of the above stains, stain patterns of the blood, Examination of fibres, hair, bones, teeth and skull; Fundamentals of DNA typing.

Text Book:

1. Eckert, W.G. (Ed), 1997, Introduction to Forensic Sciences, II Edn. CRC Press, Boca Raton.
2. B.B. Nanda and Tiwari, R.K.,2001.Forensic Science in India: A Vision for the Twenty First Century, Select Publishers, New Delhi

Reference Book:

1. James, S.H., and Nordby, J.J. 2005. Forensic Science: An Introduction to Scientific and Investigative Techniques, 2nd Edition, CRC Press, Boca Raton.
2. Bevel, T., and Gardner, R.M. 2008. Gardner, Bloodstain Pattern Analysis, 3rd Edition, CRC Press, Boca Raton.
3. Duncan, G.T., and Tracey, M.I. 1997. Introduction to Forensic Sciences, 2nd Edition, W.G. Eckert (Ed.), CRC Press, Boca Raton .
4. Poklis. A.1997. Forensic toxicology In, Introduction to Forensic Sciences, 2nd Edition, W.G. Eckert (Ed.), CRC Press, Boca Raton.
5. Tilstone, W.J., Hastrup, M.L., and Hald,C. 2012 Fisher's, Techniques of Crime Scene Investigation, CRC Press, Boca Raton

Course designers: Rm. Murugappan, Associate Professor
N. Arun Nagendran, Associate Professor

Thiagarajar College (Autonomous):: Madurai – 625 009
Department of Zoology
(For those joined B.Sc., Zoology on or after June 2020)
Programme Code UZO

Course Code	Course Title	Category	L	T	P	Credit
UZO20SE61C	**Nanotechnology**	SBE2(D)	2	-	-	2

Year	Semester	Int. Marks	Ext.Marks	Total
Third	VI	15	35	50

Preamble

Nanotechnology is an emerging field that combine principles from biology, physics, chemistry and mathematics to understand and control biological processes at the molecular level. Revolutionary advances are being made in the biomedical sciences using nanotechnology, varying from visualization to manipulation of individual molecules.

Course Outcomes

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

	Course outcomes	Expected Proficiency%	Proficiency Attained %
CO1	Understand the fundamental concepts and scope of nanotechnology	70	70
CO2	Able to explain the different types of nanoparticles	60	70
CO3	Can design suitable method for synthesizing nanomaterials	60	60
CO4	Make use of different techniques for the characterization ofnanoparticles	60	70
CO5	Demonstrate the applications of nanostructures in biomedical sciences	60	70

Mapping of Course Outcomes with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	**S**	**-**	**-**	**S**	**-**	**L**
CO2	**S**	**-**	**-**	**M**	**-**	**-**
CO3	**S**	**S**	**-**	**M**	**-**	**M**
CO4	**S**	**M**	**-**	**S**	**-**	**M**
CO5	**S**	**S**	**-**	**S**	**M**	**S**

Mapping of Course Outcomes with Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**S**	**-**	**-**	**S**	**M**
CO2	**S**	**S**	**L**	**S**	**-**
CO3	**S-**	**-**	**-**	**S**	**M**
CO4	**S**	**-**	**-**	**S**	**L**
CO5	**S**	**-**	**-**	**S**	**L**

Blooms taxonomy: Assessment Pattern

	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%

Unit I:

Introduction to nanotechnology, classification based on; morphology, material , Basic Strategies in synthesizing Nanomaterials, Top down and bottom up approaches, characterization of nanomatetials by UV-VIS Spec, FTIR spec, AFM, SEM, TEM and XRD.

Unit II:

Applications of nanotechnology; liposomes, nanoshells and hydrogels, Quantum dots, Implants- orthopaedic and vascular, Bionanosensors- nanocantilevers based on single stranded DNA, bionanosensors in agriculture

Activity: Lab Visit

Text Book

1. Subbiah,B. 2010.Nanobiotechnology. MJP Publishers, Coimbatore, India
2. Kulkarni S. K. 2015. Nanotechnology: Principles and Practices, Third Edition, Springer Publishing, US.
3. Pradeep T, 2007, Nano The Essentials. Mc Graw Hill Publications, New Delhi.
4. Balaji S , 2010, Nanobiotechnology, Mj Publishers, Chennai

