CHOICE BASED CREDIT SYSTEM - LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK

M.Sc Zoology

Part		Course	Code	Cr.	Hrs
SEMESTER I					
A	CC – 1	Structure and Functions of Invertebrates	232304101	4	6
	CC – 2	Comparative Anatomy of Vertebrates	232304102	4	6
	CC – 3	Lab Course in Invertebrates and Vertebrates	232304103	4	6
	EC –I (Generic/DS)	Molecules and their Interaction relevant to Biology	232304104	3	4
	Elective - II	Biostatistics	232304105	3	4
B	SEC I	Intellectual Property Rights	232304106	2	2
	AECC 1 – Soft Skill	Sericulture	232304107	2	2
	Total			**22**	**30**
SEMESTER II					
A	CC – 4	Cell and Molecular Biology	232304201	4	5
	CC – 5	Developmental Biology	232304202	4	5
	CC – 6	Lab Course in Cell Biology and Developmental Biology	232304203	4	5
	EC – III	Economic Entomology	232304204	3	5
	EC - IV	Research Methodology	232304205	3	5
B	SEC – II	Poultry Farming	232304206	2	3
	AECC 2	Apiculture	232304207	2	2
	*Internship	Internship / Industrial Activity		-	-
				22	**30**
SEMESTER III					
A	CC – 7	Genetics	232304301	4	5
	CC – 8	Evolution	232304302	4	5
	CC – 9	Animal Physiology	232304303	4	5
	EC - V	Stem Cell Biology	232304304	3	5
	Core	Medical Laboratory	232304305	3	4
B	SEC – III	Diary Farming	232304306	2	4
	ACEE – 3	Vermiculture	232304307	2	2
	Internship	**Internship / Industrial Activity**	232304308	2	-
				24	**30**
SEMESTER IV					
A	CC – 10	Immunology	232304401	4	5
	CC – 11	Ecology	232304402	4	5
	CC - 12	Lab Course in Immunology	232304403	4	5
	CC – 13	Project with Viva voce	232304404	3	4
	EC VI	Aquaculture	232304405		
B	SEC	Animal Behaviour	232304406	2	4
	AECC – 4	Bio-compositing	232304407	2	2
C	EA	Extension Activity	232304408	1	
	Total			**24**	**30**

* Internship will be carried out during the summer vacation of the first year and marks will be included in the Third Semester Marks Statement.

Title of the Course		**Structure and Functions of Invertebrates**						
Category	Core - 1	**Year**	I	**Credits**	4	**Course Code**	**232304101**	
		Semester	I					
Instructional Hours per week		**Lecture**	**Tutorial**	**Lab Practice**	**Total**	**CIA**	**External**	**Total**
		6	-	--	6	25	75	100

Learning Objectives	
LO1	To understand the concept of classification and their characteristic features of major group of invertebrates.
LO2	To realize the range of diversification of invertebrate animals.
LO3	To enable to find out the ancestors or derivatives of any taxon.
LO4	To know the functional morphology of system biology of invertebrates.
LO5	

UNIT	**Details**	**No. of Periods for the Unit**
I	Structure and function in invertebrates: Principles of Animal taxonomy; Species concept; International code of zoological nomenclature; Taxonomic procedures; New trends in taxonomy	
II	Organization of coelom: Acoelomates; Pseudocoelomates; Coelomates: Protostomia and Deuterostomia; Locomotion: Flagella and ciliary movement in Protozoa; Hydrostatic movement in Coelenterata, Annelida and Echinodermata	
III	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	
IV	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	
V	Invertebrate larvae: Larval forms of free living invertebrates - Larval forms of parasites; Strategies and Evolutionary significance of larval forms. Minor Phyla: Concept and significance; Organization and general characters	

Course Outcomes	
Course Outcomes	On completion of this course, students will be able;
CO1	member the general concepts and major groups in animal classification, origin, structure, functions and distribution of life in all its forms.
CO2	derstand the evolutionary process. All are linked in a sequence of life patterns.
CO3	pply this for pre-professional work in agriculture and conservation of life forms.
CO4	alyze what lies beyond our present knowledge of life process.
CO5	aluate and to create the perfect phylogenetic relationship in classification.

Text Books (Latest Editions)	
	1. Barrington, E. J.W. 1979. Invertebrate Structure and Function. The English Language Book Society and Nelson, pp-765.

