C. Abdul Hakeem College (Autonomous), Melvisharam.

Syllabus for M.Sc., Zoology effective from the year 2024-2025

Sem	*Category*	*Course Code*	*Course Title*	*Hours*	*Credits*	*Int. Marks*	*Ext. Marks*	*Max. Marks*
I	*CC Theory*	***P24MZL101***	***STRUCTURE AND FUNCTION OF INVERTEBRATES***	***75***	***5***	***25***	***75***	***100***

Objectives: To understand the concept of classification and their characteristic features of major groups of invertebrates.

Course Outcomes (COs) and Cognitive Level Mapping:

COs	CO Statement (After completing the course, the students will be able to)	Cognitive Level
CO1	Examine the general anatomy and morphology of invertebrates	**K1** **K2** **K3**
CO2	Summarize the evolutionary forces in the development of various invertebrate structures	
CO3	Interpret the functions of various organs of invertebrates and their adaptations	
CO4	Distinguish the anatomy and physiology of invertebrate structures	**K4**
CO5	Evaluate the phylogenetic relationship of invertebrates	**K5**

Cognitive Levels (K1-Remember**; K2-**Understand**; K3-**Apply**; K4-**Analyze**; K5-**Evaluate**; K6-**Create**)**

Unit – I **(15 Hours)**

Structure and functions in invertebrates: Principles of animal taxonomy; Species concept; International code of zoological nomenclature; Taxonomic procedures; New trends in taxonomy

Unit – II **(15 Hours)**

Organization of coelom: Acoelomates; Pseudocoelomates; Coelomates: Protostomia and Deuterostomia; Locomotion: Flagella and ciliary movement in Protozoa; Hydrostatic movement in Coelenterata, Annelida and Echinodermata

Unit – III **(15 Hours)**

Nutrition and Digestion: Patterns of feeding and digestion in lower metazoan; Filter feeding in polychaeta, Mollusca and Echinodermata. Respiration: Organs of respiration: Gills, lungs and trachea; Respiratory pigments; Mechanism of respiration

Unit – IV **(15 Hours)**

Excretion: Organs of excretion: coelom, coelomoducts, Nephridia and Malphigian tubules; Mechanisms of excretion; Excretion and Osmoregulation. Nervous system: Primitive nervous system: Coelenterata and Echinodermata; Advanced nervous system: Annelida, Arthropoda (Crustacea and lnsecta) and Mollusca (Cephalopoda); Trends in neural evolution

Unit – V **(15 Hours)**

Invertebrate larvae: Larval forms of free-living invertebrates - Larval forms of parasites; Strategies and Evolutionary significance of larval forms. Minor Phyla: Concept and significance *(self-study)*; Organization and general characters.

 # _____# Self-Study Component for Seminar/Assignment:
(Questions should not be asked from self-study component in the End Semester Examinations)

Text Books:

1. Barnes, R.S.K., Calow, P.J.W. Olive, D.W. Golding, J.J. Spicer. 2013. The Invertebrates: A Synthesis. Third Edition. John Wiles & Sons Inc., Hoboken. New Jersey, Delhi. Barrington, E. J.W. 1979. Invertebrate Structure and Function. The English Language Book Society and Nelson, pp-765.
2. Jordan, E.L., Verma, P.S., Invertebrate Zoology.

Reference Books:

1. Barnes, R.D. 1974. Invertebrate Zoology, (Second Edition), Holt-Saunders International Edition, pp-1024.
2. Dechenik, J.A. 2015. Biology of Invertebrates (Seventh Edition). Published by McGraw Hill Education (India) Private Limited, pp-624.

e-Resources

http://www.lscollege.ac.in/sites/default/files/e-content/Vertebrata-.pdf
http://www.econtent.in/pacc.in/courses.php?subject=M.Sc%20ZOOLOGY

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

COs	Programme Outcomes					Programme Specific Outcomes					Mean
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	3	3	3	3	3	3	3.0
CO2	3	3	3	3	3	3	3	3	3	3	3.0
CO3	3	3	3	3	3	3	3	3	3	3	3.0
CO4	2	3	2	2	2	1	3	2	1	2	2.0
CO5	1	3	1	3	3	1	1	1	3	3	2.0
Mean Overall Score											2.6

3 – Strong; 2 – Medium; 1 – Low

Prepared by	Verified by
Dr. A. Abduz Zahir	Dr. R. Rafi Mohamed

Sem	*Category*	*Course Code*	*Course Title*	*Hours*	*Credits*	*Int. Marks*	*Ext. Marks*	*Max. Marks*
I	*CC Theory*	***P24MZL102***	***COMPARATIVE ANATOMY OF VERTEBRATES***	***75***	***5***	***25***	***75***	***100***

Objectives: Exemplifying the vertebrate origin and the intermediary position of Prochordates between invertebrates and vertebrates.

Course Outcomes (COs) and Cognitive Level Mapping:

COs	CO Statement (After completing the course, the students will be able to)	Cognitive Level
CO1	Describe the general anatomy and morphology of lower chordates	**K1**
CO2	Compare the structure of vertebrate integument and its derivatives	**K2**
CO3	Illustrate the anatomy and evolution of vertebrate respiratory system	**K3**
CO4	Distinguish the vertebra of various chordates	**K4**
CO5	Appraise the comparative anatomy of nervous system of vertebrates	**K5**

Cognitive Levels (K1-Remember**; K2-**Understand**; K3-**Apply**; K4-**Analyze**; K5-**Evaluate**; K6-**Create**)**

Unit – I **(15 Hours)**

Origin of vertebrates: Concept of Protochordata. Nature of vertebrate morphology; Definition, scope and relation to other disciplines. Importance of the study of vertebrate morphology.

Unit – II **(15 Hours)**

Origin and classification of vertebrates; Vertebrate integument and its derivatives.
Development, general structure and functions of skin and its derivatives; Glands, Scales, Horns, Claws, Nails, Hoofs, Feathers and Hairs.

Unit – III **(15 Hours)**

General plan of circulation in Various groups; Blood - Evolution of Aortic, Arches and Portal systems. Respiratory system - Characters of respiratory tissue. Internal and external respiration. Comparative account of Respiratory organs.

Unit – IV **(15 Hours)**

Skeletal system: Form, Function, Body size and skeletal elements of the body.
Comparative account of Jaw suspensorium, Vertebral column - Limbs and girdles; Evolution of Urino-genital system in Vertebrate series, appearance of placoderm.

Unit – V **(15 Hours)**

Sense Organs: Simple receptors - Organs of Olfaction and hearing, Taste; Lateral line system - Electro reception. Nervous system - Comparative anatomy of the Brain in relation to its functions - Comparative Anatomy of Spinal cord – Nerves and Cranial system. Peripheral and Autonomous nervous systems *(self-study).*

 # _____# Self Study Component for Seminar/Assignment:
(Questions should not be asked from self study component in the End Semester Examinations)

Text Books:

1. Ekambaranatha Ayyar and T. N. Ananthakrishnan. 2009. Manual of Zoology, Vol – II, S. Viswanathan Pvt. Ltd. Chennai.
2. Kotpal, 2019. R.L. Modern Text Book of Zoology Vertebrates, 4th Edition, Rastogi Publications, Meerut, pp-968.
3. Yong, J. Z. 1981. The life of Vertebrates, English language Book society, London, pp-645.
4. Romer, A.S. 1971. The Vertebrate body, W.B.S. Saunders, Philadelphia, pp-600.
5. Barrington, E.J.W. The biology of Hemichordata and Prochordata. Oliver and Boyd, Edinburgh
6. Alexander, R.M. The Chordata. Cambridge University Press, Landon.
7. Carfer, G.S. Structure and Function of Nervous tissue. Academic Press, New York.

