FATIMA COLLEGE (AUTONOMOUS)

Re-Accredited with "A++" Grade by NAAC (Cycle - IV)

Maryland, Madurai - 625 018, Tamil Nadu, India

NAME OF THE DEPARTMENT : ZOOLOGY

NAME OF THE PROGRAMME : M.Sc.

PROGRAMME CODE : PSZO

ACADEMIC YEAR : 2023-2024

FATIMA COLLEGE (Autonomous), MADURAI-625 018

MINUTES OF THE BOARD OF STUDIES

NAME OF THE DEPARTMENT: M.Sc Zoology

TO BE IMPLEMENTED FROM: 2023-2024 ONWARDS

VENUE: Department of Zoology

CONVENED ON: 05.04.2023 CONVENED AT: 02.00 pm

MEMBERS PRESENT

1.	Dr. A. Tamilselvi	Head of the Department 05/04/23
2.	Dr. V. Shanmugaiah Assistant Professor Department of Microbial Technology School of Biological Sciences Madurai Kamaraj University Madurai-625021	University Nominee 5/4/23
3.	Dr. P.J. Joslin Associate Professor PG & Research Department of Zoology St. Mary's college (Autonomous) Thoothukudi-628 001	Subject Expert P. J. Joslin 5/4/2023
4.	Dr. R. Uma Maheswari Assistant Professor PG Department of Zoology Arulmigu Palaniandavar Arts college for Women Palani-624 615	R. Uma Maheswari 5/4/23

5. Dr. A. Vanniarajan Scientist Aravind Medical Research Foundation Madurai – 625 020	Industrialist / Scientist A. Vanni 05/04/23
6. Miss. S. Susaritha Research Scholar PG & Research Department of Zoology The American college Madurai – 625 020	Alumna S. Susaritha 05/04/23
7. Dr. A. Rajeswari	Dean of Academic Affairs 05/04/2023
8. Dr. Antony Amala Jayaseeli	Staff Member Antony Amala Jayaseeli 05/04/23
9. Dr. N. Malathi	Staff Member N Malathi 5/4/2023
10. Dr. J. Asnet Mary	Staff Member Asnet mary 5/4/2023
11. Dr. V. Bharathy	Staff Member V. Bhar 5/4/23
12. Dr. N. Nagarani	Staff Member N. Nag 5/4/23
13. Dr. S. Barathy	Staff Member S Bar 5/4/23
14. Mrs. J. Thelma	Staff Member Thelma 5/4/23
15 Mrs. D. Kayathri	Staff Member D. Kayathri 5/4/23

MINUTES OF THE BOARD OF STUDIES:

1. PRESENTATION OF THE ACTION TAKEN REPORT:

ACTION TAKEN REPORT FOR 2022-2023

S. NO	COMMON SUGGESTIONS OFFERED IN THE PREVIOUS BOARD	ACTION TAKEN FOR THE ACADEMIC YEAR 2022-23
1.	Hands on training may be provided to the students whenever possible	Hands on training is given to the students.
2.	Biostatistics problems may be worked using real-time data obtained from Research articles.	Real-time data is used for Biostatistical analysis.

CHANGE OF COURSE TITLE

S.NO	OLD COURSE CODE	NEW COURSE CODE	OLD COURSE TITLE	NEW COURSE TITLE	NEED FOR CHANGE
–	–	NIL	–	–	–

NEW COURSES INTRODUCED

S.NO	COURSE CODE	COURSE TITLE	RELAVANCE TO				SCOPE FOR			NEED FOR INTRODUCTION
–	–	NIL	–	–	–	–	–	–	–	–

REVISED COURSES

S. NO	COURSE CODE & COORSE TITLE	UNIT NO & REVISED CONTENT	% of REV	NEED FOR REVISION	RELAVANCE TO				SCOPE FOR		
					L	R	N	G	EMP	ENT	SD
1.	19PG1Z3 Cell & Molecular Biology	Following topics are added Unit I – overview of Cell Biology Topics – Microfilaments & microtubules structure & Dynamics. Microtubules & Mitosis. Cell movements	10 %	As per the guidelines of academic Deans & recommendation of	–	–	N	G	–	–	SD

		role of Kinesin & Dyenin. Unit-II - Brief account on Genome, Transcriptome & Proteome. Regulation of Eukaryotic genome replication		course Teachers							
2.	19PG3Z11 Biophysics	Unit-V - Biophysical principles applied to physiology - Topics included Biophysical aspects of hearing, noise and speech - mechanism of hearing - auditory an non- -auditory effects of noise pollution.	10%	As per the guidelines of Academic Deans & Recommen-dation of course Teachers	-	-	N	G	-	-	
3.	19PG3Z13 Biostatistics & Research Methodology	Unit-V - Thesis writing - Topics included - Literature review - source, Structure and stages of literature search - Critical review. Ethics in Research	10%	As per the guidelines of Academic Deans & Recommen dation of course Teachers	-	-	N	G	E M P	-	
4.	19PGR4Z16 Environ-mental Biology	Unit - III - Natural Resources Topics included - Distribution, Types - surface water, ground water, management and conservation of water resources	10%	As per the guidelines of academic Deans & Recommen dations of course Teachers	L	R	N	G	-	-	
5.	19PG4ZE3 Economic Zoology	Following topics are included - Unit I - Apiculture - Social organization and Life cycle - Behaviour of Honey bees. Unit II - Sericulture - Topics included - Moriculture, vegetative propagation and seeding	10%	As per the guidelines of Academic Deans & Recommen dation of course Teachers	L	R	N	G	-	E N T	

2. Updation of open Educational Resources

S.NO	COURSE CODE	COURSE TITLE	DETAILS OF UPDATION
—	NIL	—	—

3. Revision of courses

S.NO	COURSE CODE&TITLE	UNIT NO & REVISED CONTENT	% of REV	NEED FOR REVISION	Relevance To L	R	N	G	Sope For EMP	EN	SD
1.	19PG3Z12 Immunology	GALT & CALT are included in Unit I - Overview of the immune System. Abzymes, Antigen - Antibody interactions - Radial immunodiffusion, double immunodiffusion, Agglutination reactions: haemagglutination, bacterial agglutination, passive agglutination, agglutination inhibition are included in Unit-II Antigens & Antibodies	12 %	As per the guidelines of Academic Deans & Recommendation of course Teachers	-	-	N	G	-	-	SD
2.	19PG3Z14 Lab in Biophysics & Biostatistics	pH titration curve of acid-base using strong acid vs weak base and Effect of UV or Infra Red Radiation on the bacterial growth are includes as Experiments in Biophysics. Analysis of Data using Ms Excel is included under Bio statistics.	10 %	As per the guidelines of Academic Deans & recommendation of course teachers	L	R	N	G	EMP	-	SD
3.	19PG3ZE1 Fisheries &	The Following topics are included in —		As per the guidelines of	L	R	N	G	EMP	ENT	SD

	Aquaculture	Unit IV - Fish pathology and post Harvest Technology - Topics included - Procesing of Prawn: Fish marketing - Domestic market - marine, brackish & inland, Marketing & Export Market; Role of cooperative society. Unit V - Indian Fishery - Topic included - Ethics - National Biodiversity Authority		12 %	Academic Deans & recommendations of course Teacher								
4.	19PG4Z18 Developmental Biology	The Following topics are included in Unit I - Introduction to Developmental Biology - Cryopreservation of gametes and embryos - Ethical Issues. Unit-II - Fertilization - prevention of Polyspermy. Unit-V - organogenesis & Post embryonic development - Biology of senescence - causes.		10 %	As per the guidelines of Academic Deans & Recommendations of course Teachers	-	-	N	G	-	-	S D	
5.	19PG4Z20 Lab in Biotechnology, Economic Zoology & Ethology	Rhizogenesis, caulogenesis, Embryogenesis & Synthetic seeds are included under Plant Tissue culture Techniques. Ti plasmid isolation from Agrobacterium cultures for the selection of transformed cell and cell viability: Dye exclusion test are included as experiments in Biotechnology		15 %	As per the guidelines of Academic Deans & Recommendations of course Teachers	L	R	N	G	E M P	-	S D	

4. New courses Introduced:

NEW COURSES INTRODUCED									
S. NO	COURSE CODE	COURSE TITLE	RELEVANCE TO				SCOPE FOR			NEED FOR INTRODUCTION
-	-	NIL	-	-	-	-	-	-	-	-

5. Introduction of purely Skill-embedded certificate/Diploma/ Advanced Diploma

S. NO	COURSE CODE	COURSE TITLE	MOU WITH INDUSTRY/ ORGANISATION	SKILLS SHARPENED	COURSE OUTCOME
-	-	NIL	-	-	-

6. Approval of Ph.D course Work Syllabus - NIL

7. Rubrics for Internship/Project - NIL

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

Details of Proposed/Signed MOUs - NIL

SUGGESTIONS	COMMENDATIONS
1. In addition to the scientific names of the organisms, their common names can also be included.	1. Changes made in the content of all the revised courses are useful and appropriate.
2. Field visits can be included as a part of the Skill based/ Lab courses.	2. Inclusion of the topic ethical issues in the course content of Developmental Biology is appreciable.

1.	Dr. A. Tamil Selvi	Head of the Department 05/04/23
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3.	Dr. P. J. Joslin	Subject Expert P. J. Joslin 5/4/23
4.	Dr. R. Uma Maheswari	Subject Expert R. Uma Maheswari 5/4/23
5.	Dr. A. Vanniarajan	Industrialist/Scientist A. Vanniarajan 05/04/23
6.	Miss. S. Susaritha	Alumna S. Susaritha 05/04/23
7.	Dr. A. Rajeswari	Dean of Academic Affairs 05/04/2023
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11. Dr. V. Bhavathy	V. Bhavathy 5/4/23
12. Dr. N. Nagarani	N. Nagarani 5/4/23
13. Dr. S. Baratky	S. Baratky 5/4/23
14. Mrs. J. Thelma	J. Thelma 5/4/23
15. Mrs. D. Kayathri	D. Kayathri 5/4/23

OLD SYLLABUS

II M.Sc., ZOOLOGY

SEMESTER –III

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSZO	19PG3Z12	Immunology	Lecture	6	5

COURSE DESCRIPTION

The course intends to provide the biology of immune system and mechanism of immune response, maturation of lymphocytes and major histocompatibility complex and immune system related disorders and vaccines.