References Books
(Latest editions, and the style as given below must be strictly adhered to)

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

Mapping with Programme Outcomes*

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	S	S	S	M	S	S	S
CO2	S	S	M	M	S	S	M	M	S	S
CO3	S	M	S	M	S	S	M	M	S	S
CO4	S	M	S	M	S	S	M	M	S	M
CO5	S	M	S	M	S	S	M	M	S	M

Title of the Course		**Comparative Anatomy of Vertebrates**						
Category	Core - 2	**Year**	I	**Credits**	4	**Course Code**	**232304102**	
		Semester	I					
Instructional Hours per week		**Lecture**	**Tutorial**	**Lab Practice**	**Total**	**CIA**	**External**	**Total**
		6	-	--	6	25	75	100

Learning Objectives	
LO1	Exemplifying the vertebrate origin and the intermediary position of Prochordates between invertebrates and vertebrates.
LO2	Acquires the knowledge on evolution and adaptive radiation of Agnatha and Pisces.
LO3	Understanding knowledge about the first terrestrial vertebrates and the adaptive radiation of land animals
LO4	Imparting conceptual knowledge about the animal life in the air and their behaviours.
LO5	Understanding the origin and efficiency of mammals and evolutionary changes that occurred in the life of vertebrates.

UNIT	**Details**	**No. of Periods for the Unit**
I	Origin of vertebrates: Concept of Protochordata; The nature of vertebrate morphology; Definition, scope and relation to other disciplines; Importance of the study of vertebrate morphology.	
II	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.	
III	General plan of circulation in various groups; Blood; Evolution of heart; Evolution of aortic arches and portal systems. Respiratory system: Characters of respiratory tissue; Internal and external respiration; Comparative account of respiratory organs	
IV	Skeletal system: Form, function, body size and skeletal elements of the body; Comparative account of jaw suspensorium, Vertebral column; Limbs and girdles; Evolution of Urinogenital system in vertebrate series.	
V	Sense organs: Simple receptors; Organs of Olfaction and taste; Lateral line system; Electroreception. Nervous system: Comparative anatomy of the brain in relation to its functions; Comparative anatomy of spinal cord; Nerves-Cranial, Peripheral and Autonomous nervous systems.	

Course Outcomes	
Course Outcomes	On completion of this course, students will be able;
CO1	Remember the general concepts and major groups in animal classification, origin, structure, functions and distribution of life in all its forms.
CO2	Understand the evolutionary process. All are linked in a sequence of life patterns.
CO3	Apply this for pre-professional work in agriculture and conservation of life forms.
CO4	Analyze what lies beyond our present knowledge of life process.
CO5	Evaluate and to create the perfect phylogenetic relationship in classification.

Text Books (Latest Editions)	
	1. Swayam Prabha https://www.swayamprabha.gov.in/index.php/program/archive/9
	2. Yong, J. Z. 1981. The life of Vertebrates, English language Book society, London, pp-645.
	3. Romer, A.S. 1971. The Vertebrate body, W.B.S. Saunders, Philadelphia, pp-600.

References Books
(Latest editions, and the style as given below must be strictly adhered to)

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.
3. Ekambaranatha Ayyar and T. N. Ananthakrishnan. 2009. Manual of Zoology, Vol – II, S. Viswanathan Pvt. Ltd. Chennai.
4. Kotpal, 2019. R.L. Modern Text Book of Zoology Vertebrates, 4th Edition, Rastogi Publications, Meerut, pp-968.

Mapping with Programme Outcomes*

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	M	L	S	M	S	M	S	M	S
CO2	S	L	L	S	M	S	M	M	M	M
CO3	S	M	L	S	M	S	M	L	M	M
CO4	S	L	L	S	L	S	M	L	M	L
CO5	S	M	L	S	S	S	M	S	M	M

Title of the Course		**Lab Course in Invertebrates and Vertebrates**						
Category	Core - 3	**Year**	I	**Credits**	4	**Course Code**	**232304103**	
		Semester	I					
Instructional Hours per week		**Lecture**	**Tutorial**	**Lab Practice**	**Total**	**CIA**	**External**	**Total**
			-	6	6	25	75	100