Reference Books:

1. Waterman, A.J. 1972. Chordate Structure and Function, MacMillan Co., New York, pp.587.
2. Parker T. J. and W. A. Haswell. 1962. A text book of Zoology, Vol. 2, Vertebrates, 7th Edition, Mac Millan Press, London, pp-750.

e-Resources

va
http://www.econtent.in/pacc.in/courses.php?subject=M.Sc%20ZOOLOGY

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

COs	Programme Outcomes					Programme Specific Outcomes					Mean
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	3	3	3	3	3	3	3.0
CO2	3	3	3	3	3	3	3	3	3	3	3.0
CO3	3	3	3	3	3	3	3	3	3	3	3.0
CO4	2	3	2	2	2	1	3	2	1	2	2.0
CO5	1	3	1	3	3	1	1	1	3	3	2.0
Mean Overall Score											2.6

3 – Strong; 2 – Medium; 1 – Low

Prepared by	Verified by
Dr. R. Rafi Mohamed	Dr. R. Rafi Mohamed

Sem	*Category*	*Course Code*	*Course Title*	*Hours*	*Credits*	*Int. Marks*	*Ext. Marks*	*Max. Marks*
I	*CC Practical*	***P24MZLP11***	***LAB COURSE IN INVERTEBRATES AND VERTEBRATES***	***75***	***5***	***25***	***75***	***100***

Objectives: Understanding the different systems in invertebrates and vertebrates and develop the practical skills.

Course Outcomes (COs) and Cognitive Level Mapping:

COs	CO Statement (After completing the course, the students will be able to)	Cognitive Level
CO1	Recognize the structure and functions of various systems in animals	**K1**
CO2	Differentiate the adaptive features of different groups of animals	**K2**
CO3	Demonstrate the mounting techniques	**K3**
CO4	Point out the morphology of various systems of animals	**K4**
CO5	Summarize the adaptive mechanism of various animals	**K5**

Cognitive Levels (K1-Remember**; K2-**Understand**; K3-**Apply**; K4-**Analyze**; K5-**Evaluate**; K6-**Create**)**

INVERTEBRATES

Major Dissection (Hands-on to be done individually)

Earthworm : Nervous system

Pila : Digestive and nervous systems

Sepia : Nervous system

Cockroach : Nervous system

Grasshopper : Digestive system and Nervous system

Prawn : Appendages, nervous and digestive systems

Crab : Nervous system

Minor Dissection / Mounting

Earthworm : Body and Pineal setae

Pila : Radula (Demo)

Cockroach : Mouth parts

Housefly : Mouth parts

Honey bee : Mouth parts & Sting Apparatus

Mosquito : Mouth parts

Grasshopper : Mouth parts

Slides/charts/diagrams with special reference to their salient features and their modes of life

1. *Entamoeba histolytica*
2. *Paramecium*
3. Sycon sponge
4. *Hydra* with bud
5. Sporocyst – Liver fluke
6. *Cercaria* larva
7. Tape worm (Scolex)
8. *Ascaris* T. S.
9. Mysis larva of Prawn

Spotters

1. Scorpion (Giant forest)
2. *Penaeus indicus*
3. *Emerita* (*Hippa*)
4. *Perna viridis*

VERTEBRATES

Major Dissection

1. Digestive system of locally available Teleost Fishes (Marine or freshwater)
2. Nervous system of locally available Teleost Fishes (Marine or freshwater)

– 5^{th} or Trigeminal nerve
– 7^{th} or Facial nerve
– 9^{th} and 10^{th} or Glossopharyngeal & Vagus nerve

Minor Dissection/Mounting

1. Mounting of cycloid, ctenoid and placoid scales

Study of the following specimens with special reference to their salient features and their modes of life

1. *Amphioxus* sp. (Lancelet)
2. *Ascidia* sp. (Sea squirt)
3. *Scoliodon laticaudatus* (Indian dog shark)
4. *Trygon* sp. (Sting ray)
5. *Torpedo* sp. (Electric ray)
6. *Arius maculatus* (Cat fish)
7. *Belone cancila* (Flute fish)
8. *Exocoetus poecilopterus* (Flying fish)
9. *Mugil cephalus* (Mullet)
10. *Tilapia mossambicus* (Tilapia)
11. *Rachycentron canadum* (Cobia)
12. *Tetrodon punctatus* (Puffer fish)

Study of the frog skeleton system (Representative samples)

1. Entire skeleton
2. Skull
3. Hyoid apparatus
4. Pectoral girdle and sternum
5. Pelvic girdle
6. Fore limb
7. Hind limb

Text Books:

1. Lal, S.S. 2009. Practical Zoology, Rastogi Publications, pp-484.
2. Iuliis G. D. and D. Pulerà, 2007. The Dissection of Vertebrates: A Laboratory Manual. Academic Press, Imprint of Elsevier Publication, pp-416.
3. Verma, P.S. 2000. Manual of Practical Zoology: Chordates, S. Chand Publishing Company, pp-528

Reference Books:

1. Preeti, G., Mridula, C., 2000. Modern Experimental Zoology, Indus International Publication.
2. Sinha, J., A.K. Chatterjeee, Chattopadhya, P. 2011. Advanced Practical Zoology, Arunabha Sen Publishers, pp-1070.

e-Resources

https://www.mlsu.ac.in/econtents/758_PRACTICAL%20ZOOLOGY%20%20VERTEBRATE%20(%20PDFDrive%20).pdf
https://sites.google.com/db.du.ac.in/department-of-zoology/research/e-content
http://14.139.133.28/cgi-bin/koha/opac-detail.pl?biblionumber=41667&shelfbrowse_itemnumber=55808
http://www.lscollege.ac.in/sites/default/files/e-content/Dr.Faiyaz%20%20Ahmad%28UG-2%20Practical%20Museum%20specimens%29.pdf

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

COs	Programme Outcomes					Programme Specific Outcomes					Mean
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	3	3	3	3	3	3	3.0
CO2	3	3	3	3	3	3	3	3	3	3	3.0
CO3	3	3	3	3	3	3	3	3	3	3	3.0
CO4	2	3	2	2	2	1	3	2	1	2	2.0
CO5	1	3	1	3	3	1	1	1	3	3	2.0
Mean Overall Score											2.6

3 – Strong; 2 – Medium; 1 – Low

Prepared by	Verified by
Dr. S. Abdul Majeed & Dr. A. Abduz Zahir	Dr. R. Rafi Mohamed

Sem	*Category*	*Course Code*	*Course Title*	*Hours*	*Credits*	*Int. Marks*	*Ext. Marks*	*Max. Marks*
I	*DSSEC Theory*	***P24EZL101***	***MOLECULES AND THEIR INTERACTION RELEVANT TO BIOLOGY (ELECTIVE - I)***	***75***	***3***	***25***	***75***	***100***

Objectives: To understand the biochemical and biophysical mechanisms in human metabolism

Course Outcomes (COs) and Cognitive Level Mapping:

COs	CO Statement (After completing the course, the students will be able to)	Cognitive Level
CO1	State the basic biophysical and biochemical properties of biomolecules	**K1**
CO2	Describe the molecular structural elucidation of carbohydrates, proteins, Lipids and nucleic acids.	**K2** **K3**
CO3	Illustrate the various metabolic principles of a cell.	
CO4	Compare the various bioenergetics process of cell metabolism	**K4**
CO5	Organize the significance of enzymes in cell metabolism	**K5**

Cognitive Levels (K1-Remember**; K2-**Understand**; K3-**Apply**; K4-**Analyze**; K5-**Evaluate**; K6-**Create**)**

Unit – I **(15 Hours)**

Basics of biophysical chemistry and biochemistry: Structure of atoms, molecules, Stabilizing interactions (Vander Waals, electrostatic, hydrogen, covalent, hydrophobic interaction and disulfide). Principles of biophysical chemistry (pH, buffer, reaction kinetics, thermodynamics, biological oxidation and reduction reactions).