COURSE OBJECTIVES

To understand the functions of immune system and to envisage the different immune response in human health.

UNITS

UNIT –I OVERVIEW OF THE IMMUNE SYSTEM (15 HRS.) 1%

Historical perspective (Overview) - Innate (Nonspecific) and adaptive (Specific) immunity – Cells of the immune system: B-lymphcytes, T lymphocytes, mononuclear cells, granulocytic cells (Neutrophils, Eosinophils, Basophils), Mast cells, Dendritic cells – Primary lymphoid organs: Thymus, Bone marrow, Lymphatic system – Secondary lymphoid organs: Lymph nodes, spleen, MALT, Bursa of Fabricius. Primary immune response and secondary immune response.

Self-study – Secondary lymphoid organs

UNIT –II ANTIGENS AND ANTIBODIES (15 HRS.)

11%

Antigen-structure and properties, Haptens, Adjuvants, Epitopes: B cell epitope and T cell epitope. **Antibody**: Immunoglobulin - structure, classes biological functions. Characteristics - Isotypes - Allotypes - Idiotypes - Immunoglobulin super family, monoclonal and polyclonal antibodies. Organization and rearrangement of light-chain genes (κ & λ chain) and Heavy chain genes - Antigen–Antibody interactions, Immunodiffusion and immunoelectrophoresis.Agglutination, Precipitation, Hybridoma Technology.

Self-study - B cell epitopes and T cell epitopes.

UNIT –III LYMPHOCYTES MATURATION AND ACTIVATION & MHC (15 HRS.)

B-cell maturation – B cell activation and proliferation - affinity maturation – class switching – generation of plasma cells and memory B cells - General organization and inheritance of MHC – MHC Genes - Structure of MHC molecules – Class I & II - Processing and presentation of exogenous and endogenous antigens - Tissue typing - T-cell maturation: Thymic selection – T cell activation – T cell differentiation.

Self-study - Structure of MHC molecules – Class I & II

UNIT –IV COMPLEMENT SYSTEM AND HYPERSENSITIVITY (15 HRS.)

Complement activation pathways: Classical, Alternate and Lectin - Regulation of complement system - Biological consequences of complement activation - Complement deficiencies. Hypersensitive reactions – IgE mediated (Type I) Hypersensitivity: components, mechanism, mediators and consequences – Antibody mediated cytotoxic hypersensitivity (Type II) – Immune complex mediated Types III hypersensitivity and T_{DTH} mediated Type IV hypersensitivity.

Self-study - Biological consequences of complement activation

UNIT –V VACCINE AND IMMUNITY IN HEALTH AND DISEASE (15 HRS.)

Vaccines: Whole organism vaccines, Purified macromolecules as Vaccines, Recombinant vector vaccines, Synthetic peptide vaccines, Multivalent subunit vaccines. Immune response and immune evasion during bacterial

(Tuberculosis), Parasitic (Malaria) and viral (HIV) infections.Congenitalimmunodeficiency diseases (SCID and Ataxia). Autoimmunity: Organ- specific autoimmune diseases. Systemic auto-immune diseases.

Self-study - Congenital immunodeficiency diseases

REFERENCES:

1. Owen J, Punt J, Stranford S.A. (2013). *Kuby Immunology*. 7th ed., Macmillan, International Ed..
2. Rao C.V. (2007). *A text book of Immunology*, 3rd ed., Narosa Publishing House, New Delhi.
3. Parham P. (2014). *The Immune System*, Fourth Edition, Garland Science Publisher, USA.
4. Chakravarthy A.K. (2003). *Immunology*, 2nd ed., N.L. Publishers. Siliguri.
5. Lydyard P.M, Whelan A, Fanger M.W. (2003). *Instant notes on Immunology*. Viva Books Private Limited. New Delhi.
6. Clark W.R. (1991). *The experimental foundations of modern Immunology*, 4th ed., John Wiley and Sons, INC.
7. Roitt I.M. (1988). *Essential Immunology*, 6th ed., English Language Book Society/ Blackwell Scientific Publications.
8. Emil R. U., Benacerraf B. (1984). *Text book of Immunology*, 2nd Ed., Williams and Wilkins, Baltimore, London.
9. Mc Connell, Munro A, Waldmann H. (1984). *The Immune System*, 2nd Ed., Blackwell Scientific Publication.
10. Hyde R.M. (1977). *Immunology*, 3rd Ed., B.I.W. Waverly Pvt Ltd New Delhi.

DIGITAL OPEN EDUCATIONAL RESOURCES (DOER):

1. https://pubmed.ncbi.nlm.nih.gov/30426422/
2. https://www.nature.com/articles/nrrheum.2017.125
3. https://www.oercommons.org/courses/vaccination
4. https://www.ncbi.nlm.nih.gov/books/NBK562228/
5. http://www.ncbi.nlm.nih.gov/books/NBK27092/

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 OVERVIEW OF THE IMMUNE SYSTEM				
1.1	Historical perspective (Overview)	1	Discussion	Black Board
1.2	Innate (Nonspecific) immunity	1	Chalk & Talk	LCD
1.3	adaptive (Specific) immunity	1	Lecture	PPT & White board
1.4	Cells of the immune system: B-lymphcytes, T lymphocytes, mononuclear cells,	1	Lecture	Smart Board
1.5	granulocytic cells (Neutrophils, Eosinophils, Basophils), Mast cells, Dendritic cells	1	Lecture	Black Board
1.6	Primary lymphoid organs: Thymus	1	Chalk & Talk Discussion	Google classroom
1.7	Bone marrow, Lymphatic system	2	Lecture	Black Board
1.8	Secondary lymphoid organs: Lymph nodes,	1	Discussion	Black Board
1.9	Spleen, MALT, Bursa of Fabricius.	1	Lecture	Black Board
1.10	Primary immune response and secondary immune response		Lecture	Black Board
UNIT -2 ANTIGENS AND ANTIBODIES				
2.1	**Antigen**-structure and	1	Lecture	Green Board Charts
2.2	Properties of antigen, Haptens, Adjuvants,	2	Chalk & Talk	Green Board
2.3	B cell epitopes – Properties	1	Discussion	Black Board
2.4	T cell epitope – Properties	1	Chalk & Talk	LCD
2.5	Immunoglobulin - structure,	1	Lecture	PPT & White board

2.6	classes of Ig – Structure and biological functions of IgG.	1	Lecture	Smart Board
2.7	Structure and biological functions of IgA, IgM	1	Lecture	Black Board
2.8	Structure and biological functions of IgD and IgE	1	Chalk & Talk Discussio n	Google classroom
2.9	Characteristics - Isotypes - Allotypes - Idiotypes - Immunoglobulin super family,	1	Lecture	Black Board
2.10	monoclonal and polyclonal antibodies. – Hybridoma Technology – Method	1	Discussio n	Black Board
2.11	Hybridoma Technology applications	1	Lecture	Black Board
2.12	Organization and rearrangement of light-chain genes (κ & λ chain	1	Lecture	Black Board
2.13	Organization and rearrangement of Heavy chain genes	1	Lecture	Black Board
2.14	Antigen–Antibody interactions, Immunodiffusio n Agglutination, Precipitation	1	Lecture	Black Board
2.15	immunoelectrophoresis.	1	Lecture	Black Board
2.16	B cell epitopes – Properties	1	Discussio n	Black Board
2.17	T cell epitope – Properties	1	Chalk & Talk	LCD
UNIT -3 LYMPHOCYTES MATURATION AND ACTIVATION & MHC				
3.1	B-cell maturation& B cell activation	3	Chalk &Talk	Black Board
3.2	B- Cell proliferation, affinity maturation – class switching	3	Chalk & Talk	LCD
3.3	generation of plasma cells and memory B cells	1	Lecture	PPT & White board
3.4	MHC Genes - Structure of MHC molecules – Class I & II	2	Lecture	Smart Board
3.5	Processing and presentation of exogenous antigens	1	Lecture	Black Board
3.6	Processing and presentation of endogenous antigens	1	Discussio n	Google classroom
3.7	Tissue typing	1	Lecture	Black Board
3.7	T-cell maturation	2	Lecture	Black Board

3.8	Thymic selection – T cell activation - T cell differentiation	1	Lecture	Black Board
UNIT -4 COMPLEMENT SYSTEM AND HYPERSENSITIVITY				
4.1	Complement activation pathways: Classical	1	Chalk & Talk	Black Board
4.2	Complement activation pathways: Alternate	2	Chalk & Talk	LCD
4.3	Lectin pathways	2	Lecture	PPT & White board
4.4	Regulation of complement system	1	Lecture	Smart Board
4.5	Biological consequences of complement activation	2	Lecture	Black Board
4.6	Complement deficiencies	1	Discussio n	Google classroom
4.7	Hypersensitive reactions – IgE mediated (Type I) Hypersensitivity	2	Lecture	Black Board
4.7	Antibody mediated cytotoxic hypersensitivity	2	Lecture	Black Board
4.8	Immune complex mediated Types III hypersensitivity	1	Lecture	Black Board
4.9	T_{DTH} mediated Type IV hypersensitivity	1	Lecture	Black Board
UNIT -5 VACCINE AND IMMUNITY IN HEALTH AND DISEASE				
5.1	Vaccines: Whole organism vaccines, - Heat killed vaccines, Attenuated vaccines	2	Chalk & Talk	Black Board
5.2	Purified macromolecules as Vaccines, Recombinant vector vaccines,	3	Chalk & Talk	LCD
5.3	Synthetic peptide vaccines, Multivalent subunit vaccines.	2	Lecture	PPT & White board
5.4	Immune response and immune evasion during bacterial (Tuberculosis),	1	Lecture	Smart Board
5.5	Parasitic (Malaria)	1	Lecture	Black Board
5.6	viral (HIV) infection	1	Discussio n	Google classroom
5.7	Congenital immunodeficiency diseases (SCID and Ataxia).	2	Lecture	Black Board
5.8	Autoimmunity, Organ- specific autoimmune diseases, Systemic auto-immune diseases	3	Discussio n	Black Board