Learning Objectives	
LO1	Understanding the different systems in invertebrates & vertebrates.
LO2	Learning about various animal species, their phylogenetic affinities and their adaptive features
LO3	Imparting conceptual knowledge about the salient features and functional anatomy.
LO4	Developing the skill in mounting techniques of the biological samples.
LO5	Gaining fundamental knowledge on the skeletal system

Details

INVERTEBRATES

Dissection

Earthworm : Nervous system
Pila : Digestive and nervous systems
Sepia : Nervous system
Cockroach : Nervous system
Grasshopper : Digestive system and mouth parts
Prawn : Appendages, nervous and digestive systems
Crab : Nervous system

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

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

Spotters

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

Mounting

Earthworm : Body setae
Pila : Radula
Cockroach : Mouth parts
Grasshopper : Mouth parts

CHORDATES

Study the nervous system of Indian dog shark - Dissection

1. Nervous system of *Scoliodon laticaudatus* – 5th or Trigeminal nerve
2. Nervous system of *Scoliodon laticaudatus* – 7th or Facial nerve
3. Nervous system of *Scoliodon laticaudatus* – 9th and 10th or Glossopharyngeal & Vagus nerve

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)
13. *Dendrophis* sp. (Tree snake)

Study of the different types of scales in fishes

1. Cycloid scale
2. Ctenoid scale
3. Placoid scale

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

Mounting

1. Weberian ossicles of fish

Course Outcomes	
Course Outcomes	On completion of this course, students will be able;
CO1	Understand the structure and functions of various systems in animals
CO2	Learn the adaptive features of different groups of animals
CO3	Learn the mounting techniques
CO4	Acquire strong knowledge on the animal skeletal system
CO5	Understand the structure and functions of various systems in animals

Text Books (Latest Editions)

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

References Books **(Latest editions, and the style as given below must be strictly adhered to)**
1. Preeti, G., and C. Mridula, 2000. Modern Experimental Zoology, Indus International Publication. 2. Sinha, J., A. K. Chatterjeee, P. Chattopadhya. 2011. Advanced Practical Zoology, Arunabha Sen Publishers, pp-1070.

Mapping with Programme Outcomes*										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	S	M	S	S	M	S	M	S
CO2	S	M	L	S	M	S	M	M	M	M
CO3	M	M	L	S	L	S	M	L	M	M
CO4	S	S	L	S	L	S	M	L	M	L
CO5	S	S	M	L	M	S	M	S	M	M

*S - Strong; M - Medium; L - Low

Title of the Course		**Molecules and their Interaction relevant to Biology**						
Category	EC I	**Year**	I	**Credits**	3	**Course Code**	**232304104**	
		Semester	I					
Instructional Hours per week		**Lecture**	**Tutorial**	**Lab Practice**	**Total**	**CIA**	**External**	**Total**
		4	-	--	4	25	75	100

Pre-requisite:

Understanding fundamental properties of elements, atoms, molecules, chemical bonds, linkages and structure, composition, metabolism and functions of biomolecules.

Learning Objectives

Students should know the fundamentals of biochemistry

UNIT	**Details**	**No. of Periods for the Unit**
I	Basics of biophysical chemistry and biochemistry: Structure of atoms, molecules and chemical bonds - Principles of biophysical chemistry (pH, buffer, reaction kinetics, thermodynamics, colligative properties).	
II	Biomolecular interactions and their properties: Stabilizing interactions (Vander Waals, electrostatic, hydrogen bonding, hydrophobic interaction etc. - Composition, structure, metabolism and function of biomolecules (carbohydrates, lipids, proteins, nucleic acids and vitamins).	
III	Bioenergetics and enzymology: Bioenergetics, glycolysis, oxidative phosphorylation, coupled reaction, group transfer, biological energy transducers - Principles of catalysis, enzymes and enzyme kinetics, enzyme regulation, mechanism of enzyme catalysis, isoenzymes	
IV	Structural conformation of proteins and nucleic acids: Conformation of proteins (Ramachandran plot, secondary, tertiary and quaternary structure; domains; motifs and folds) - Conformation of nucleic acids (A-, B-, Z-DNA), t-RNA, micro-RNA).	
V	Stabilizing interactions in biomolecules: Stability of protein and nucleic acid structures - hydrogen bonding, covalent bonding, hydrophobic interactions and disulfide linkage.	