Unit – II **(15 Hours)**

Carbohydrates: Structure, classification and function, Metabolism of carbohydrates: Glycolysis, Pentose-phosphate pathway, TCA cycle, Gluconeogenesis, Glycogen metabolism, Regulation of carbohydrate metabolism. Bioenergetics: Electron transport chain, Oxidative phosphorylation, coupled reaction, phosphoryl group transfer, biological energy transducers.

Unit – III **(15 Hours)**

Amino acids: Types of amino acids and their properties, Peptide bond, Biologically active peptides, Analysis of amino acids. Metabolism of amino acids: Transamination and oxidative deamination and Urea cycle. Proteins: structure (primary, secondary, three-dimensional and quaternary), properties and function of proteins. Ramachandran plot.

Unit – IV **(15 Hours)**

Lipids: Structure and classification; Biosynthesis of fatty acids; Metabolism of lipids: beta-oxidation of fatty acids; Storage lipids; Structural lipids in membranes: Lipids as signals, cofactors, pigments. coenzymes and vitamins. Nucleic acids: Structure, Synthesis and degradation of nucleic acids, Importance of free nucleotides.

Unit – V **(15 Hours)**

Enzymes: Classification and properties; enzyme kinetics and mechanism of action; Enzyme inhibition and repression; Coenzymes; Regulation of enzymes (allosteric, phosphorylation and proteolytic cleavage).

 # _____# Self Study Component for Seminar/Assignment:
(Questions should not be asked from self-study component in the End Semester Examinations)

Text Books:

1. Berg, J. M., J. L. Tymoczko and L. Stryer 2002. Biochemistry. 5th Ed., W.H. Freeman & Co., New York, pp-1050.
2. Kuchel P.W. and G. B. Ralston. 2008. Biochemistry. McGraw Hill (India) Private Limited, UP, pp-580.
3. McKee T. and J. R. McKee. 2012. Biochemistry: The Molecular Basis of Life. (7th Edition). Oxford University Press, US, pp-793.
4. Nelson D.L. and M.M. Cox. 2012. Lehninger's Principles of Biochemistry. (6th Edition). W. H. Freeman Publishers, New York, pp-1158.
5. David Sheehan, Physical Biochemistry: Principles and Applications, 2nd Edition, John Wiley, 2009.
6. Vasantha Pattabhi, N. Gautham Biophysics 2nd Edition, 2010Alpha Science Intl Ltd.

Reference Books:

1. Berg, J. M., J. L. Tymoczko and L. Stryer 2002. Biochemistry. 5th Ed., W.H. Freeman & Co., New York, pp-1050.
2. Kuchel P.W. and G. B. Ralston. 2008. Biochemistry. McGraw Hill (India) Private Limited, UP, pp-580.
3. McKee T. and J. R. McKee. 2012. Biochemistry: The Molecular Basis of Life. (7th Edition). Oxford University Press, US, pp-793.
4. Nelson D.L. and M.M. Cox. 2012. Lehninger's Principles of Biochemistry. (6th Edition). W. H. Freeman Publishers, New York, pp-1158.

e-Resources:

1. https://www.cbspd.com/assets/uploads/toc/9789394525573T.pdf
2. https://multiplex.videohall.com/presentations/932.html

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

COs	Programme Outcomes					Programme Specific Outcomes					Mean
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	3	3	3	3	3	3	3.0
CO2	3	3	3	3	3	3	3	3	3	3	3.0
CO3	3	3	3	3	3	3	3	3	3	3	3.0
CO4	2	3	2	2	2	1	3	2	1	2	2.0
CO5	1	3	1	3	3	1	1	1	3	3	2.0
Mean Overall Score											2.6

3 – Strong; 2 – Medium; 1 – Low

Prepared by	Verified by
Dr. G. Taju	Dr. R. Rafi Mohamed

Sem	*Category*	*Course Code*	*Course Title*	*Hours*	*Credits*	*Int. Marks*	*Ext. Marks*	*Max. Marks*
I	*DSSEC Theory*	***P24EZL102***	***BIOSTATISTICS (ELECTIVE - II)***	***75***	***3***	***25***	***75***	***100***

Objectives: To understand the basic concepts of biostatistics in order to analyze and solve biological problems in a more systematic way through computational management

Course Outcomes (COs) and Cognitive Level Mapping:

COs	CO Statement (After completing the course, the students will be able to)	Cognitive Level
CO1	Define the basic concepts of biostatistics, various data collection & Processing methods	**K1** **K2** **K3**
CO2	Describe the measures of statistical tools	
CO3	Design experiments and apply biostatistics to biological studies	
CO4	Analyze various statistical tools using modern statistical techniques and software's	**K4** **K5**
CO5	Decide various practical problems in biological and health management studies using statistical tools	

Cognitive Levels (K1-Remember**; K2-**Understand**; K3-**Apply**; K4-**Analyze**; K5-**Evaluate**; K6-**Create**)**

Unit – I **(15 Hours)**

- Definition, scope and application of statistics
- Primary and secondary data: Source and implications
- Classification and tabulation of biological data: Types and applications.
- Variables: Definition and types.
- Frequency distribution: Construction of frequency, distribution table for grouped data; Graphic methods: Frequency polygon and ogive curve
- Diagrammatic representation: Histogram, bar diagram, pictogram and pie chart.

(Computer Lab based approach is must)

Unit – II **(15 Hours)**

- Measures of central tendency: Mean, median and mode for continuous and discontinuous variables.
- Measures of dispersion: Range, variation, standard deviation, standard error and coefficient of variation.

(Problems based on biological examples required) (Computer Lab based approach is must)

Unit – III **(15 Hours)**

- Probability: Theories and rules;
- Probability - Addition and multiplication theorem
- Probability distribution: Properties and application of Normal, Binomial and Poisson distributions.

(Computer Lab based approaches is must)

Unit – IV **(15 Hours)**

- Correlation: Types - Karl Pearsons Co-efficient, Rank correlation, Significance test for correlation coefficients.
- Regression analysis: Computation of biological data, calculation of regression co-efficient, graphical representation and prediction.

(Problems based on biological examples required) (Computer Lab based approach is must)

Unit – V **(15 Hours)**

- Hypothesis testing: Student '*t*' test - paired sample and mean difference '*t*' tests.
- Chi-square test of significance.
- Analysis of variance: one way and two-way classification.
- Use of computer in biostatistics-data calculation using MS Excel
- Data analysis with comprehensive statistical software's.

(Computer Lab based approach is must)

Experiential Learning

1. Visit to a pond or lake ecosystem/market and measuring the morphometry of fishes/crabs
2. Visit to primary health center and collection of analysis of available data

Self-Study Component for Seminar/Assignment:

(Questions should not be asked from self-study component in the End Semester Examinations)

Text Books:

1. Zar, J.H. 2019. Biostatistical Analysis, Pearson Education (Singapore) Pvt. Ltd., Delhi, India, pp-660.
2. Arora, P. N. and P. K. Malhan. 1996. Biostatistics, Himalaya Publishing House, Mumbai, pp-447.
3. Gurumani, N. 2005. Introduction to Biostatistics, M.J.P. Publishers, Delhi, pp-407.
4. Das, D. and A. Das. 2004. Academic Statistics in Biology and Psychology, Academic Publisher, Kolkata, pp-363.
5. Palanichamy, S. and Manoharan, M. 1990. Statistical Methods for Biologists, Palani Paramount Publications, Tamil Nadu, pp-264.