EVALUATION PATTERN

Internal

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assessment
	T1 10 Mks.	T2 10 Mks.	Seminar 5 Mks.	Assignment 5 Mks	OBT/PPT 5 Mks	35 Mks.	5 Mks.	40Mks.	
K2	4	4	-	-	-	8	-	8	20 %
K3	2	2	-	5	-	9	-	9	22.5 %
K4	2	2	-	-	5	9	-	9	22.5 %
K5	2	2	5	-	-	9	-	9	22.5 %
Non Scholastic	-	-	-	-	-		5	5	12.5 %
Total	10	10	5	5	5	35	5	40	100 %

CIA

Scholastic	35
Non Scholastic	5
	40

EVALUATION PATTERN

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

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Summarize the overview of the immune system	K4	PSO1 & PSO5
CO 2	Elaborate the structure and properties of antigen and antibody and its interactions.	K1	PSO1 & PSO9
CO 3	Determine the concept of MHC molecules and maturation and activation of lymphocyte.	K1	PSO1 &PSO5
CO 4	Analyze the complement system and the types of hypersensitivity reactions.	K2	PSO1 & PSO9
CO 5	Prioritize the types of vaccines and immunity in health and disease.	K4	PSO1 & PSO9

Mapping of COs with PSOs

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

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

Mapping of COs with POs

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

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

♦ Weakly Correlated -**1**

COURSE DESIGNER:

Dr. J. Asnet Mary

Forwarded By

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

HOD'S Signature & Name

NEW SYLLABUS
II M.Sc., ZOOLOGY
SEMESTER –III

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSZO	19PG3Z12	Immunology	Lecture	6	5

COURSE DESCRIPTION

The course intends to provide the biology of immune system and mechanism of immune response, maturation of lymphocytes and major histocompatibility complex and immune system related disorders and vaccines.

COURSE OBJECTIVES

To understand the functions of immune system and to envisage the different immune response in human health.

UNITS

UNIT –I OVERVIEW OF THE IMMUNE SYSTEM (15 HRS.)

Historical perspective (Overview) - Innate (Nonspecific) and adaptive (Specific) immunity – Cells of the immune system: B-lymphcytes, T lymphocytes, mononuclear cells, granulocytic cells (Neutrophils, Eosinophils, Basophils), Mast cells, Dendritic cells – Primary lymphoid organs: Thymus, Bone marrow, Lymphatic system – Secondary lymphoid organs: Lymph nodes, spleen, MALT, GALT, CALT, Bursa of Fabricius. Primary and secondary immune response.

Self-study – Secondary lymphoid organs

UNIT –II ANTIGENS AND ANTIBODIES (15 HRS.)

Antigen-structure and properties, Haptens, Adjuvants, Epitopes: B cell epitope and T cell epitope. **Antibody**: Immunoglobulin - structure, classes

biological functions. Characteristics - Isotypes - Allotypes - Idiotypes - monoclonal and polyclonal antibodies- Hybridoma Technology, Abzymes. Organization and rearrangement of light-chain genes (κ & λ chain) and Heavy chain genes - Antigen–Antibody interactions:Precipitation reactions – Radial immunodiffusion,double immunodiffusionand immunoelectrophoresis.Agglutination reactions: hemagglutination, bacterial agglutination, passive agglutination, agglutination inhibition, Radioimmunoassay.

Self-study - B cell epitopes and T cell epitopes.

UNIT –III LYMPHOCYTES MATURATION AND ACTIVATION & MHC (15 HRS.)

B-cell maturation – B cell activation and proliferation - affinity maturation – class switching – generation of plasma cells and memory B cells - General organization and inheritance of MHC – MHC Genes - Structure of MHC molecules – Class I & II - Processing and presentation of exogenous and endogenous antigens - Tissue typing - T-cell maturation: Thymic selection – T cell activation – T cell differentiation.

Self-study - Structure of MHC molecules – Class I & II

UNIT –IV COMPLEMENT SYSTEM AND HYPERSENSITIVITY (15 HRS.)

Complement activation pathways: Classical, Alternate and Lectin - Regulation of complement system - Biological consequences of complement activation - Complement deficiencies. Hypersensitive reactions – IgE mediated (Type I) Hypersensitivity: components, mechanism, mediators and consequences – Antibody mediated cytotoxic hypersensitivity (Type II) – Immune complex mediated Types III hypersensitivity and T_{DTH} mediated Type IV hypersensitivity.

Self-study - Biological consequences of complement activation

UNIT –V VACCINE AND IMMUNITY IN HEALTH AND DISEASE (15 HRS.)

Vaccines: Whole organism vaccines, Purified macromolecules as Vaccines, Recombinant vector vaccines, Synthetic peptide vaccines, Multivalent subunit vaccines. Immune response and immune evasion during bacterial

(Tuberculosis), Parasitic (Malaria) and viral (HIV) infections.Congenitalimmunodeficiency diseases (SCID and Ataxia). Autoimmunity: Organ- specific autoimmune diseases. Systemic auto-immune diseases.

Self-study - Congenital immunodeficiency diseases

REFERENCES:

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18. Emil R. U., Benacerraf B. (1984). *Text book of Immunology*, 2nd Ed., Williams and Wilkins, Baltimore, London.
19. Mc Connell, Munro A, Waldmann H. (1984). *The Immune System*, 2nd Ed., Blackwell Scientific Publication.
20. Hyde R.M. (1977). *Immunology*, 3rd Ed., B.I.W. Waverly Pvt Ltd New Delhi.

DIGITAL OPEN EDUCATIONAL RESOURCES (DOER):

6. https://pubmed.ncbi.nlm.nih.gov/30426422/
7. https://www.nature.com/articles/nrrheum.2017.125
8. https://www.oercommons.org/courses/vaccination
9. https://www.ncbi.nlm.nih.gov/books/NBK562228/
10. http://www.ncbi.nlm.nih.gov/books/NBK27092/

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 OVERVIEW OF THE IMMUNE SYSTEM				
1.1	Historical perspective (Overview)	1	Discussion	Black Board
1.2	Innate (Nonspecific) immunity	1	Chalk & Talk	LCD
1.3	adaptive (Specific) immunity	1	Lecture	PPT & White board
1.4	Cells of the immune system: B-lymphcytes, T lymphocytes, mononuclear cells,	1	Lecture	Smart Board
1.5	granulocytic cells (Neutrophils, Eosinophils, Basophils), Mast cells, Dendritic cells	1	Lecture	Black Board
1.6	Primary lymphoid organs: Thymus	1	Chalk & Talk Discussion	Google classroom
1.7	Bone marrow, Lymphatic system	2	Lecture	Black Board
1.8	Secondary lymphoid organs: Lymph nodes,	1	Discussion	Black Board
1.9	Spleen, MALT, GALT, CALT, Bursa of Fabricius.	1	Lecture	Black Board
1.10	Primary immune response and secondary immune response		Lecture	Black Board
UNIT -2 ANTIGENS AND ANTIBODIES				
2.1	**Antigen**-structure and	1	Lecture	Green Board Charts
2.2	Properties of antigen, Haptens, Adjuvants,	2	Chalk & Talk	Green Board
2.3	B cell epitopes – Properties	1	Discussion	Black Board
2.4	T cell epitope – Properties	1	Chalk & Talk	LCD
2.5	Immunoglobulin - structure,	1	Lecture	PPT & White board
2.6	classes of Ig – Structure and biological functions of IgG.	1	Lecture	Smart Board

2.7	Structure and biological functions of IgA, IgM	1	Lecture	Black Board
2.8	Structure and biological functions of IgD and IgE	1	Chalk & Talk Discussion	Google classroom
2.9	Characteristics - Isotypes - Allotypes - Idiotypes - Immunoglobulin super family,	1	Lecture	Black Board
2.10	Monoclonal and polyclonal antibodies. – Hybridoma Technology – Method	1	Discussion	Black Board
2.11	Hybridoma Technology applications	1	Lecture	Black Board
2.12	Organization and rearrangement of light-chain genes (κ & λ chain	1	Lecture	Black Board
2.13	Organization and rearrangement of Heavy chain genes	1	Lecture	Black Board
2.14	Antigen–Antibody interactions, Precipitation reactions - Radial immunodiffusion	1	Lecture	Black Board
2.15	Double immunodiffusion and immunoelectrophoresis	1	Lecture	Black Board
2.16	Agglutination reactions: Hemagglutination, bacterial agglutination, passive agglutination	1	Discussion	Black Board
2.17	Agglutination inhibition, Radioimmunoassay	1	Chalk & Talk	LCD
UNIT -3 LYMPHOCYTES MATURATION AND ACTIVATION & MHC				
3.1	B-cell maturation& B cell activation	3	Chalk &Talk	Black Board
3.2	B- Cell proliferation, affinity maturation – class switching	3	Chalk & Talk	LCD
3.3	generation of plasma cells and memory B cells	1	Lecture	PPT & White board
3.4	MHC Genes - Structure of MHC molecules – Class I & II	2	Lecture	Smart Board
3.5	Processing and presentation of exogenous antigens	1	Lecture	Black Board
3.6	Processing and presentation of endogenous antigens	1	Discussion	Google classroom
3.7	Tissue typing	1	Lecture	Black Board