Course Outcomes	
Course Outcomes	On completion of this course, students will be able;
CO1	Learn the structure, properties, metabolism and bioenergetics of biomolecules
CO2	Acquire knowledge on various classes and major types of enzymes, classification, their mechanism of action and regulation
CO3	Understand the fundamentals of biophysical chemistry and biochemistry, importance and applications of methods in conforming the structure of biopolymers
CO4	Comprehend the structural organization of and proteins, carbohydrates, nucleic acids and lipids
CO5	Familiarize the use of methods for the identification, characterization and conformation of biopolymer structures

Text Books (Latest Editions)

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. Satyanarayana U. and U. Chakrapani, 2006. Biochemistry. (3rd Edition). Books and Allied (P) Ltd. Calcutta, pp-695.

References Books
(Latest editions, and the style as given below must be strictly adhered to)

1. Buchanan, B.B., W. Gruissem and R.L. Jones. 2015. Biochemistry and Molecular Biology of Plants. John Wiley and Sons Ltd., UK, pp-1280.
2. Murray, R.K., D.K. Granner, P.A. Mayes and V.W. Rodwell. 2003. Harper's Illustrated Biochemistry (26th Edition), The McGraw-Hill Companies, Inc., USA, pp-704.
3. Palmer, T. 2004. Enzymes. Affiliated East-West Press Pvt. Ltd., New Delhi, pp-416.
4. Voet D. and J.G. Voet. 2011. Biochemistry. (4th Edition). John Wiley & Sons (Asia) Pvt. Ltd., pp-1428.

Mapping with Programme Outcomes*

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	M	S	M	S	L	S	M	S	M	M
CO2	S	S	L	S	S	S	M	M	M	S
CO3	M	M	M	S	M	S	S	S	S	L
CO4	S	M	S	M	S	M	S	S	S	M
CO5	M	S	S	M	M	S	M	L	S	M

*S - Strong; M - Medium; L-Low

Title of the Course		**BOSTATISTICS**						
Category	EC - II	**Year**	I	**Credits**	3	**Course Code**	**232304105**	
		Semester	I					
Instructional Hours per week		**Lecture**	**Tutorial**	**Lab Practice**	**Total**	**CIA**	**External**	**Total**
		4	-	--	4	25	75	100

Pre-requisite:

Students should be aware of importance of analysis of quantitative and qualitative information from biological studies.

Students should know basic concepts in Biostatistics.

UNIT	**Details**	**No. of Periods for the Unit**
I	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.	
II	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.	
III	Probability: Theories and rules; Probability - Addition and multiplication theorem; Probability distribution: Properties and application of Normal, Binomial and Poisson distributions.	
IV	Hypothesis testing: Student'*t*' test - paired sample and mean difference'*t*' tests. 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.	
V	Analysis of variance: one way and two way classification. Data analysis with comprehensive statistical software using Statistical Package for the Social Sciences (SPSS).	

Course Outcomes	
Course Outcomes	On completion of this course, students will be able;
CO1	Clear understanding of design and application of biostatistics relevant to experimental and population studies.
CO2	Acquired skills to perform various statistical analyses using modern statistical techniques and software.
CO3	Knowledge on the merits and limitation of practical problems in biological/ health management study as well as to propose and implement appropriate statistical design/ methods of analysis.

Text Books (Latest Editions)

1. Arora, P. N. and P. K. Malhan. 1996. Biostatistics, Himalaya Publishing House, Mumbai, pp-447.
2. Gurumani, N. 2005. Introduction to Biostatistics, M.J.P. Publishers, Delhi, pp-407.
3. Das, D. and A. Das. 2004. Academic Statistics in Biology and Psychology, Academic Publisher, Kolkata, pp-363.
4. Palanichamy, S. and Manoharan, M. 1990. Statistical Methods for Biologists, Palani Paramount Publications, Tamil Nadu, pp-264.