Reference Books:

1. Bailey, N. T. J. 1959. Statistical in Biology, English Universities Press, London, pp-48.
2. Sokal, R. R. and F. J. Rohlf, 1973. Introduction to Biostatistics, W.H. Freeman, London, pp-467.
3. Sokal, R.R. and F.J. Rohlf. 1981. Biometry: The principles and practice of statistics in biological research, San Francisco: W.H. Freeman, London, pp-859.
4. Bailey, N. T. J. 1994. Statistical Methods in Biology (Third Edition), Cambridge University Press, Cambridge, pp-255.
5. Wayne W. Daniel. Biostatistics: A Foundation for Analysis in the Health Sciences, John Wiley & Sons Inc, USA, pp-443.
6. Snedecor, G. W. and W. G. Cochran. 1967. Statistical Methods (Sixth Edition), Oxford & IBH Publishing Co., New Delhi, pp-593.
7. Pagano, M. and K. Gauvreau. 2008. Principles of Biostatistics (Second Edition), Cengage Learning, New Delhi, pp-525.

e-Resources

1. **https://usiu-ke.libguides.com/c.php?g=942913&p=6796759**
2. **https://biostat.ufl.edu/current-students/e-learning-resources/**

3. https://epgp.inflibnet.ac.in/

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

COs	Programme Outcomes					Programme Specific Outcomes					Mean
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	3	3	3	3	3	3	3.0
CO2	3	3	3	3	3	3	3	3	3	3	3.0
CO3	3	3	3	3	3	3	3	3	3	3	3.0
CO4	2	3	2	2	2	1	3	2	1	2	2.0
CO5	1	3	1	3	3	1	1	1	3	3	2.0
Mean Overall Score											2.6

3 – Strong; 2 – Medium; 1 – Low

Prepared by	Verified by
Dr. K.G.M.T. Ansari	Dr. R. Rafi Mohamed, Chairman & HOD

Sem	*Category*	*Course Code*	*Course Title*	*Hours*	*Credits*	*Int. Marks*	*Ext. Marks*	*Max. Marks*
I	*AEC Theory*	***P24CHR101***	***HUMAN RIGHTS***	***30***	***2***	***25***	***75***	***100***

Objectives: To know about the values of human and his rights

Course Outcomes (COs) and Cognitive Level Mapping:

COs	CO Statement (After completing the course, the students will be able to)	Cognitive Level
CO1	Define the basic principles of human rights	**K1**
CO2	Explain the various human right declarations	**K2**
CO3	Apply and appraise the fundamental rights	**K3**
CO4	Explain Social and Political rights of Women	**K4**
CO5	Clarify the refugees and capital punishments in the developing world	**K5**

Cognitive Levels (K1-Remember**; K2-**Understand**; K3-**Apply**; K4-**Analyze**; K5-**Evaluate**; K6-**Create**)**

Unit – I **(6 Hours)**

Definition of Human Rights - Nature, Content, Legitimacy and Priority - Theories on Human Rights - Historical Development of Human Rights.

Unit – II **(6 Hours)**

International Human Rights - Prescription and Enforcement up to World War II - Human Rights and the U. N.O. - Universal Declaration of Human Rights - International Covenant on Civil and Political Rights - International Convention on Economic, Social and Cultural Rights and Optional Protocol.

Unit – III **(6 Hours)**

Human Rights Declarations - U.N. Human Rights Declarations - U.N. Human Commissioner.

Unit – IV **(6 Hours)**

Amnesty International - Human Rights and Helsinki Process - Regional Developments - European Human Rights System - African Human Rights System - International Human Rights in Domestic courts.

Unit – V **(6 Hours)**

Contemporary Issues on Human Rights: Children's Rights - Women's Rights - Dalit's Rights - Bonded Labour and Wages - Refugees - Capital Punishment.

Fundamental Rights in the Indian Constitution - Directive Principles of State Policy - Fundamental Duties - National Human Rights Commission.

 # _____# Self Study Component for Seminar/Assignment:
(Questions should not be asked from self-study component in the End Semester Examinations)

Text Books:

1. International Bill of Human Rights, Amnesty International Publication, 1988.
2. Human Rights, Questions and Answers, UNESCO, 1982
3. Mausice Cranston - What is Human Rights
4. Desai, A.R. - Violation of Democratic Rights in India
5. Pandey - Constitutional Law.
6. Timm. R.W. - Working for Justice and Human Rights
7. Human Rights, A Selected Bibliography, USIS.

Reference Books:

1. J.C.Johari - Human Rights and New World Order.
2. G.S. Bajwa - Human Rights in India.
3. Amnesty International, Human Rights in India.
4. P.C.Sinha& - International Encyclopedia of Peace, Security
5. K. Cheous (Ed) Social Justice and Human Rights (Vols 1-7).
6. Devasia, V.V. - Human Rights and Victimology.

e-Resources

https://vidyamitra.inflibnet.ac.in/index.php/home/subjects?domain=Social+Sciences&subdomain=Human+Rights+and+Duties

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

COs	Programme Outcomes					Programme Specific Outcomes					Mean
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	3	3	3	3	3	3	3.0
CO2	3	3	3	3	3	3	3	3	3	3	3.0
CO3	3	3	3	3	3	3	3	3	3	3	3.0
CO4	2	3	2	2	2	1	3	2	1	2	2.0
CO5	1	3	1	3	3	1	1	1	3	3	2.0
Mean Overall Score											2.6

3 – Strong; 2 – Medium; 1 – Low

Prepared by	Verified by
Dr. B. Kaja Magdoom	Dr. R. Rafi Mohamed, Chairman & HOD

Sem	*Category*	*Course Code*	*Course Title*	*Hours*	*Credits*	*Int. Marks*	*Ext. Marks*	*Max. Marks*
II	*CC Theory*	***P24MZL201***	***CELLULAR AND MOLECULAR BIOLOGY***	***75***	***5***	***25***	***75***	***100***

Objectives: To understand the ultra-structure and functions of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes and organelles.

Course Outcomes (COs) and Cognitive Level Mapping:

COs	**CO Statement** (After completing the course, the students will be able to)	**Cognitive Level**
CO1	Define the general concepts of cell and molecular biology.	**K1**
CO2	Explain the molecular and cellular structures influencing functional features.	**K2**
CO3	Interpret the importance of Cell cycle and Nucleic acid structure.	**K3**
CO4	Contrast the functions of hormones and cell signaling.	**K4**
CO5	Evaluate the application of cell and molecular biology in medicine	**K5**

Cognitive Levels (K1-Remember**; K2-**Understand**; K3-**Apply**; K4-**Analyze**; K5-**Evaluate**; K6-**Create**)**

Syllabus:

Unit – I **(15 Hours)**

General features of the cell: Basic structure of prokaryotic and eukaryotic cells - Protoplasm and deutroplasm - cell organelles; cell theory; Diversity of cell size and shapes.

Unit – II **(15 Hours)**

Cellular organization: Membrane structure and functions - Structure of model membrane, lipid bilayer and membrane proteins diffusion, osmosis, ion channels, active transport, mechanism and regulation of intracellular transport. Structure and functions of Intracellular organelles: Nucleus, mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum and chloroplasts.

Unit – III **(15 Hours)**

Cell division and Cell cycle: Mitosis and meiosis, their regulation, steps in cell cycle and control of cell cycle. Molecular biology of cell: Structure of DNA and RNA; Process of DNA replication, transcription and translation in pro- and eukaryotic cells; Genetic maps.

Unit – IV **(15 Hours)**

Cell communication and cell signaling: Membrane- associated receptors for peptide and steroid hormones - signaling through G-protein coupled receptors, signal transduction pathways. General principles of cell communication: extracellular space and matrix, interaction of cells with other cells and non-cellular structures.