3.7	T-cell maturation	2	Lecture	Black Board
3.8	Thymic selection – T cell activation - T cell differentiation	1	Lecture	Black Board
UNIT -4 COMPLEMENT SYSTEM AND HYPERSENSITIVITY				
4.1	Complement activation pathways: Classical	1	Chalk & Talk	Black Board
4.2	Complement activation pathways: Alternate	2	Chalk & Talk	LCD
4.3	Lectin pathways	2	Lecture	PPT & White board
4.4	Regulation of complement system	1	Lecture	Smart Board
4.5	Biological consequences of complement activation	2	Lecture	Black Board
4.6	Complement deficiencies	1	Discussio n	Google classroom
4.7	Hypersensitive reactions – IgE mediated (Type I) Hypersensitivity	2	Lecture	Black Board
4.7	Antibody mediated cytotoxic hypersensitivity	2	Lecture	Black Board
4.8	Immune complex mediated Types III hypersensitivity	1	Lecture	Black Board
4.9	T_{DTH} mediated Type IV hypersensitivity	1	Lecture	Black Board
UNIT -5 VACCINE AND IMMUNITY IN HEALTH AND DISEASE				
5.1	Vaccines: Whole organism vaccines, - Heat killed vaccines, Attenuated vaccines	2	Chalk & Talk	Black Board
5.2	Purified macromolecules as Vaccines, Recombinant vector vaccines,	3	Chalk & Talk	LCD
5.3	Synthetic peptide vaccines, Multivalent subunit vaccines.	2	Lecture	PPT & White board
5.4	Immune response and immune evasion during bacterial (Tuberculosis),	1	Lecture	Smart Board
5.5	Parasitic (Malaria)	1	Lecture	Black Board
5.6	viral (HIV) infection	1	Discussio n	Google classroom
5.7	Congenital immunodeficiency diseases (SCID and Ataxia).	2	Lecture	Black Board
5.8	Autoimmunity, Organ- specific autoimmune diseases, Systemic auto-immune diseases	3	Discussio n	Black Board

EVALUATION PATTERN

Internal

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assessment
	T1 10 Mks.	T2 10 Mks.	Seminar 5 Mks.	Assignment 5 Mks	OBT/PPT 5 Mks	35 Mks.	5 Mks.	40Mks.	
K2	4	4	-	-	-	8	-	8	20 %
K3	2	2	-	5	-	9	-	9	22.5 %
K4	2	2	-	-	5	9	-	9	22.5 %
K5	2	2	5	-	-	9	-	9	22.5 %
Non Scholastic	-	-	-	-	-		5	5	12.5 %
Total	10	10	5	5	5	35	5	40	100 %

CIA	
Scholastic	35
Non Scholastic	5
	40

EVALUATION PATTERN

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

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Summarize the overview of the immune system	K4	PSO1 & PSO5
CO 2	Elaborate the structure and properties of antigen and antibody and its interactions.	K1	PSO1 & PSO9
CO 3	Determine the concept of MHC molecules and maturation and activation of lymphocyte.	K1	PSO1 &PSO5
CO 4	Analyze the complement system and the types of hypersensitivity reactions.	K2	PSO1 & PSO9
CO 5	Prioritize the types of vaccines and immunity in health and disease.	K4	PSO1 & PSO9

Mapping of COs with PSOs

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

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

Mapping of COs with POs

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

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

♦ Weakly Correlated -**1**

COURSE DESIGNER:

Dr. J. Asnet Mary

Forwarded By

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

HOD'S Signature & Name

OLD SYLLABUS

II M.Sc., ZOOLOGY

SEMESTER –III

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PGSZO	19PG3Z14	Lab in Biophysics & Biostatistics	Practical	4	2

COURSE DESCRIPTION

The course is designed to give a hand on experience in Biophysics and biostatistics

COURSE OBJECTIVES

On completion of the course, students should be able to develop skill in performing experiments, analysis and interpretation of the result.

BIOPHYSICS **7 %**

1. pH Meter: Standardization of pH meter, Preparation of Buffers.
2. pH titration curve of acid-base
3. Osmolarity: Determination of osmotic pressure of salts.
4. To study the characteristics of absorption spectra of Aromatic Amino Acids.
5. To study the characteristics of absorption spectra of Proteins
6. Colorimeter: Verification of Beer's Lambert law, determination of absorption maxima of coloured compounds, and molar extinction coefficient.
7. Estimation of percent purities of dyes and inorganic compound
8. Centrifuge – Principle and techniques.
9. Separation of aminoacid mixture using paper chromatography
10. Surface tension by drop weight method
11. Comparison of Viscosity of two liquids

BIOSTATISTICS **3%**

1. Collection of data and representation - histogram, curves and pie diagrams.
2. Calculation of mean, median, mode, standard deviation, standard error, variance and coefficient of variation - individual observation
3. Calculation of mean, median, mode, standard deviation, standard error, variance and coefficient of variation – continuous series.
4. Calculation of correlation coefficient – width/diameter of shell.
5. Calculation of correlation coefficient – height and weight of students in the class.
6. Calculation of regression co-efficient using length and width of leaves.
7. Probability experiment with coin tossing (one coin, two coins). using chi square test
8. Test of significance for small samples – student's t test.

REFERENCES:

1. Rajan S., Christy, S.R., (2011) *Experimental procedures in Life Sciences,*Anjana Book House, Chennai.
2. Sinha J., Chatterjee A.K., Chattopadhyay P., (2015) *Advanced Practical Zoology, Books and Allied (P) Ltd., Calcutta.*
3. Tembhare D.B., (2008) *Techniques in Life Sciences, 1st ed.*, Himalaya Publishing House Pvt. Ltd., Mumbai.
4. Dutta A., (2009*) Experimental Biology Lab manual*, Narosa Publishing House, New Delhi.
5. Palanivelu P., (2004) *Analytical Biochemistry and Separation Techniques – A laboratory manual for B.Sc and M.Sc students, 3rd ed.*, Kalaimani Printers, Madurai.
6. Wilson K and Walker J., (2013) *Principles and Techniques of Biochemistry and Molecular Biology, 7th ed.,* Cambridge University Press, New York.
7. Roe S., (2001) *Protein Purification Techniques – A Practical Approach, 2nd* ed., Oxford University Press.
8. Boyer R., (2000) *Modern Experimental Biochemistry, 3rd ed.,* Pearson Education Inc.
9. Wilson K and Kenneth H.G., (1992) *A Biologists Guide to Principles and Techniques of Practical Biochemistry, 3rd ed.*, Cambridge University Press, Cambridge, UK.

10. Khan I.A and Khanum A., (2004) *Fundamentals & Biostatistics, 2nd ed.*, Ukaaz Publications, Hyderabad.

DIGITAL OPEN EDUCATIONAL RESOURCES (DOER):

1. https://vlab.amrita.edu/index.php?sub=3&brch=258
2. https://bms.ucsf.edu/resources-learning-biostatistics
3. https://nextgenu.org/mod/url/view.php?id=31720
4. https://instr.iastate.libguides.com/oer/stats
5. https://www.biophysics.org/education-careers/education-resources/additional-education-resources

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
BIOPHYSICS				
1	pH Meter: Standardization of pH meter, Preparation of Buffers.	4	Chalk & Talk	pH meter
2	pH titration curve of acid-base	4	Hands on training	pH meter
3	Determination of osmotic pressure of salts.	4	Hands on training	sample
4	Absorption spectra of Aromatic Amino Acids.	4	Hands on training	Colorimeter
5	characteristics of absorption spectra of Proteins	4	Hands on training	Colorimeter
6	Colorimeter: Verification of Beer's Lambert law, determination of absorption maxima of coloured compounds, and molar extinction coefficient.	4	Chalk & Talk	Colorimeter
7	Estimation of percent purities of dyes and inorganic compound	4	Hands on training	colorimeter
8	Centrifuge – Principle and techniques.	4	Chalk & Talk	centrifuge
9	Separation of amino acid mixture using paper chromatography	4	Hands on training	Filter paper

10	Surface tension by drop weight method	4	Hands on training	Instrument
BIOSTATISTICS				
11	Collection of data and representation - histogram, curves and pie diagrams.	4	Lecture	Green Board
12	Measures of Central tendency – individual observation	4	Hands on training	Leaves/Shell
13	Measures of Central tendency – continuous series	4	Hands on training	Leaves/Shell
14	Calculation of correlation coefficient – width/diameter of shell	4	Hands on training	Leaves/Shell
15	Calculation of correlation coefficient – height and weight of students in the class.	4	Hands on training	Meter scale/Weighing machine
16	Calculation of regression co-efficient using length and width of leaves/Shell	4	Hands on training	Leaves/Shell
17	Probability experiment with coin tossing (one coin, two coins). using chi square test	4	Hands on taining	Coin
18	Test of significance for small samples – student's t test.	4	Chalk & Talk	Green Board

CIA

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

Evaluation Pattern

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

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Recall the principle of centrifuge, pH meter, Chromatography	**K1**	PSO1, PSO3, PSO5
CO 2	Determine the maximum absorption and its molar extinction coefficient of sample	**K5**	PSO3, PSO5
CO 3	Estimate the pH Titration curve, Surface tension and viscosity of sample	**K5 & K6**	PSO3
CO 4	Interpret the results for statistical analysis including mean, median, mode and Standard deviation for individual, continuous series	**K2 & K5**	PSO3&PSO7 &PSO11
CO 5	Determine the correlation, regression and significance for the statistical data	**K5**	PSO3 & PSO5, PSO11

Mapping of COs with PSOs

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

Mapping of COs with POs

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

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

♦ Weakly Correlated -**1**

COURSE DESIGNER:
Dr. N. Nagarani

Forwarded By

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

HOD'S Signature

& Name

NEW SYLLABUS

II M.Sc., ZOOLOGY

SEMESTER –III

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PGSZO	19PG3Z14	Lab in Biophysics & Biostatistics	Practical	4	2

COURSE DESCRIPTION

The course is designed to give a hand on experience in Biophysics and biostatistics

COURSE OBJECTIVES

On completion of the course, students should be able to develop skill in performing experiments, analysis and interpretation of the result.

BIOPHYSICS

12. pH Meter: Standardization of pH meter,
13. pH titration curve of acid-base using Strong Acid Vs Weak Base.
14. Osmolarity: Determination of osmotic pressure of salts.
15. To study the characteristics of absorption spectra of Aromatic Amino Acids.
16. To study the characteristics of absorption spectra of Proteins
17. Colorimeter: Verification of Beer's Lambert law, determination of absorption maxima of coloured compounds, and molar extinction coefficient.
18. Estimation of percent purities of dyes and inorganic compound
19. Centrifuge – Principle and techniques.
20. Separation of aminoacid mixture using paper chromatography

21. Surface tension by drop weight method
22. Comparison of Viscosity of two liquids.
23. Effect of UV or Infra Red Radiation on the bacterial growth.