References Books
(Latest editions, and the style as given below must be strictly adhered to)

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. Zar, J.H. 1998. Biostatistical Analysis, Pearson Education (Singapore) Pvt. Ltd., Delhi, India, pp-660.
5. Bailey, N. T. J. 1994. Statistical Methods in Biology (Third Edition), Cambridge University Press, Cambridge, pp-255.
6. Wayne W. Daniel. Biostatistics: A Foundation for Analysis in the Health Sciences, John Wiley & Sons Inc, USA, pp-443.
7. Snedecor, G. W. and W. G. Cochran. 1967. Statistical Methods (Sixth Edition), Oxford & IBH Publishing Co., New Delhi, pp-593.
8. Pagano, M. and K. Gauvreau. 2008. Principles of Biostatistics (Second Edition), Cengage Learning, New Delhi, pp-525.

Mapping with Programme Outcomes*

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	L	M	S	S	M	S	M	M
CO2	S	S	S	S	S	S	S	S	S	S
CO3	M	S	S	S	S	S	S	S	S	L
CO4	M	M	S	L	M	M	M	S	L	M
CO5	M	M	S	L	M	S	M	L	S	M

*S - Strong; M - Medium; L- Low

Title of the Course		**Intellectual Property Rights**						
Category	SEC I	**Year**	I	**Credits**	2	**Course Code**	**232304106**	
		Semester	I					
Instructional Hours per week		**Lecture**	**Tutorial**	**Lab Practice**	**Total**	**CIA**	**External**	**Total**
		2	-	--	2	25	75	100

Pre-requisite:
Students should be aware of importance of analysis of quantitative and qualitative information from biological studies.

Learning Objectives		
	Students should know basic concepts in Biostatistics.	
UNIT	**Details**	**No. of Periods for the Unit**
I	Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad - Genesis and Development - the way from WTO to WIPO - TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations - Important examples of IPR.	
II	Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad	
III	International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.	
IV	Digital Innovations and Developments as Knowledge Assets - IP Laws, Cyber Law and Digital Content Protection - Unfair Competition - Meaning and Relationship between Unfair Competition and IP Laws - Case Studies.	
V	Infringement of IPRs, Enforcement Measures, Emerging issues - Case Studies.	

Course Outcomes	
Course Outcomes	On completion of this course, students will be able;
CO1	Claim the rights for the protection of their invention done in their project work.
CO2	Identify criterias' to fit one's own intellectual work in particular form of IPRs
CO3	To get registration in our country and foreign countries of their invention, designs and thesis or theory written by students during their project.

Text Books (Latest Editions)
1. Deborah E. Bouchoux, "Intellectual Property: The Law of Trademarks, Copyrights,

Patents and Trade Secrets", Cengage Learning, Third Edition, 2012.
2. Prabuddha Ganguli,"Intellectual Property Rights: Unleashing the Knowledge Economy", McGraw Hill Education, 2011.
3. Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.

References Books
(Latest editions, and the style as given below must be strictly adhered to)

01. V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt Ltd, 2012

02. S.V Satakar Intellectual property Rights and Copy Rights, Ess Publication, New Delhi, 2002.

Mapping with Programme Outcomes*										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	M	M	S	S	M	M	M
CO2	S	S	M	S	M	S	S	S	M	L
CO3	S	M	M	S	M	L	L	S	L	S
CO4	M	M	S	L	M	S	S	S	S	S
CO5	M	S	S	L	S	M	M	L	L	S

*S - Strong; M - Medium; L – Low

Title of the Course		**SERICULTURE**						
Category	AECC - I	**Year**	I	**Credits**	2	**Course Code**	**232304107**	
		Semester	I					
Instructional Hours per week		**Lecture**	**Tutorial**	**Lab Practice**	**Total**	**CIA**	**External**	**Total**
		2	-	--	2	25	75	100

Learning Objectives		
	Students should know basic concepts and techniques in Sericulture.	
UNIT	**Details**	**No. of Periods for the Unit**
I	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.	**6**
II	Host plants; Moriculture- distribution, morphology, propagation- seedling, cutting, grafting, layering and micropropagation methods, maintenance- irrigation, manuring and pruning, pests and diseases of mulberry.	**6**
III	*Bombyx mori*- morphology, anatomy, life cycle, geographical locations, larval moults, voltinism, indigenous and commercial races. Diapause. Egg-storage and transportation.	**6**
IV	*Bombyx mori*- morphology, anatomy, life cycle, geographical locations, larval moults, voltinism, indigenous and commercial races. Diapause. Egg-storage and transportation. 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.	**6**
V	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.	**6**

Course Outcomes	
Course Outcomes	On completion of this course, students will be able;
CO1	To understand the various practices in sericulture. To know the needs for sericulture and the status of India in global market.
CO2	Able to apply the techniques and practices needed for sericulture.
CO3	To know the difficulties in sericulture and be able to propose plans against it.