Unit – V **(15 Hours)**

Cancer cells: Characteristic features of normal and cancer cells; Carcinogens: types and cancer induction; Metastasis; Oncogenes and tumor suppressor genes, apoptosis; therapeutic interventions of uncontrolled cell growth.

 # _____# Self Study Component for Seminar/Assignment:
(Questions should not be asked from self-study component in the End Semester Examinations)

Text Books:

1. Plopper, G., D. Sharp, and E. Sikorski. 2015. Lewin's Cells (Third Edition), Jones & Bartlett, New Delhi, pp-1056
2. Plopper, G. 2013. Principles of Cell Biology, Jones & Bartlett, Maryland, pp-510

Reference Books:

1. Karp, G. 2010. Cell Biology (Sixth Edition), John Wiley & Sons, Singapore, pp-765.
2. Lodish, H., C. A. Kaiser, A. Bretscher, *et al*., 2013. Molecular Cell Biology (Seventh Edition), Macmillan, England, pp-1154
3. De Robertis, E.D.P. and E. M. F. De Robertis Jr, 1987. Cell and Molecular Biology. Info-Med, Hong Kong, pp-734
4. Abbas, A. K., A. H. Lichtman and S. Pillai, 2007, Cell and Molecular Immunology (Sixth Edition), Saunders, Philadelphia, pp-566
5. Loewy, A.G., P. Siekevitz and J. R. Menninger, *et al*., 1991, Cell Structure and Function (Third Edition), Saunders, Philadelphia, pp-947
6. Watson, J. D., N.H. Hopkins, J.W. Roberts, *et al*., 1987, Molecular Biology of the Gene (Fourth Edition), Benjamin/Cummings, California, pp-1163
7. Han, S. S. and J. Holmstedt. 1979, Cell Biology, McGraw Hill, pp-319
8. Alberts, B., A. Johnson, J. Lewis, *et al*., 2015, Molecular Biology of the Cell (Sixth Edition), Garland Science, New York, pp-1342
9. Clark, D.P., 2005. Molecular Biology, Elsevier, China, pp-784
10. Tropp, B. 2008. Molecular Biology Genes to Proteins (Third Edition), Jones & Bartlett, US, pp-1000

e-Resources

https://open.umn.edu/opentextbooks/textbooks/244
http://www.cellbiol.com/#google_vignette
https://www.nature.com/subjects/molecular-biology
https://www.cellbio.com/
https://bio.libretexts.org/Bookshelves/Cell_and_Molecular_Biology

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

COs	Programme Outcomes					Programme Specific Outcomes					Mean
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	3	3	3	3	3	3	3.0
CO2	3	3	3	3	3	3	3	3	3	3	3.0
CO3	3	3	3	3	3	3	3	3	3	3	3.0
CO4	2	3	2	2	2	1	3	2	1	2	2.0
CO5	1	3	1	3	3	1	1	1	3	3	2.0
Mean Overall Score											2.6

3 – Strong; 2 – Medium; 1 – Low

Prepared by	Verified by
Dr. R. Ajaz Haja Mohideen	Dr. R. Rafi Mohamed, Chairman & HOD

Sem	*Category*	*Course Code*	*Course Title*	*Hours*	*Credits*	*Int. Marks*	*Ext. Marks*	*Max. Marks*
II	*CC Theory*	***P24MZL202***	***DEVELOPMENTAL BIOLOGY***	***75***	***4***	***25***	***75***	***100***

Objectives: Understand the process of gametogenesis, cleavage and gastrulation, embryonic development, extra embryonic membrane in various animals and humans.

Course Outcomes (COs) and Cognitive Level Mapping:

COs	CO Statement (After completing the course, the students will be able to)	Cognitive Level
CO1	Define the various preliminary events of animal development	**K1**
CO2	Describe the cellular changes that occur in the embryo during development	**K2** **K3**
CO3	Illustrate the process involved in the emergence of various organs of an embryo	
CO4	Contrast the cell communication between the developing embryo	**K4**
CO5	Evaluate the application of developmental principles in health sciences	**K5**

Cognitive Levels (K1-Remember**; K2-**Understand**; K3-**Apply**; K4-**Analyze**; K5-**Evaluate**; K6-**Create**)**

Unit – I **(15 Hours)**

- The beginning of Organisms-the structure, formation and role of Sperm and egg
- Fertilization and its mechanism -external fertilization (Sea urchin) and internal fertilization (Mammals)
- Fate map and early development in Sea urchin, Amphibians, and Mammals
- Parthenogenesis (*self-study*)

Unit – II **(15 Hours)**

- The stem cell concept and its origin
- Emergence of Central nervous system and epidermis-fate of neural crest cells-formation of eye
- Emergence of mesoderm -heart and blood vessels
- Emergence of endoderm-extra embryonic membranes
- Mammalian pattern of sex determination
- Environmental sex determination (*self-study*)

Unit – III **(15 Hours)**

- Cellular and Nuclear Differentiation-Nuclear transplantation experiments
- Metamorphosis-Amphibian Metamorphosis-Insect metamorphosis
- Regeneration-Morphallactic regeneration in Hydra-compensatory regeneration in Mammalian liver
- Germ cell determination and gamete maturation
- Role of Y factor in male sex determination (*self-study*)

Unit – IV **(15 Hours)**

- Cell adhesion during development-role of cadherins and integrins
- Cell-cell signaling during development-mechanism and proteins involved
- Paracrine factors- induction and competence
- Signal transduction cascades during induction (*self-study*)
- Role of extracellular matrix (ECM)

Unit – V **(15 Hours)**

- Genetic errors of human development
- Cell death and Ageing-genes involved and causes
- Embryological therapies during animal development
- Cancer as disease during embryonic development (*self-study*)
- Stem cell therapy and its applications
- Developmental plasticity and symbiosis

Experiential Learning:

- Visit to clinical embryology labs
- Visit to IVF units in hospitals

Self-Study Component for Seminar/Assignment:
(Questions should not be asked from self-study component in the End Semester Examinations)

Text Books:

1. S. Chattopadhyay (2019) An Introduction to Developmental Biology. Books and Allied Private Limited, India ISBN: 9789384294830.
2. Gilbert, S.F., 2018. Developmental Biology. Sinauer Associates, USA. (available as print version and e-book in Z library)
3. Balinsky, B. I., 2012. Introduction to Embryology (Students low price Edition), Saunders C. Philadelphia.
4. Lewis Wolpert and Jim Smith (2016) Principles of Development. Oxford University Press, USA.
5. Berrill, N.J. 1974. Developmental Biology, Tata Mc-Graw Hill Publications, New Delhi, pp-535.
6. Tyler, M.S. 2000. Developmental Biology - A Guide for Experimental Study, Sunderland, MA, pp-208.
7. Subramaniam, T.2011. Molecular Developmental Biology (2nd Edition), Narosa Publishers, India, pp-364.