BIOSTATISTICS

9. Collection of data and representation - histogram, curves and pie diagrams.
10. Calculation of mean, median, mode, standard deviation, standard error, variance and coefficient of variation - individual observation
11. Calculation of mean, median, mode, standard deviation, standard error, variance and coefficient of variation – continuous series.
12. Calculation of correlation coefficient – width/diameter of shell.
13. Calculation of correlation coefficient – height and weight of students in the class.
14. Calculation of regression co-efficient using length and width of leaves.
15. Probability experiment with coin tossing (one coin, two coins). using chi square test
16. Test of significance for small samples – student's t test.
17. Analysis of Data using Ms Excel.

REFERENCES:

11. Rajan S., Christy, S.R., (2011) *Experimental procedures in Life Sciences,*Anjana Book House, Chennai.
12. Sinha J., Chatterjee A.K., Chattopadhyay P., (2015) *Advanced Practical Zoology, Books and Allied (P) Ltd., Calcutta.*
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15. Palanivelu P., (2004) *Analytical Biochemistry and Separation Techniques – A laboratory manual for B.Sc and M.Sc students, 3rd ed.*, Kalaimani Printers, Madurai.
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DIGITAL OPEN EDUCATIONAL RESOURCES (DOER):

6. https://vlab.amrita.edu/index.php?sub=3&brch=258
7. https://bms.ucsf.edu/resources-learning-biostatistics
8. https://nextgenu.org/mod/url/view.php?id=31720
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COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
BIOPHYSICS				
1	pH Meter: Standardization of pH meter, Preparation of Buffers.	4	Chalk & Talk	pH meter
2	pH titration curve of acid-base	4	Hands on training	pH meter

3	Determination of osmotic pressure of salts.	4	Hands on training	sample
4	Absorption spectra of Aromatic Amino Acids.	4	Hands on training	Colorimeter
5	characteristics of absorption spectra of Proteins	4	Hands on training	Colorimeter
6	Colorimeter: Verification of Beer's Lambert law, determination of absorption maxima of coloured compounds, and molar extinction coefficient.	4	Chalk & Talk	Colorimeter
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8	Centrifuge – Principle and techniques.	4	Chalk & Talk	centrifuge
9	Separation of amino acid mixture using paper chromatography	4	Hands on training	Filter paper
10	Surface tension by drop weight method	4	Hands on training	Instrument
BIOSTATISTICS				
11	Collection of data and representation - histogram, curves and pie diagrams.	4	Lecture	Green Board
12	Measures of Central tendency – individual observation	4	Hands on training	Leaves/Shell
13	Measures of Central tendency – continuous series	4	Hands on training	Leaves/Shell
14	Calculation of correlation coefficient – width/diameter of shell	4	Hands on training	Leaves/Shell
15	Calculation of correlation coefficient – height and weight of students in the class.	4	Hands on training	Meter scale/Weighing machine
16	Calculation of regression co-efficient using length and width of leaves/Shell	4	Hands on training	Leaves/Shell
17	Probability experiment with coin tossing (one coin, two coins). using chi square test	4	Hands on taining	Coin

18	Test of significance for small samples – student's t test.	4	Chalk & Talk	Green Board

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

Evaluation Pattern

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

COURSE OUTCOMES

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

NO.	**COURSE OUTCOMES**	**KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)**	**PSOs ADDRESSED**
CO 1	Recall the principle of centrifuge, pH meter, Chromatography	**K1**	PSO1, PSO3, PSO5
CO 2	Determine the maximum absorption and its molar extinction coefficient of sample	**K5**	PSO3, PSO5
CO 3	Estimate the pH Titration curve, Surface tension and viscosity of sample	**K5 & K6**	PSO3
CO 4	Interpret the results for statistical analysis including mean, median, mode and Standard deviation for individual, continuous series	**K2 & K5**	PSO3&PSO7 &PSO11
CO 5	Determine the correlation, regression and significance for the statistical data	**K5**	PSO3 & PSO5, PSO11

Mapping of COs with PSOs

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

Mapping of COs with POs

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

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

♦ Weakly Correlated -**1**

COURSE DESIGNER:
Dr. N. Nagarani

Forwarded By

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

HOD'S Signature

& Name

OLD SYLLABUS

II M.Sc., ZOOLOGY

SEMESTER –III

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSZO	19PG3ZE1	Fisheries & Aquaculture	Lecture	4	4

COURSE DESCRIPTION

This Course focuses on Fisheries and Aquaculture of Finfishes, Marine Prawn, Pearl Oyster and Disease Management.

COURSE OBJECTIVES

To impart knowledge on Fisheries and Aquaculture Practices in India.

UNIT I - INDIAN CAPTURE FISHERIES (15 HRS)

History of Fisheries, Indian Capture Fisheries: Riverine fisheries, Estuarine fisheries, Reservoir fisheries, Lacustrine Fisheries, Cold-water fisheries; Marine Capture fisheries: Inshore capture fisheries, Off shore and deep sea fisheries

UNIT II - AQUACULTURE PRACTICES (15 HRS)

Preparation and Construction of Ponds; Water Quality Management; Maintenance of Fish Farms; Fish Nutrition – Live feed, Artificial feed - FCR; Induced Breeding – Eyestalk ablation and Hypophysation.

UNIT III - CULTURE SYSTEMS (15 HRS)

Culture Systems – Based on habitat, expenses, site, climatic conditions and Composition of Organisms Culture of Indian Major Carps, Marine Prawn, Pearl Oyster and Sea Cucumber - Sewage fed fish culture, Integrated Fish Farming.

UNIT IV - FISH PATHOLOGY AND POST HARVEST TECHNOLOGY

(15 HRS) **10%**

Parasitic diseases – Protozoan, Helminth, Crustacean, Fungal, Bacterial and Viral diseases and Deficiency Diseases; Preservation of Fish; Fish Marketing

UNIT V - INDIAN FISHERY (15 HRS)

2%

Indian Fish Geography, Fishing Gears and Methods, Fishing Crafts; Indian Exclusive Economic Zone – Use of Remote Sensing and GIS.Role of Government and Public Sector on Indian Fisheries, FFDAs.

REFERENCE BOOKS:

1. Pandey K. and Shukla J.P., (2012) *Fish and Fisheries*, 3rd Revised ed., Rastogi Publications, Meerut.

2. Srivastava C.B.L., (2008) *A Textbook of Fishery Science and Indian Fisheries*, 3rd Revised ed., Published by KitabMahal, Allahabad.

3. Kumar R., (2012) *Fish Farming Management*, 1st ed., Arise Publishers and Distributors, New Delhi.

4. Chandrasekhar Y.S., (2013) *Fish Nutrition in Aquaculture*, 1st ed., Swastik Publications, New Delhi.

5. Reddy S.M. and Sambasiva Rao K.R.S., (1999) *A Textbook of Aquaculture*, Discovery Publishing House, New Delhi.

DIGITAL OPEN EDUCATIONAL RESOURCES (DOER):

1. http://ecoursesonline.iasri.res.in/course/index.php?categoryid=72
2. https://nfdb.gov.in/
3. https://indianfisheries.icsf.net/
4. https://www.india.gov.in/topics/agriculture/fisheries
5. http://eprints.cmfri.org.in/

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT-1 INDIAN CAPTURE FISHERIES				
1.1	History of Fisheries	2	Chalk & Talk	Black Board
1.2	Indian Capture Fisheries: Riverine fisheries, Estuarine fisheries, Reservoir fisheries,	7	Chalk & Talk	LCD

	Lacustrine Fisheries, Cold-water fisheries			
1.3	Marine Capture fisheries: Inshore capture fisheries, Off shore and deep sea fisheries	5	Lecture	PPT & White board
UNIT-2 AQUACULTURE PRACTICES				
2.1	Preparation and Construction of Ponds	4	Lecture	Charts
2.2	Water Quality Management	2	Chalk & Talk	PPT& Videos
2.3	Maintenance of Fish Farms	2	Chalk & Talk	PPT
2.4	Fish Nutrition – Live feed, Artificial feed – FCR	3	Chalk & Talk	PPT& Videos
2.5	Induced Breeding – Eyestalk ablation and Hypophysation	2	Chalk & Talk	PPT
UNIT-3 CULTURE SYSTEMS				
3.1	Culture Systems – Based on habitat, expenses, site, climatic conditions and Composition of Organisms	2	Lecture	PPT& Videos
3.2	Culture of Indian Major Carps, Marine Prawn, Pearl Oyster and Sea Cucumber	5	Lecture	PPT& Videos
3.3	Sewage fed fish culture	2	Chalk & Talk	PPT& Videos
3.4	Integrated Fish Farming.	3	Chalk & Talk	PPT& Videos
UNIT-4 FISH PATHOLOGY AND POST HARVEST TECHNOLOGY				
4.1	Parasitic diseases – Protozoan, Helminth, Crustacean, Fungal, Bacterial and Viral diseases and Deficiency Diseases	10	Chalk & Talk	PPT& Videos
4.2	Preservation of Fish	2	Chalk & Talk	PPT& Videos

4.3	Fish Marketing	2	Lecture	PPT& Videos
UNIT-5 INDIAN FISHERIES				
5.1	Indian Fish Geography	2	Chalk & Talk	PPT& Videos
5.2	Fishing Gears and Methods, Fishing Crafts	5	Chalk & Talk	PPT& Videos
5.3	Indian Exclusive Economic Zone – Use of Remote Sensing and GIS.	2	Chalk & Talk	PPT& Videos
5.4	Role of Government and Public Sector on Indian Fisheries, FFDAs.	4	Chalk & Talk	PPT & Videos

EVALUATION PATTERN

Internal

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assessment
	T1 10 Mks.	T2 10 Mks.	Seminar 5 Mks.	Assignment 5 Mks	OBT/PPT 5 Mks	35 Mks.	5 Mks.	40Mks.	
K2	**4**	**4**	**-**	**-**	**-**	**8**	-	**8**	20 %
K3	**2**	**2**	**-**	**5**	**-**	**9**	-	**9**	22.5 %
K4	**2**	**2**	**-**	**-**	**5**	**9**	-	**9**	22.5 %
K5	**2**	**2**	**5**	**-**	**-**	**9**	-	**9**	22.5 %
Non Scholastic	**-**	**-**	**-**	**-**	-		**5**	**5**	12.5 %
Total	**10**	**10**	**5**	**5**	**5**	**35**	**5**	**40**	**100 %**

CIA

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

EVALUATION PATTERN

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

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Identify the economically important fishes and fishery products.	**K1**	PSO1& PSO2
CO 2	Plans according to the recent concepts in fisheries management.	**K3**	PSO3
CO 3	Distinguish the various aquaculture systems.	**K2**	PSO5
CO 4	Organizes the type of hatchery, brood stock, larval production, feed management water quality and	**K3**	PSO4, PSO9

	disease management in cultivable species, live feed production.		
CO 5	Evaluates the Fisheries and Aquaculture Practices in India.	**K4**	PSO5, PSO7 & PSO10

Mapping of COs with PSOs

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

Mapping of COs with POs

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

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

♦ Weakly Correlated -**1**

COURSE DESIGNER:
Dr. Antony AmalaJayaseeli

Forwarded By

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

HOD'S Signature

& Name

NEW SYLLABUS

II M.Sc., ZOOLOGY

SEMESTER –III

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSZO	19PG3ZE1	Fisheries & Aquaculture	Lecture	4	4

COURSE DESCRIPTION

This Course focuses on Fisheries and Aquaculture of Finfishes, Marine Prawn, Pearl Oyster and Disease Management.