Text Books (Latest Editions)
01. G. Ganga and J. Sulochana Chetty. 2019. An introduction to sericulture, 2nd edition, Oxford 02. and IBH Publishing Co. Pvt. Ltd., New Delhi. 2. M. Johnson and M. Kesary. 2019. Sericulture, Saras publication, Tamilnadu. 3. Singh, Amardev & Ravinder Kumar. 2013. Sericulture handbook Vol 1, Biotech. 4. M. Madan Mohan Rao. An Introduction to Sericulture, 2nd edition, BS Publications.
Web Resources
. https://agritech.tnau.ac.in/sericulture/
2. https://csb.gov.in/

Mapping with Programme Outcomes*										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	M	L	L	L	L	L	M	S	L	L
CO2	L	M	L	M	L	M	M	S	M	L
CO3	M	S	L	L	L	M	L	L	M	S
CO4	M	S	M	S	M	M	L	L	S	S
CO5	M	M	L	M	M	L	L	L	L	M

*S - Strong; M - Medium; L- Low

Title of the Course		**CELL AND MOLECULAR BIOLOGY**						
Category	Core 4	**Year**	I	**Credits**	4	**Course Code**	**232304201**	
		Semester	II					
Instructional Hours per week		**Lecture**	**Tutorial**	**Lab Practice**	**Total**	**CIA**	**External**	**Total**
		5	-	--	5	25	75	100

Learning Objectives	
	To understand the ultrastructures and functions of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes and organelles.
	To realize involvement of various cellular components in accomplishing cell division.
	To enable a successful performance in cell biology component of CSIR-UGC NET.
	To understand the ultrastructures and functions of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes and organelles.

UNIT	**Details**	**No. of Periods for the Unit**
I	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.	
II	Cellular organization: Membrane structure and functions - Structure of model membrane, lipid bilayer and membrane proteins diffusion, osmosis, ion channels, active transport, ion pumps, mechanism and regulation of intracellular transport, electrical properties of membranes. Structure and functions of Intracellular organelles: Nucleus, mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes, plastids, vacuoles and chloroplasts.	
III	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.	
IV	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.	
V	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.	

Course Outcomes	
Course Outcomes	On completion of this course, students will be able;
CO1	Understand the general concepts of cell and molecular biology.
CO2	Visualize the basic molecular processes in prokaryotic and eukaryotic cells, especially relevance of molecular and cellular structures influencing functional features.
CO3	Perceive the importance of physical and chemical signals at the molecular level resulting in modulation of response of cellular responses.

CO4	Updated the knowledge on the rapid advances in cell and molecular biology for a better understanding of onset of various diseases including cancer.
CO5	Understand the general concepts of cell and molecular biology.

Text Books (Latest Editions)
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
References Books **(Latest editions, and the style as given below must be strictly adhered to)**
Plopper, G., D. Sharp, and E. Sikorski. 2015. Lewin's Cells (Third Edition), Jones & Bartlett, New Delhi, pp
Plopper, G. 2013. Principles of Cell Biology, Jones & Bartlett, Maryland, pp

Mapping with Programme Outcomes*

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	L	L	L	L	S	S	S	M	M	M
CO2	M	M	M	S	S	S	S	M	S	M
CO3	S	S	S	M	M	S	M	M	L	S
CO4	M	M	S	L	S	S	L	M	S	S
CO5	S	M	M	S	S	S	S	M	S	S

*S - Strong; M - Medium; L – Low

Title of the Course		**Developmental Biology**					
Category	Core - V	**Year**	I	**Credits**	4	**Course**	**232304202**

		Semester	II			**Code**	
Instructional Hours per week	**Lecture**	**Tutorial**	**Lab Practice**	**Total**	**CIA**	**External**	**Total**
	5	-	--	5	25	75	100

Learning Objectives

Understand the process of gametogenesis, cleavage and gastrulation, embryonic development, extra embryonic membrane and placenta in various animals and human.

Learn the principles, methods and applications of cryo-preservation of gametes and embryo.