Reference Books:

1. Slack J.M.W. 2012. Essential Developmental Biology (3rd Edition), Wily-Blackwell Publications, USA, pp-496.
2. Mari-Beffa, M. and J. Knight. 2005. Key Experiments in Practical Developmental Biology, Cambridge University Press, UK, pp-404.

e-Resources

1. https://en.wikibooks.org/wiki/Category:Book:Developmental_Biology
2. https://www.journals.elsevier.com/developmental-biology
3. https://plato.stanford.edu/entries/biology-developmental/
4. https://www.khanacademy.org/science/biology/developmental-biology
5. https://www.sdbonline.org/
6. https://epgp.inflibnet.ac.in/

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

COs	Programme Outcomes					Programme Specific Outcomes					Mean
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	3	3	3	3	3	3	3.0
CO2	2	2	3	2	1	2	2	3	2	1	2.1
CO3	2	3	2	2	2	1	3	2	1	2	2.0
CO4	3	3	3	3	3	3	3	3	3	3	3.0
CO5	3	3	3	3	3	3	3	3	3	3	3.0
Mean Overall Score											2.6

3 – Strong; 2 – Medium; 1 – Low

Prepared by	Verified by
Dr. M. Feroz Khan	Dr. R. Rafi Mohamed, Chairman & HOD

Sem	*Category*	*Course Code*	*Course Title*	*Hours*	*Credits*	*Int. Marks*	*Ext. Marks*	*Max. Marks*
II	*CC Practical*	***P24MZLP21***	***LAB COURSE IN CELL BIOLOGY AND DEVELOPMENTAL BIOLOGY***	***75***	***4***	***25***	***75***	***100***

Objectives: To gain knowledge on various practical aspects of cell and developmental biology

Course Outcomes (COs) and Cognitive Level Mapping:

COs	CO Statement (After completing the course, the students will be able to)	Cognitive Level
CO1	Identify cell differentiation during animal development	**K1**
CO2	Differentiate cell types, cellular structures using different microscopic techniques.	**K2**
CO3	Demonstrate animal handling - skills through the wet-lab	**K3**
CO4	Infer various animal experiment in development studies	**K4**
CO5	Score human karyotyping and chromosome mapping to identify abnormalities	**K5**

Cognitive Levels (K1-Remember**; K2-**Understand**; K3-**Apply**; K4-**Analyze**; K5-**Evaluate**; K6-**Create**)**

CELL AND MOLECULAR BIOLOGY

1. Determination of cell size using micrometer
2. Mitosis in root meristematic cells of plants
3. Identification of various stages of meiosis in the testes of grasshopper (demo)
4. Detection of polytene chromosome in salivary gland cells of the larvae of the Chironomus larva
5. Detection of sex chromatin in squamous cells
6. Isolation of genomic DNA from eukaryotic tissue (demo)
7. Isolation of total RNA from bacterial cells/tissues (demo)
8. Agarose gel electrophoresis of DNA (demo)
9. SDS-Polyacrylamide gel electrophoresis (demo)

DEVELOPMENTAL BIOLOGY

Slides/Charts/Demo

1. Structure of sperm and egg of Sea urchin and a Mammal
2. Fate map of Sea urchin, tunicate, frog, fish and mammal
3. Different stages in frog development – (2-cell stage, 4 cell stage, 8 cell stage, blastula and gastrula)
4. Development of chick stage – (Blastodisc stage, primitive streak, 24^{hrs} embryo, 48^{hrs} embryo, 72^{hrs} embryo and 96 ^{hrs} embryo)
5. Section through ovary and testes of shrimp, fish, frog and mammal
6. Study of slides showing of larval forms: Trochophore, Nauplius, Zoea, Bipinnaria,
7. Demonstration of uterine cycle in a mammal (Rat).
8. Induced spawning in Catla fish
9. *In vitro* fertilization and development in mammals (visit to IVF centers nearby)
10. Regeneration in Frog Tadpoles
11. Metamorphosis in Frog Tadpole
12. Cryopreservation of gametes (Lab demo)

Text Books:

1. C.B. Powar, Cell Biology – Himalaya Publication, New Delhi. 2. Dr. S.P. Singh, Dr. B.S.
2. Tomar – Cell Biology 9th revised edition, Rastogi Publication, Meerut
3. S. C. Goel - Principles of animal developmental biology, Himalaya Publishing House.
4. S.F. Gilbert - Developmental Biology,4th Edn.Sinauer Associates Inc. Publishers.

Reference Books:

1. Gupta P.K. – Cell and Molecular Biology, Rastogi Publication, Meerut.
2. Veer BalaRastogi – Introduction to Cell Biology, Rastogi Publication, Meerut.
3. Leon W. Browwer - Developmental Biology. 2nd Edition. Saunders College publishing.
4. R. A. Pedersen and G. P. Schatten - Current Topics in Developmental Biology eds.

e-Resources:

https://sites.google.com/db.du.ac.in/department-of-zoology/research/e-content
https://www.shivajicollege.ac.in/e-content.php

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

COs	Programme Outcomes					Programme Specific Outcomes					Mean
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	2	3	3	2	3	2	2	3	3	2.5
CO2	2	2	3	3	3	2	3	3	2	3	2.6
CO3	3	2	2	3	3	2	3	2	3	3	2.6
CO4	3	2	2	3	2	2	3	3	3	2	2.5
CO5	2	2	3	2	3	3	3	2	2	2	2.4
Mean Overall Score											2.5

3 – Strong; 2 – Medium; 1 – Low

Prepared by	Verified by
Dr. K.G.M.T. Ansari	Dr. R. Rafi Mohamed, Chairman & HOD

Sem	*Category*	*Course Code*	*Course Title*	*Hours*	*Credits*	*Int. Marks*	*Ext. Marks*	*Max. Marks*
II	*DSSEC Theory*	***P24EZL201***	***WILDLIFE MANAGEMENT (ELECTIVE - III)***	***30***	***3***	***25***	***75***	***100***

Objectives: To understand the importance of animal conservation and protection for sustainable environment

Course Outcomes (COs) and Cognitive Level Mapping:

COs	CO Statement (After completing the course, the students will be able to)	Cognitive Level
CO1	Define the basic principles of wildlife management	**K1**
CO2	Describe the ecology of wildlife	**K2**
CO3	Demonstrate the importance of wildlife protection principles.	**K3**
CO4	Compare various Wildlife protection Acts and its implementation	**K4**
CO5	Evaluate the current wildlife protection in India.	**K5**

Cognitive Levels (K1-Remember**; K2-**Understand**; K3-**Apply**; K4-**Analyze**; K5-**Evaluate**; K6-**Create**)**

Unit – I **(6 Hours)**

- Introduction, scope and present status of Wildlife in India.
- Governmental and NGO involvement in protection and conservation of wildlife (*Self-study*).
- Indian Forest Act (1927) – Forest Conservation Act (1985).
- Statutory bodies (IUCN, ZSI, IBWL, BNHS, ZSI, WWF, IBA etc).
- Wildlife protection Act (1972), Rules, regulations and punishment (*Self-study*).
- Red, Green & Blue Data Book.

Unit – II **(6 Hours)**

- Wildlife ecology-Aquatic, terrestrial, forest and mountain ecosystems.
- Animal populations – natality, mortality, fecundity and growth (*Self-study*).
- Intraspecific and interspecific relationships (*Self-study*).
- Dispersal and factors influencing dispersal (*Self-study*).
- Population analysis and interpretations. Effects of man's involvement on wildlife. Scrub jungle ecology.
- Forestry and Silviculture-Major vegetation types in India – classification, characteristics, composition and distribution.

Unit – III **(6 Hours)**

- Ichthyology- Endangered species and economically important fishes (*Self-study*)
- Amphibology – endangered species and economically important amphibians.
- Herpetology – endangered species and economically important reptiles; special emphasis on Olive Ridley, Crocodiles and snakes.
- Ornithology – endangered species and economically important birds; bird migration, nesting, bird watching, birds in relation to humans (*Self-study*).
- Mammalogy – endangered species and economically important mammals.

Unit – IV **(6 Hours)**

- Wildlife management Concepts and principles; planning and execution.
- Habitat evaluation – physical and remote sensing.
- Habitat conservation and protection (*Self-study*).
- Capture and marking technique for census and treatment – bird rings and radio collars.

Unit – V **(6 Hours)**

- List & location of Zoos, Sanctuaries, Parks and Biosphere reserves of India.
- Rehabilitation programmes (eg. Project Tiger, Project Crocodile, Project Elephant, Project Turtle).
- National parks – Khaziranga, Gir, Bandhipur, Kanha, Guindy, Corbett, etc.
- Marine National Parks – Mannar, Kutch, Point Calimere, etc.
- Sanctuaries – Periyar, Mudumalai, Vedanthangal, Bhandipur, etc (*Self-study*).
- Zoos – Mysore, Trivandrum, Vandalur, Hyderabad, etc (*Self-study*).