Reference Book

1. Goodsell, D S. 2004 Bionanotechnology Wiley-Liss, Inc., Hoboken, New Jersey.
2. NicoliniC 2009, Nanobiotechnology And Nanobiosciences, Pan Stanford Publishing Pte. Ltd. Singapore
3. Charles P P And Owens F J, 2003 , Introduction To Nanotechnology, Wiley Interscience New Jersy
4. Hornyak, G. L., Moore, J. J., Tibbals, H. F. and Dutta, J. 2009. Fundamentals of Nanotechnology. CRC Press, Taylor & Francis Group, New York.
5. Kodoloc, V. I., Zaikov, G. E. and Haghi, A. K. 2014. Nanostructures, Nanomaterials, and Nanotechnologies to Nanoindustry. Apple Academic Press, Canada.
6. Oashby, M. F., Ferreira, P. J. and Schodek, D. L. 2009. Nanomaterials, Nanotechnologies and Design: An Introduction for Engineers and architects. Butterworth-Heinemann, UK.
7. Goodsell, D. S. 2004. Bionanotechnology: Lessons from Nature. Wiley-Liss, Inc., New Jersey, US.
8. Neves, A. R. and Reis, S. 2018. Nanoparticles in Life Sciences and Biomedicine, Pan Stanford Publishing, Singapore.
9. Anal, A. K. 2018. Bionanotechnology: Principles and Applications. CRC Press, Taylor & Francis Group, New York.

Course designer:

Dr. T S Ramyaa Lakshmi. Assistant Professor

Thiagarajar College (Autonomous):: Madurai – 625 009
Department of Zoology
(For those joined B.Sc., Zoology on or after June 2020)
Programme Code UZO

Course Code	Course Title	Category	L	T	P	Credit
UZO20SE61C	**Stem Cell Biology**	SBE2(B)	2	-	-	2

Year	Semester	Int. Marks	Ext.Marks	Total
Third	Third	15	35	50

Preamble

The course emphasizes the importance of stem cells and their application in therapeutic purpose. Elaborates the different types of stem cells and their properties. Controversies surrounding stem cell therapy is also highlighted.

Course Outcomes

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

	Course outcomes	Expected Proficiency %	Proficiency Attained %
CO1	Define the concepts of stem cells and its niches	70	70
CO2	Differentiate theoretically the adult and embryonic stem cells	70	70
CO3	Illustrate the ethics and conflicts in stem cell application	70	60
CO4	Outline the procedure for stem cell isolation, differentiation and maintenance	60	70
CO5	Analyse the case studies associated with stem cell therapy	60	60

Mapping of Course Outcomes with Programme Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5	PO6
CO1	**S**	**-**	**-**	**S**	**S**	**M**
CO2	**S**	**-**	**-**	**S**	**M**	**-**
CO3	**S**	**S**	**M**	**S**	**S**	**M**
CO4	**S**	**S**	**M**	**S**	**M**	**M**
CO5	**S**	**S**	**S**	**S**	**S**	**S**

Mapping of Course Outcomes with Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	M	M	S	-
CO2	S	S	S	S	-
CO3	S	-	-	S	L
CO4	S	-	-	S	-
CO5	S	-	L	S	S

Blooms taxonomy: Assessment Pattern

	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%

Course Title: Stem Cell Biology

Unit I

Definition of stem cells, Pluripotency and plasticity, Regulators of pluripotency, iPS, Embryonic stem cells, Adult Stem Cell Niches, primordial germ cells as stem cells, common markers to identify stem cells, protocol for embryonic stem cells isolation.

Unit II

Clinical applications of stem cells, Stem cells and aging, stem cells and cancer, Epigenetics in stemcells, Tissue regeneration **,** Stem cell banking, Ethical issues in stem cell research.

Text Books

1. Lanza R and Atala A (2014) Essentials of stemcells, 3rd edition, Elsevier Pub, California, USA.
2. Lodish H, Berk A, Kaiser C A, Krieger M, Bretscher A, Ploegh. H, Martin C K; Yaffe M, Amon A (2021) Molecular Cell Biology 9th Ed, W.H. Freeman & Co.

References:

1. StemBook is an open-access (free) collection of original, peer-reviewed chapters coveringtopicsrelatedtostemcellbiology.http://www.stembook.org.
2. Lodish et al. 2008. Molecular Cell Biology. 6th Ed., W.H. Freeman &Co.N2008
3. Regad, T., Sayers, T. J. and Rees, R. C. 2015. Principles of Stem Cell Biology and Cancer. Future Applications and Therapeutics. Wiley Blackwell, UK.
4. Lonza, R., Gearhart, J., Hogan, B., Melton, D., Pederson, R., Thomas, E. D., Thomson, J. and Wilmut, I. 2009. Essentials of Stem Cell Biology, Second Edition, Academic Press, US.
5. Marshak D, Gardner R, Gottleib D, 2001, Stem cell biology, Cold spring Harbor Press. 0-87969-575-7/01(e-book)

Course Designer:Dr. T S RamyaaLakshmi Assistant Professor