COURSE OBJECTIVES

To impart knowledge on Fisheries and Aquaculture Practices in India.

UNIT I - INDIAN CAPTURE FISHERIES (15 HRS)

History of Fisheries, Indian Capture Fisheries: Riverine fisheries, Estuarine fisheries, Reservoir fisheries, Lacustrine Fisheries, Cold-water fisheries; Marine Capture fisheries: Inshore capture fisheries, Off shore and deep sea fisheries.

UNIT II - AQUACULTURE PRACTICES (15HRS)

Preparation and Construction of Ponds; Water Quality Management; Maintenance of Fish Farms; Fish Nutrition – Live feed, Artificial feed - FCR; Induced Breeding – Eyestalk ablation and Hypophysation.

UNIT III - CULTURE SYSTEMS (15 HRS)

Culture Systems – Based on habitat, expenses, site, climatic conditions and Composition of Organisms Culture of Indian Major Carps, Marine Prawn,

Pearl Oyster and Sea Cucumber - Sewage fed fish culture, Integrated Fish Farming.

UNIT IV - FISH PATHOLOGY AND POST HARVEST TECHNOLOGY (15 HRS)

Parasitic diseases – Protozoan, Helminth, Crustacean, Fungal, Bacterial and Viral diseases and Deficiency Diseases; Preservation of Fish – Processing of Prawn; Fish Marketing – Domestic Market – Marine, Brackish &Inland Marketing&Export Market; Role of Cooperative Society

UNIT V - INDIAN FISHERY (15 HRS)

Indian Fish Geography, Fishing Gears and Methods, Fishing Crafts; Indian Exclusive Economic Zone – Use of Remote Sensing and GIS.Role of Government and Public Sector on Indian Fisheries, FFDAs. Ethics National Biodiversity Authority (NBA).

REFERENCE BOOKS:

1. Pandey K. and Shukla J.P., (2012) *Fish and Fisheries*, 3rd Revised ed., Rastogi Publications, Meerut.
2. Srivastava C.B.L., (2008) *A Textbook of Fishery Science and Indian Fisheries*, 3rd Revised ed., Published by KitabMahal, Allahabad.
3. Kumar R., (2012) *Fish Farming Management*, 1st ed., Arise Publishers and Distributors, New Delhi.
4. Chandrasekhar Y.S., (2013) *Fish Nutrition in Aquaculture*, 1st ed., Swastik Publications, New Delhi.
5. Reddy S.M. and Sambasiva Rao K.R.S., (1999) *A Textbook of Aquaculture*, Discovery Publishing House, New Delhi.

DIGITAL OPEN EDUCATIONAL RESOURCES (DOER):

1. http://ecoursesonline.iasri.res.in/course/index.php?categoryid=72
2. https://nfdb.gov.in/
3. https://indianfisheries.icsf.net/
4. https://www.india.gov.in/topics/agriculture/fisheries

5. http://eprints.cmfri.org.in/

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT-1 INDIAN CAPTURE FISHERIES				
1.1	History of Fisheries	2	Chalk & Talk	Black Board
1.2	Indian Capture Fisheries: Riverine fisheries, Estuarine fisheries, Reservoir fisheries, Lacustrine Fisheries, Cold-water fisheries	7	Chalk & Talk	LCD
1.3	Marine Capture fisheries: Inshore capture fisheries, Off shore and deep sea fisheries	5	Lecture	PPT & White board
UNIT-2 AQUACULTURE PRACTICES				
2.1	Preparation and Construction of Ponds	4	Lecture	Charts
2.2	Water Quality Management	2	Chalk & Talk	PPT& Videos
2.3	Maintenance of Fish Farms	2	Chalk & Talk	PPT
2.4	Fish Nutrition – Live feed, Artificial feed – FCR	3	Chalk & Talk	PPT& Videos
2.5	Induced Breeding – Eyestalk ablation and Hypophysation	2	Chalk & Talk	PPT
UNIT-3 CULTURE SYSTEMS				
3.1	Culture Systems – Based on habitat, expenses, site, climatic conditions and Composition of Organisms	2	Lecture	PPT& Videos

3.2	Culture of Indian Major Carps, Marine Prawn, Pearl Oyster and Sea Cucumber	5	Lecture	PPT& Videos
3.3	Sewage fed fish culture	2	Chalk & Talk	PPT& Videos
3.4	Integrated Fish Farming.	3	Chalk & Talk	PPT& Videos
UNIT-4 FISH PATHOLOGY AND POST HARVEST TECHNOLOGY				
4.1	Parasitic diseases – Protozoan, Helminth, Crustacean, Fungal, Bacterial and Viral diseases and Deficiency Diseases	10	Chalk & Talk	PPT& Videos
4.2	Preservation of Fish	2	Chalk & Talk	PPT& Videos
4.3	Fish Marketing	2	Lecture	PPT& Videos
UNIT-5 INDIAN FISHERIES				
5.1	Indian Fish Geography	2	Chalk & Talk	PPT& Videos
5.2	Fishing Gears and Methods, Fishing Crafts	5	Chalk & Talk	PPT& Videos
5.3	Indian Exclusive Economic Zone – Use of Remote Sensing and GIS.	2	Chalk & Talk	PPT& Videos
5.4	Role of Government and Public Sector on Indian Fisheries, FFDAs.	4	Chalk & Talk	PPT & Videos

EVALUATION PATTERN

Internal

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assessment
	T1 10 Mks.	T2 10 Mks.	Seminar 5 Mks.	Assignment 5 Mks	OBT/PPT 5 Mks	35 Mks.	5 Mks.	40Mks.	
K2	4	4	-	-	-	8	-	8	20 %
K3	2	2	-	5	-	9	-	9	22.5 %
K4	2	2	-	-	5	9	-	9	22.5 %
K5	2	2	5	-	-	9	-	9	22.5 %
Non Scholastic	-	-	-	-	-		5	5	12.5 %
Total	10	10	5	5	5	35	5	40	100 %

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

EVALUATION PATTERN

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

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Identify the economically important fishes and fishery products.	K1	PSO1& PSO2
CO 2	Plans according to the recent concepts in fisheries management.	K3	PSO3
CO 3	Distinguish the various aquaculture systems.	K2	PSO5
CO 4	Organizes the type of hatchery, brood stock, larval production, feed management water quality and disease management in cultivable species, live feed production.	K3	PSO4, PSO9
CO 5	Evaluates the Fisheries and Aquaculture Practices in India.	K4	PSO5, PSO7 & PSO10

Mapping of COs with PSOs

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

Mapping of COs with POs

CO/ PSO	PO1	PO2	PO3	PO4
CO1	3	2	2	2

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

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

♦ Weakly Correlated -**1**

COURSE DESIGNER:
Dr. Antony AmalaJayaseeli

Forwarded By

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

HOD'S Signature & Name

OLD SYLLABUS

II M.Sc., ZOOLOGY

SEMESTER –IV

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSZO	19PG4Z18	Developmental Biology	Lecture	6	5

COURSE DESCRIPTION

This Course focuses on the developmental process from a single egg to zygote by fertilization, into blastula by Cleavage, followed by Gastrulation into Gastrula. From Gastrula, organ forming rudiments are formed, which give rise to the Organ Systems of the Organism.

COURSE OBJECTIVES

Imparts knowledge on the developmental process from a single egg to foetus, then in an adult.

UNITS 5%

UNIT I: INTRODUCTION TO DEVELOPMENTAL BIOLOGY (15 HRS)

Historical Review and Scope of Embryology; Reproductive Cycles –Regulation; Structure of sperms and eggs - influence of yolk - polarity - symmetry - Egg membranes; Gametogenesis : Migration of Germ cells in Vertebrates, Spermatogenesis and Oogenesis.

UNIT II: FERTILIZATION (15 HRS)

3%

Fertilization – Sea Urchin, and Mammals - Approach of the Spermatozoan to the Egg; Reaction of the Egg; Fusion of Gametic Nuclei; Egg Cytoplasm rearrangement by Fertilization; Parthenogenesis.

UNIT III: CLEAVAGE (15 HRS)

Cleavage: Planes of Cell Divisions; Patterns of cleavage; Laws of Cleavage; Cellular Mechanism of Cleavage; Morula and Blastula; Physiology of Cleavage; Products of Cleavage;; Role of Maternal genes during the early Development.

UNIT IV: GASTRULATION (15 HRS)

Gastrulation – Unique features – Gastrula; Morphogenetic movements; Fate maps, Fate of Germinal layers; Axis Formation in Sea Urchin, Fishes, Amphibians, Birds and Mammals; Concept of Spemann's Organizer; Formation of Extra embryonic membranes; Placentation in Mammals

UNIT V: ORGANOGENESIS & POSTEMBRYONIC DEVELOPMENT

(15 HRS) **2%**

Development of Central Nervous System, Heart and Lungs; Metamorphosis in Insects, and Amphibians; Teratology; Types of Regeneration, Molecular basis and rôle of Genes on Teratology; Aging and Senescence.