Experiential Learning:

Visit to Zoo, Ecopark, sanctuaries, forest etc., (3 to 4 days)

Self-Study Component for Seminar/Assignment:

(Questions should not be asked from self-study component in the End Semester Examinations)

Text Books:

1. The Development of International Principles and Practices of Wildlife Research Management by Stephen H. Berwick and U. B. Sahania
2. Ecology of a changing planet by Mark B. Bush
3. Human import on ecosystem by Trivi and O'Hore

Reference Books:

1. National Parks of Madhyapradesh by S. K. Tiwari
2. Endangered Animals of India and their Conservation by S. M. Nair

e-Resources

https://wildlife.onlinelibrary.wiley.com/journal/19372817
https://www.wildlifebiology.org/
https://nature.arizona.edu/undergraduate/wildlife-conservation-management
https://www.jstor.org/journal/jwildmana
https://wii.gov.in/
https://onlinecourses.swayam2.ac.in/cec23_ge04/preview
https://cwsindia.org/

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

COs	Programme Outcomes					Programme Specific Outcomes					Mean
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	3	3	3	3	3	3	3.0
CO2	3	3	3	3	3	3	3	3	3	3	3.0
CO3	3	3	3	3	3	3	3	3	3	3	3.0
CO4	2	3	2	2	2	1	3	2	1	2	2.0
CO5	1	3	1	3	3	1	1	1	3	3	2.0
Mean Overall Score											2.6

3 – Strong; 2 – Medium; 1 – Low

Prepared by	Verified by
Dr. M. Feroz Khan	Dr. R. Rafi Mohamed, Chairman & HOD

Sem	*Category*	*Course Code*	*Course Title*	*Hours*	*Credits*	*Int. Marks*	*Ext. Marks*	*Max. Marks*
II	*DSSEC Theory*	***P24EZL202***	***GENERAL ENTOMOLOGY (ELECTIVE - IV)***	***75***	***3***	***25***	***75***	***100***

Objectives: To understand the basics of insect structure and function

Course Outcomes (COs) and Cognitive Level Mapping:

COs	CO Statement (After completing the course, the students will be able to)	Cognitive Level
CO1	Explain the external morphology and functions of various insects.	**K1**
CO2	Relate the anatomy of insects.	**K2**
CO3	Illustrate the physiology of various insect organs	**K3**
CO4	Infer the embryonic development and metamorphosis of entomo-taxa	**K4**
CO5	Compare the significance of adaptation of various insect fauna.	**K5**

Cognitive Levels (K1-Remember**; K2-**Understand**; K3-**Apply**; K4-**Analyze**; K5-**Evaluate**; K6-**Create**)**

Unit – I **(15 Hours)**

- Head- Compound eyes, antennae and mouthparts
- Thorax- tergum, sternum and pleuron. Legs: structure and modifications
- Wings- structure and modifications
- Abdomen- Segmentation, pregenital appendages, cerci and external genitilia

Unit – II **(15 Hours)**

- Digestive system: Structure and anatomy of the alimentary canal
- Respiratory system: Structure in aquatic and terrestrial insects
- Circulatory system: Circulatory organs, types and functions of hemocytes

Unit – III **(15 Hours)**

- Excretory system: Structure and physiology of excretory organs.
- Nervous system: Central, Visceral and Peripheral nervous system, types of Ganglions
- Neuron endocrine system (*self-study*)
- Sensory system: photoreception, mechanoreceptor and chemoreception, sound production in insects

Unit – IV **(15 Hours)**

- Muscular system: Types of insect muscles and their functions.
- Reproductive system: Structure of male and female reproductive system
- Embryonic and postembryonic development; Types of metamorphosis.
- Secretory glands and metamorphosis (*self-study*)

Unit – V **(15 Hours)**

Classification of insects upto order level.

- Apterygota - Collembola, Protura, Diplura and Thysanura.
- Exopterygota- Ephemeroptera, Odonata, Plecoptera, Dictyoptera, Isoptera, Dermaptera, Orthoptera, Phasmida, Embioptera, Zoraptera, Psocoptera, Mallophaga, Siphunculata, Hemiptera and Thysanoptera.
- Endopterygota- Neoptera, Coleoptera, Mecoptera, Siphonaptera, Diptera, Trichoptera, Lepidoptera and Hymenoptera.

 # _# Self Study Component for Seminar/Assignment:
(Questions should not be asked from self-study component in the End Semester Examinations)

- Visit to nearby agricultural farm and collection and observation of insects
- Visit to Insect museum- Agricultural University/College

Text Books:

1. Chapman: The Insects: structure and function (4th ed, 1998, ELBS)
2. Imms: A general text book of entomology, 2 vols (1997, Asia Publishing House)
3. McGavin: Essential Entomology (2001, Oxford Univ Press)
4. Nalina Sundari and Santhi: Entomology (2006, MJP Publishers)

Reference Books:

1. Srivastava: A text book of applied entomology, Vol I & II (1993, Kalyani Publishers)
2. Wigglesworth: Principles of Insect Physiology (1972, ELBS)
3. Gullan and Cranston: The Insects: An outline of entomology (5th ed, 2014, Wiley Blackwell)

e-Resources

https://drive.google.com/file/d/1THk9MahgWfG_V-ziLBuMVamvxPP9gXSu/view?usp=sharing
https://www.amentsoc.org/insects/fact-files/orders/
https://www.amentsoc.org/insects/what-bug-is-this/adult-key.html

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

COs	Programme Outcomes					Programme Specific Outcomes					Mean
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	1	2	3	3	2	2	2	3	2.3
CO2	3	2	3	2	3	3	2	3	2	3	2.6
CO3	3	2	1	1	3	3	3	2	2	2	2.2
CO4	3	2	2	3	3	3	2	3	3	3	2.7
CO5	3	3	2	3	3	3	3	2	3	2	2.7
Mean Overall Score											2.5

3 – Strong; 2 – Medium; 1 – Low

Prepared by	Verified by
Dr. K. Jahir Hussain	Dr. R. Rafi Mohamed, Chairman & HOD

Sem	*Category*	*Course Code*	*Course Title*	*Hours*	*Credits*	*Int. Marks*	*Ext. Marks*	*Max. Marks*
II	*SEC Theory*	***P24SZL201***	***SERICULTURE (SBS - I)***	***45***	***2***	***25***	***75***	***100***

Objectives: To understand the basic principles behind sericulture industry

Course Outcomes (COs) and Cognitive Level Mapping:

COs	CO Statement (After completing the course, the students will be able to)	Cognitive Level
CO1	Recognize the sericulture practices followed in India.	**K1**
CO2	Describe the techniques and practices of moriculture.	**K2**
CO3	Demonstrate the life cycle of silkworm	**K3**
CO4	Analyze silk harvesting	**K4**
CO5	Recommend sericulture as a self employment	**K5**

Cognitive Levels (K1-Remember**; K2-**Understand**; K3-**Apply**; K4-**Analyze**; K5-**Evaluate**; K6-**Create**)**

Unit – I **(9 Hours)**

Introduction to textile fibers; types- natural and synthetic fibers; sources of silk fiber- Tasar, Muga, Anaphe, Gonometa, Fagara, spider and mussel; properties and importance of silk fiber. History, development, status, characteristics and advantages of sericulture in India.

Unit – II **(9 Hours)**

Host plants; Moriculture- distribution, morphology, propagation- seedling, cutting, grafting, layering and micropropagation methods, maintenance- irrigation, manuring and pruning, pests and diseases of mulberry.