UNIT	**Details**	**No. of Periods for the Unit**
I	Pattern of animal development: Chief events in animal development; History of thoughts and conceptual developments. Gametogenesis: Origin of germ cells, permatogenesis - Sperm morphology in relation to the type of fertilization, Oogenesis - Oogenesis in insects and amphibians; Composition and synthesis of yolk in invertebrates (insects and crustaceans) and vertebrates; Genetic control of vitellogenin synthesis in amphibians	
II	Fertilization: Sperm aggregation, Sperm activation, Chemotaxis, Sperm maturation and capacitaion in mammals, Acrosome reaction. Sperm – egg interaction. Sperm entry into the egg - Egg activation - Intracellular calcium release - Cortical reaction - Physiological polyspermy - Fusion of male and female pronuclei - Post fertilization metabolic activation - Parthenogenesis	
III	Cleavage and gastrulation: Pattern of embryonic cleavage, mechanisms of cleavage, mid blastula transition - Determinate and regulatory embryos, Factors affecting gastrulation, mechanisms and types of gastrulation in respective animal embryos (Sea urchin, *Amphioxus*, Amphibians, Aves, Mammals); Fate maps - (Amphibian and Chick), Epigenesis and preformation – Formation of primary germ layers	
IV	Embryonic Development; Embryonic development of fish and birds, formation of extra embryonic membranes in mammalian – Organogenesis - Development of endodermal, mesodermal and ectodermal derivatives. Embryonic Induction and neurulation; Formation and migration of neural crest cells - types of neural crest cells and their patterning - primary and secondary neurulation. Gene and development; Anterior- posterior axis in determination in drosophila, Maternal effect genes - *Bicoid* and *Nanos* proteins; Generation of dorsal - ventral polarity- Genetic control of segmentation – Gap genes; pair rule genes; Homeotic genes	
V	Post embryonic development metamorphosis: Endocrine control of metamorphosis in insect and amphibian - Endocrine control of moulting and growth in crustaceans and insects - Neoteny and pedogenesis. Regeneration: Formation of ectodermal cap and regeneration blastema – Types of regeneration in planaria, Regenerative ability in different animal groups, Factors stimulating regeneration – Biochemical changes assosciated with regeneration. Aging and senescences: Biology of senescences- cause of aging- mechanism involved in apoptosis. Experimental Embryology: Mammalian reproduction: Mammalian reproductive cycle, Hormonal regulation, Endocrine changes associated with normal pregnancy, Induced ovulation in humans – Cryopreservation of gametes/embryos - Ethical issues in cryopreservation	

Course Outcomes	
Course Outcomes	On completion of this course, students will be able;

CO1	efine the concepts of embryonic development
CO2	bserve various stages of cell divisions under microscope
CO3	nderstand the formation of zygote
CO4	fferentiate the blastula and gastrula stages
CO5	arn the distinguishing features of three different germ layers and formation of various tissues and organs

Text Books (Latest Editions)
1. Wilt, F.H. and N.K. Wessel. 1967. Methods in Developmental Biology, Thomas Y Crowell, New York. 2. Slack J.M.W. 2012. Essential Developmental Biology (3rd Edition), Wily-Blackwell Publications, USA, pp-496. 3. Mari-Beffa, M. and J. Knight. 2005. Key Experiments in Practical Developmental Biology, Cambridge University Press, UK, pp-404.
References Books **(Latest editions, and the style as given below must be strictly adhered to)**
1. Balinsky, B. I. 1981. Introduction to Embryology (5th Edition), CBS College Publishers, New York, pp-782. 2. Gilbert. S. F. 2006. Developmental Biology, 8th Edition, INC Publishers, USA, pp-785. 3. Berrill, N.J. 1974. Developmental Biology, Tata Mc-Graw Hill Publications, New Delhi, pp-535. 4. Tyler, M.S. 2000. Developmental Biology - A Guide for Experimental Study, Sunderland, MA, pp-208. 5. Subramoniam, T. 2011. Molecular Developmental Biology (2nd Edition), Narosa Publishers, India, pp-364. 6. www.easybiologyclass.com › developmental-biology-e 7. www.studocu.com › document › lecture-notes › view 8. *ocw.mit.edu* › courses › 7-22-developmental-biology-f.