REFERENCE BOOKS:

1. Browder L.N., *Developmental Biology*, Saunders College, Philadelphia (1980).
2. Balinsky B.L., *An Introduction to Embryology*, 5th ed., Saunders Co., Philadelphia (1981).
3. Berrill N.J., *Developmental Biology*, Tata McGraw Hill, New Delhi, (1986).
4. Carlson B.M., *Foundations of Embryology*, Tata McGraw Hill, New Delhi, (2007).
5. Gilbert S.F., *Developmental Biology*, Sinamer Associates Inc. Saunderland, Massachusets, U.S.A. (2003).

DIGITAL OPEN EDUCATIONAL RESOURCES (DOER):

1. https://embryology.med.unsw.edu.au/embryology/index.php/Gastrulation
2. https://teachmeanatomy.info/the-basics/embryology/gastrulation/
3. http://pressbooks-dev.oer.hawaii.edu/biology/chapter/fertilization-and-early-embryonic-development/
4. https://vivaopen.oercommons.org/courseware/lesson/660/overview
5. https://louis.oercommons.org/courseware/module/828/student/?task=4

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 INTRODUCTION TO DEVELOPMENTAL BIOLOGY				

1.1	Historical Review and Scope of Embryology	2	Chalk &Talk	LCD
1.2	Reproductive Cycles –Regulation	4	Chalk & Talk	LCD
1.3	Structure of sperms and eggs - influence of yolk - polarity - symmetry - Egg membranes;	3	Lecture	PPT
1.4	Gametogenesis : Migration of Germcells in Vertebrates, Spermatogenesis and Oogenesis	4	Lecture	PPT
UNIT-2 FERTILIZATION				
2.1	Fertilization – Sea Urchin, and Mammals - Approach of the Spermatozoan to the Egg; Reaction of the Egg; Fusion of Gametic Nuclei;	5	Discussion	Google classroom
2.2	Egg Cytoplasm rearrangementby Fertilization;	3	Specimen	Microscope
2.1	Parthenogenesis.	2	Discussion	Black Board
UNIT-3 CLEAVAGE				
2.1	Cleavage: Planes of Cell Divisions; Patterns of cleavage; Laws of Cleavage	5	Lecture	Green Board Charts
2.2	Cellular Mechanism of Cleavage; Morula and Blastula	2	Chalk & Talk	Green Board
1.1	Physiology of Cleavage	2	Chalk & Talk	Black Board
1.2	Products of Cleavage	2	Chalk & Talk	LCD
1.3	Role of Maternal genes during the early Development	2	Lecture	PPT
UNIT -4 GASTRULATION				
4.1	Gastrulation – Unique features– Gastrula	2	Lecture	Black Board
4.2	Morphogenetic movements; Fate maps	2	Discussion	Google classroom
4.3	Fate of Germinal layers; Axis Formation in Sea Urchin, Fishes, Amphibians, Birds and Mammals	4	Specimen	Microscope
4.4	Concept of Spemann's Organizer	2	Discussion	Black Board
4.5	Formation of Extra embryonic membranes; Placentation in Mammals	3	Lecture	LCD
UNIT-5 ORGANOGENESIS & POST EMBRYONIC DEVELOPMENT				
5.1	Development of Central Nervous System, Heart and Lungs	5	Lecture	LCD

5.2	Metamorphosis in Insects, and Amphibians	3	Lecture	LCD
5.3	Teratology; Molecular basis, Role of Genes on Teratology & Types	3	Lecture	LCD
5.4	Aging and Senescence	2	Lecture	LCD

EVALUATION PATTERN

Internal

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assessment
	T1 10 Mks.	T2 10 Mks.	Seminar 5 Mks.	Assignment 5 Mks	OBT/PPT 5 Mks	35 Mks.	5 Mks.	40Mks.	
K2	4	4	-	-	-	8	-	8	20 %
K3	2	2	-	5	-	9	-	9	22.5 %
K4	2	2	-	-	5	9	-	9	22.5 %
K5	2	2	5	-	-	9	-	9	22.5 %
Non Scholastic	-	-	-	-	-		5	5	12.5 %
Total	10	10	5	5	5	35	5	40	100 %

CIA

Scholastic	35
Non Scholastic	5
	40

EVALUATION PATTERN

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

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Recalls the basic concepts of Developmental Biology.	K1	PSO1& PSO2
CO 2	Explain how fertilization, cleavage and Gastrulation occur.	K2	PSO2
CO 3	Compares the basic concepts of organogenesis in different organisms.	K2	PSO5
CO 4	Understand the development of egg into a foetus, then into adult.	K2	PSO2, PSO11
CO 5	Associate the embryo development with Phylogeny.	K3	PSO2, PSO9

Mapping of COs with PSOs

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

Mapping of COs with POs

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

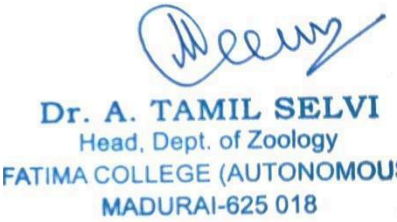
Note: ♦ Strongly Correlated – **3** ♦ Moderately Correlated – **2**

♦ Weakly Correlated -**1**

COURSE DESIGNER:

Dr. Antony Amala Jayaseeli

Forwarded By



HOD'S Signature & Name

NEW SYLLABUS

II M.Sc., ZOOLOGY

SEMESTER –IV

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSZO	19PG4Z18	Developmental Biology	Lecture	6	5

COURSE DESCRIPTION

This Course focuses on the developmental process from a single egg to zygote by fertilization, into blastula by Cleavage, followed by Gastrulation into Gastrula. From Gastrula, organ forming rudiments are formed, which give rise to the Organ Systems of the Organism.

COURSE OBJECTIVES

Imparts knowledge on the developmental process from a single egg to foetus, then in an adult.

UNITS

UNIT I: INTRODUCTION TO DEVELOPMENTAL BIOLOGY (15 HRS)

Historical Review and Scope of Embryology; Reproductive Cycles –Regulation; Structure of sperms and eggs - influence of yolk - polarity - symmetry - Egg membranes; Gametogenesis : Migration of Germ cells in Vertebrates, Spermatogenesis and Oogenesis. Cryopreservation of gametes and embryos- Ethical Issues in Cryopreservation.

UNIT II: FERTILIZATION (15 HRS)

Fertilization – Sea Urchin, and Mammals - Approach of the Spermatozoan to the Egg; Reaction of the Egg – prevention of polyspermy; Fusion of Gametic Nuclei; Egg Cytoplasm rearrangement by Fertilization. Parthenogenesis.

UNIT III: CLEAVAGE (15 HRS)

Cleavage: Planes of Cell Divisions; Patterns of cleavage; Laws of Cleavage; Cellular Mechanism of Cleavage; Morula and Blastula; Physiology of Cleavage; Products of Cleavage; Role of Maternal genes during the early Development.

UNIT IV: GASTRULATION (15 HRS)

Gastrulation – Unique features – Gastrula; Morphogenetic movements; Fate maps, Fate of Germinal layers; Axis Formation in Sea Urchin, Fishes, Amphibians, Birds and Mammals; Concept of Spemann's Organizer; Formation of Extra embryonic membranes; Placentation in Mammals

UNIT V: ORGANOGENESIS & POSTEMBRYONIC DEVELOPMENT (15 HRS)

Development of Central Nervous System, Heart and Lungs; Metamorphosis in Insects, and Amphibians; Teratology; Types of Regeneration, Molecular basis and rôle of Genes on Teratology; Aging and Senescence – Biology of Senescence – Causes of Ageing

REFERENCE BOOKS:

6. Browder L.N., *Developmental Biology*, Saunders College, Philadelphia (1980).
7. Balinsky B.L., *An Introduction to Embryology*, 5th ed., Saunders Co., Philadelphia (1981).
8. Berrill N.J., *Developmental Biology*, Tata McGraw Hill, New Delhi, (1986).
9. Carlson B.M., *Foundations of Embryology*, Tata McGraw Hill, New Delhi, (2007).
10. Gilbert S.F., *Developmental Biology*, Sinamer Associates Inc. Saunderland, Massachusets, U.S.A. (2003).

DIGITAL OPEN EDUCATIONAL RESOURCES (DOER):

6. https://embryology.med.unsw.edu.au/embryology/index.php/Gastrulation
7. https://teachmeanatomy.info/the-basics/embryology/gastrulation/
8. http://pressbooks-dev.oer.hawaii.edu/biology/chapter/fertilization-and-early-embryonic-development/
9. https://vivaopen.oercommons.org/courseware/lesson/660/overview
   https://louis.oercommons.org/courseware/module/828/student/?task=4

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 INTRODUCTION TO DEVELOPMENTAL BIOLOGY				
1.1	Historical Review and Scope of Embryology	2	Chalk &Talk	LCD
1.2	Reproductive Cycles –Regulation	4	Chalk & Talk	LCD
1.3	Structure of sperms and eggs - influence of yolk - polarity - symmetry - Egg membranes;	3	Lecture	PPT
1.4	Gametogenesis : Migration of Germcells in Vertebrates, Spermatogenesis and Oogenesis	4	Lecture	PPT
UNIT-2 FERTILIZATION				
2.1	Fertilization – Sea Urchin, and Mammals - Approach of the Spermatozoan to the Egg; Reaction of the Egg; Fusion of Gametic Nuclei;	5	Discussion	Google classroom
2.2	Egg Cytoplasm rearrangementby Fertilization;	3	Specimen	Microscope
2.1	Parthenogenesis.	2	Discussion	Black Board
UNIT-3 CLEAVAGE				
2.1	Cleavage: Planes of Cell Divisions; Patterns of cleavage; Laws of Cleavage	5	Lecture	Green Board Charts
2.2	Cellular Mechanism of Cleavage; Morula and Blastula	2	Chalk & Talk	Green Board
1.1	Physiology of Cleavage	2	Chalk & Talk	Black Board
1.2	Products of Cleavage	2	Chalk & Talk	LCD
1.3	Role of Maternal genes during the early Development	2	Lecture	PPT
UNIT -4 GASTRULATION				
4.1	Gastrulation – Unique features– Gastrula	2	Lecture	Black Board
4.2	Morphogenetic movements; Fate maps	2	Discussion	Google classroom
4.3	Fate of Germinal layers; Axis Formation in Sea Urchin, Fishes, Amphibians, Birds and Mammals	4	Specimen	Microscope