Unit – III **(9 Hours)**

Bombyx mori- morphology, anatomy, life cycle, geographical locations, larval moults, voltinism, indigenous and commercial races. Diapause. Egg-storage and transportation.

Unit – IV **(9 Hours)**

Rearing houses and equipment. Rearing operations- disinfection, brushing, feeding and spacing. Moulting and spinning. Harvest. Rearing methods- chawki, lasso, showa, shelf-rearing, floor-rearing and shoot rearing. Diseases of *Bombyx mori*- protozoan, bacterial, viral and fungal. Pests of silkworm- Uzi fly, desmestids, mites, ants, nematodes, aves and mammals.

Unit – V **(9 Hours)**

Physical and commercial characteristics of cocoons. Cocoon harvesting and marketing. Cocoon sorting, stifling, deflossing, riddling, cooking, brushing, reeling and re-reeling. Weaving. By-products of sericulture industry. (Field visit)

 # _____# Self Study Component for Seminar/Assignment:
(Questions should not be asked from self-study component in the End Semester Examinations)

Text Books:

1. Ganga and J. Sulochana Chetty. 2019. An introduction to sericulture, 2nd edition, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
2. M. Johnson and M. Kesary. 2019. Sericulture, Saras publication, Tamil Nadu.

Reference Books:

1. Singh, Amardev & Ravinder Kumar. 2013. Sericulture handbook Vol 1, Biotech.
2. M. Madan Mohan Rao. An Introduction to Sericulture, 2nd edition, BS Publications.

e-Resources

1. https://agritech.tnau.ac.in/sericulture
2. https://csb.gov.in

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

COs	Programme Outcomes					Programme Specific Outcomes					Mean
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	3	3	3	3	3	3	3.0
CO2	3	3	3	3	3	3	3	3	3	3	3.0
CO3	3	3	3	3	3	3	3	3	3	3	3.0
CO4	2	3	2	2	2	1	3	2	1	2	2.0
CO5	1	3	1	3	3	1	1	1	3	3	2.0
Mean Overall Score											2.6

3 – Strong; 2 – Medium; 1 – Low

Prepared by	Verified by
Dr. B. Kaja Magdoom	Dr. R. Rafi Mohamed

Sem	*Category*	*Course Code*	*Course Title*	*Hours*	*Credits*	*Int. Marks*	*Ext. Marks*	*Max. Marks*
II	*AEC Theory*	***P24CRM201***	**RESEARCH METHODOLOGY**	***60***	***2***	***25***	***75***	***100***

Objectives: The main objective of this paper is to expose students to acquire knowledge on different types of research, scientific writing and apply for grant.

Course Outcomes (COs) and Cognitive Level Mapping:

COs	CO Statement (After completing the course, the students will be able to)	Cognitive Level
CO1	Define the basic principles of biological research	**K1**
CO2	Discuss biological research problems and literature sources	**K2**
CO3	Produce quality science writing and communication	**K3**
CO4	Device various projects in biological research	**K4**
CO5	Criticize various online sources and AI in research	**K5**

Cognitive Levels (K1-Remember**; K2-**Understand**; K3-**Apply**; K4-**Analyze**; K5-**Evaluate**; K6-**Create**)**

Unit – I **(12 Hours)**

- Concepts of Research-Scientific temper, Empiricism and Rationalism. Knowledge, Information and Data.
- Basic concepts of research -Meaning, Objectives, Motivation and Approaches. Types of Research - Descriptive/Analytical, Applied/ Fundamental, Quantitative/Qualitative, Conceptual/Empirical.
- Research methods versus Methodology, Research Process (*Self-study*).

Unit – II **(12 Hours)**

- Research formulation -Observation and Facts, Prediction and explanation, Induction, Deduction.
- Defining and formulating the research problem, Selecting the problem and necessity of defining the problem.
- Literature review - Importance of literature review in defining a problem, Critical literature review-Theory, Principle, Law and Canon (*Self-study*).

Unit – III **(12 Hours)**

- Scientific Documentation and Communication-Structure and components of Scientific Reports – types of Report – Technical Reports and Thesis/dissertations.
- Preparing Research papers for journals, Seminars and Conference; Impact factor, Citation Index, h-index. DOI. ISBN & ISSN.
- Conventions and strategies of authentication – citation styles, bibliography, referencing and foot notes (*Self-study*).
- Software for managing bibliographies - EndNote. Presentation techniques - Assignment, Seminar, Debate, Workshop, Colloquium, Conference, Oral presentation, Poster Presentation.
- Artificial intelligence Tools-ChatGPT, Quillbot etc (*Self-study*)

Unit – IV **(12 Hours)**

- Preparation of Project Proposal (Major & Minor project of different funding agencies).
- Funding Agencies UGC, CSIR, DST, DBT ICMR, BRNS, TNSTC and ICAR, Women Scientists schemes.
- Global Information System – BIOSIS, Medline and Medlars, AGRIS, Pubmed, Google Scholar (*Self-study*).
- Sources of Information - Primary and secondary sources. Library - books, journals, periodicals, reference sources, abstracting and indexing sources, Reviews, Treatise, Monographs.

Unit – V **(12 Hours)**

- Online resources – INFLIBNET, e-libraries, e-Books, e-Encyclopedia, e-Journals, e-Thesis, Shodhganga, ePG-Pathshala, TED Talk, Institutional Websites.
- MOOC - SWAYAM, NPTEL. Networking platforms for researchers - Academia, ResearchGate (*Self-study*).
- Ethics in research - Plagiarism, Plagiarism checking software - Turnitin, Viper, Urkund; Citation and Acknowledgement.
- Extension: Lab to Field, Extension communication, Extension tools.

Experiential Learning: Visit to universities and institutes of state and national importance having sophisticated library facilities

Self-Study Component for Seminar/Assignment:
(Questions should not be asked from self-study component in the End Semester Examinations)

Text Books:

1. Kothari C. R. 2009. Research Methodology: Methods and Techniques (2ndedn.). New Age International Publishers, New Delhi.
2. Paul Oliver. 2005. Writing Your Thesis. Vistara Publications. New Delhi.
3. Rajathi A. and P. Chandran, 2010. SPSS for You. MJP Publishers, Chennai
4. Samuels M. L., Witmer J. A. and Schaffner A. 2016. Statistics for Life Sciences (5th edn). Pearson Education Inc., New Delhi.

Reference Books:

1. Sundar Rao P.S.S. and Richard J. 2006. Introduction to Biostatistics and Research Methods (4th edn). Prentice Hall, New Delhi.
2. Zar J. H. 2008. Biostatistical Analysis (3rd edn.). Pearson Education Inc., New Delhi

e-Resources

1. **https://mrcet.com/downloads/digital_notes/CSE/Mtech/I%20Year/RESEARCH%20METHODLOGY.pdf**
2. **https://dhsgsu.edu.in/images/Reading-Material/Commerce/Econtent/RM-SELF-LEARNING.pdf**
3. **https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SBAX1023.pdf**
4. **https://paperpal.com/blog/academic-writing-guides/what-is-research-methodology**
5. **https://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/law/09._research_methodology/01._basics_of_research/et/8148_et_et.pdf**
6. **https://www.youtube.com/watch?v=Nv3CcyjhMbA**

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CO3	2	3	2	2	2	1	3	2	1	2	2.0
CO4	3	3	3	3	3	3	3	3	3	3	3.0
CO5	3	3	3	3	3	3	3	3	3	3	3.0
Mean Overall Score											2.6

3 – Strong; 2 – Medium; 1 – Low

Prepared by	Verified by
Dr. M. Feroz Khan	Dr. R. Rafi Mohamed, Chairman & HOD