4.4	Concept of Spemann's Organizer	2	Discussion	Black Board
4.5	Formation of Extra embryonic membranes; Placentation in Mammals	3	Lecture	LCD
UNIT-5 ORGANOGENESIS & POST EMBRYONIC DEVELOPMENT				
5.1	Development of Central Nervous System, Heart and Lungs	5	Lecture	LCD
5.2	Metamorphosis in Insects, and Amphibians	3	Lecture	LCD
5.3	Teratology; Molecular basis, Role of Genes on Teratology & Types	3	Lecture	LCD
5.4	Aging and Senescence	2	Lecture	LCD

EVALUATION PATTERN

Internal

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assessment
	T1 10 Mks.	T2 10 Mks.	Seminar 5 Mks.	Assignment 5 Mks	OBT/PPT 5 Mks	35 Mks.	5 Mks.	40Mks.	
K2	**4**	**4**	**-**	**-**	**-**	**8**	-	**8**	20 %
K3	**2**	**2**	**-**	**5**	**-**	**9**	-	**9**	22.5 %
K4	**2**	**2**	**-**	**-**	**5**	**9**	-	**9**	22.5 %
K5	**2**	**2**	**5**	**-**	**-**	**9**	-	**9**	22.5 %
Non Scholastic	**-**	**-**	**-**	**-**	-		**5**	**5**	12.5 %
Total	**10**	**10**	**5**	**5**	**5**	**35**	**5**	**40**	**100 %**

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

EVALUATION PATTERN

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

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Recalls the basic concepts of Developmental Biology.	**K1**	PSO1& PSO2
CO 2	Explain how fertilization, cleavage and Gastrulation occur.	**K2**	PSO2
CO 3	Compares the basic concepts of organogenesis in different organisms.	**K2**	PSO5
CO 4	Understand the development of egg into a foetus, then into adult.	**K2**	PSO2, PSO11
CO 5	Associate the embryo development with Phylogeny.	**K3**	PSO2, PSO9

Mapping of COs with PSOs

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

Mapping of COs with POs

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

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

♦ Weakly Correlated -**1**

COURSE DESIGNER:

Dr. Antony Amala Jayaseeli

Forwarded By

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

HOD'S Signature & Name

Old Syllabus

II M.Sc., ZOOLOGY

SEMESTER –IV

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSZO	**19PG4Z20**	**Lab in Biotechnology, Economic Zoology & Ethology**	**Practical**	**4**	**2**

COURSE DESCRIPTION

This course provides rich knowledge in isolating DNA from different sources. It also helps to observe the behavioural pattern of selected animals.

COURSE OBJECTIVES

- Students acquire hands on experience in using lab equipment.
- Gain knowledge in tissue culture and micropropagation techniques.
- Enable the students to know about chasing behaviour in fish.

UNITS

Biotechnology **15%**

1. Biosafety guidelines
2. Plant tissue culture techniques: Preparation of MS media, callus formation.
3. Micropropagation techniques
4. Isolation of genomic DNA from goat liver
5. Isolation of plasmid DNA from bacteria
6. DNA estimation using diphenylamine method
7. Restriction enzymes digestion of DNA.
8. Separation of DNA using Agarose gel electrophoresis.
9. Demonstration of PCR techniques.
10. Elution of DNA from Gel

Economic zoology

11. Visit of silk farms and silk reeling weaving units in nearby areas and submission of the report.

12.Observation of larval stages of Prawn.

13.Newton's Bee hive.

14.Feeder

Ethology

15.A field study of foraging or trail making behaviour in ant species.

16.Study of nest building behaviour in birds.

17.Study of habitat selection in spiders.

18.Chasing behaviour in fish.

REFERENCES:

1. Sinha J., Chatterjee A.K., Chattopadhyay P., (2015) *Advanced Practical Zoology, Books and Allied (P) Ltd., Calcutta.*
2. Rajan S., Christy, S.R., (2011) *Experimental procedures in Life Sciences, Anjana Book House, Chennai.*

DIGITAL OPEN EDUCATIONAL RESOURCES (DOER):

1. https://www.youtube.com/watch?v=nr1tV_LuqJk
2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3395714/
3. https://www.ncbi.nlm.nih.gov/probe/docs/techpcr/
4. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6617107/
5. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4242575/

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
BIOTECHNOLOGY				
1	Biosafety guidelines	4	Lecture	
2	Plant tissue culture techniques: Preparation of MS media, callus formation.	4	Demonstration & hands on training	Plant
3	Micropropagation techniques	4	Demonstration & hands on training	
4	Isolation of genomic DNA from goat liver	4	Demonstration & hands on training	Goat liver
5	Isolation of plasmid DNA from bacteria	4	Demonstration & hands on training	Bacterial culture

6	DNA estimation using diphenylamine method	4	Demonstration & hands on training	Isolated DNA
7	Restriction enzymes digestion of DNA.	4	Demonstration & hands on training	Isolated DNA
8	Separation of DNA using Agarose gel electrophoresis	4	Demonstration & hands on training	Isolated DNA
9	Demonstration of PCR techniques	4	Demonstration	
10	Elution of DNA from Gel	4	Demonstration & hands on training	Isolated DNA
ECONOMIC ZOOLOGY				
11	Visit of silk farms and silk reeling weaving units in nearby areas and submission of the report.	4	Demonstration	
12	Observation of larval stages of Prawn	4	Demonstration	Slides
13	Newton's Bee hive.	4	Demonstration	Model
14	Feeder	4	Demonstration	Model
ETHOLOGY				
15	A field study of foraging or trail making behaviour in ant species	4	Demonstration	Nature Observation
16	Study of nest building behaviour in birds	4	Demonstration	Nature Observation
17	Study of habitat selection in spiders	4	Demonstration	Nature Observation
18	Chasing behaviour in fish	4	Demonstration	Nature Observation

CIA

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

Evaluation Pattern

MARKS		
CIA	ESE	Total
40	60	100

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Demonstrate the plant tissue culture technique.	K2	PSO3
CO 2	Experiment with DNA isolation	K3	PSO3
CO 3	Estimate DNA quantitatively	K5	PSO3
CO 4	Analyse Newton's bee hive	K6	PSO2
CO 5	Relate nest building in different birds	K1	PSO2

Mapping of COs with PSOs

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

Mapping of COs with POs

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

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

COURSE DESIGNER:

1. **Dr. S. Barathy**

Forwarded By

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

HOD'S Signature & Name

New Syllabus

II M.Sc., ZOOLOGY

SEMESTER –IV

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSZO	**19PG4Z20**	**Lab in Biotechnology, Economic Zoology & Ethology**	**Practical**	**4**	**2**

COURSE DESCRIPTION

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COURSE OBJECTIVES

- Students acquire hands on experience in using lab equipment.
- Gain knowledge in tissue culture and micropropagation techniques.
- Enable the students to know about chasing behaviour in fish.

UNITS

Biotechnology

1. Biosafety guidelines
2. Plant tissue culture techniques:, Explant Establishment, Callus Induction, Rhizogenesis, Caulogenesis, Embryogenesis and Synthetic seeds
3. Micropropagation techniques
4. Isolation of plasmid DNA from bacteria
5. Ti Plasmid isolation from Agrobacterium cultures and selection of transformed cells
6. Cell viability: Dye exclusion test

7. Restriction enzymes digestion of DNA.
8. Separation of DNA using Agarose gel electrophoresis.
9. Demonstration of PCR techniques.

Economic zoology

10. Observation of larval stages of Prawn.
11. Newton's Bee hive.
12. Feeder
13. Visit of silk farms and silk reeling weaving units in nearby areas and submission of the report.

Ethology

14. A field study of foraging or trail making behaviour in ant species.
15. Study of nest building behaviour in birds.
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1	Biosafety guidelines	4	Lecture	
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3	Rhizogenesis, Caulogenesis	4	Demonstration & hands on training	
4	Embryogenesis and Synthetic seeds	4	Demonstration & hands on training	Explant

5	Micropropagation techniques	4	Demonstration & hands on training	Explant
6	Isolation of plasmid DNA from bacteria	4	Demonstration & hands on training	Bacterial culture
7	Ti Plasmid isolation from *Agrobacterium* cultures and selection of transformed cells	4	Demonstration & hands on training	Bacterial culture
8	Cell viability: Dye exclusion test	4	Demonstration & hands on training	Lymophocyte culture
9	Restriction enzymes digestion of DNA.	4	Demonstration & hands on training	Isolated DNA
10	Separation of DNA using Agarose gel electrophoresis	4	Demonstration & hands on training	Isolated DNA
11	Demonstration of PCR techniques	4	Demonstration	-
ECONOMIC ZOOLOGY				
11	Visit of silk farms and silk reeling weaving units in nearby areas and submission of the report.	4	Demonstration	-
12	Observation of larval stages of Prawn	4	Demonstration	Slides
13	Newton's Bee hive.	4	Demonstration	Model
14	Feeder	4	Demonstration	Model
ETHOLOGY				
15	A field study of foraging or trail making behaviour in ant species	4	Demonstration	Nature Observation
16	Study of nest building behaviour in birds	4	Demonstration	Nature Observation
17	Study of habitat selection in spiders	4	Demonstration	Nature Observation
18	Chasing behaviour in fish	4	Demonstration	Nature Observation

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

Evaluation Pattern

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

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
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Mapping of COs with PSOs

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

Mapping of COs with POs

CO/ PSO	PO1	PO2	PO3	PO4
CO1	2	2	3	2
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CO5	2	3	2	2

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

COURSE DESIGNER:

2. **Dr. S. Barathy**

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