Mapping with Programme Outcomes*										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	S	S	L	S	M	L	M
CO2	S	S	S	S	S	L	S	S	S	S
CO3	S	M	S	S	S	S	S	L	L	M
CO4	S	S	S	S	S	M	S	S	S	L
CO5	S	S	S	M	S	S	S	L	L	M

*S - Strong; M - Medium; L – Low

Title of the Course		**Lab Course in Cell Biology and Developmental Biology**						
Category	Core VI	**Year**	I	**Credits**	4	**Course Code**	**232304203**	
		Semester	II					
Instructional Hours per week		**Lecture**	**Tutorial**	**Lab Practice**	**Total**	**CIA**	**External**	**Total**
		-	1	4	5	25	75	100

Learning Objectives

Practical course aims at demonstrating significant cellular and molecular biological principles, quantitative and analytical approaches that enable the students to translate the theoretical foundation in cell biology, genetics and developmental biology into practical understanding.

Details

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
4. Detection of polytene chromosome in salivary gland cells of the larvae of the Chironomus
5. Detection of sex chromatin
6. Identification of blood cells in the haemolymph of the of the cockroach
7. Isolation of genomic DNA from eukaryotic tissue
8. Isolation of total RNA from bacterial cells/tissues
9. Agarose gel electrophoresis of DNA
10. SDS-Polyacrylamide gel electrophoresis

DEVELOPMENTAL BIOLOGY

Gametogenesis - Observation of gametes from gonadal tissue sections

i. Oogenesis:
   - ✓ Section through ovary of shrimp, fish, frog and mammals

ii Spermatogenesis:
   - ✓ Section through testis of shrimp, fish, calotes and mammals

Fertilization

iii Induced spawning in polycheate worm *Hydroids elegans*

iv *In vitro* fertilization and development in a polycheate worm *Hydroids elegans*

v Observation of egg developmental stages in *Emerita emeritus*

Embryogenesis

vi Observation and whole mount preparation of the chick blastoderm - 18 hours of development

vii Chick embryonic stage - 24 hours of development

viii Chick embryonic stage - 48 hours of development

ix Chick embryonic stage - 72 hours of development

x Chick embryonic stage - 96 hours of development

Histological observation: Section through various developmental stages in chick embryo

Experimental Embryology

Regeneration in Frog Tadpoles

xi Blastema formation

xii Demonstration of regenerative process in tadpole

Metamorphosis

xiii Demonstration of metamorphosis in Frog Tadpole using exogenous Iodine

Cryopreservation

xiv Demonstration of cryopreservation of gametes of fin fish/shell fish

Course Outcomes	
Course Outcomes	On completion of this course, students will be able;
CO1	Acquire knowledge to differentiate the cells of various living organisms and become awares of physiological processes of cells e.g. cell divisions, various stages of fertilization and embryo development.
CO2	Understand and observe as well as correctly identify different cell types, cellular structures using different microscopic techniques.
CO3	Develop handling - skills through the wet-lab course.
CO4	Learn the method of culturing of *Drosophila* and identification of their wild and mutant strains
CO5	Acquire skills to perform human karyotyping and chromosome mapping to identify abnormalities

Mapping with Programme Outcomes*

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	M	S	S	S	S	S	L	L	M
CO2	S	S	S	S	S	M	M	M	M	M
CO3	S	S	M	S	S	L	S	M	L	M
CO4	M	M	L	M	L	M	M	S	M	L
CO5	S	S	M	L	S	M	L	S	S	S

Title of the Course		**Economic Entomology**						
Category	EC - III	**Year**	I	**Credits**	3	**Course Code**	**232304204**	
		Semester	II					
Instructional Hours per week		**Lecture**	**Tutorial**	**Lab Practice**	**Total**	**CIA**	**External**	**Total**
		5	-	--	5	25	75	100

Pre-requisite:

The students with a basic background in biological sciences with a special emphasis on the study of insects including systematic, beneficial insects, destructive insects, integrated pest management and insects of medical and veterinary importance.

Learning Objectives

Students should acquire a fairly good understanding about the life of insects and their classification.

UNIT	**Details**	**No. of Periods for the Unit**
I	Overview of insects and insect taxonomy: Insects and their biological success - Man and insects; Basic concepts in Insect Taxonomy and classification.	
II	Beneficial insects: Silkworms - types, life history, disease management and rearing methods - Types of honey bees, life history, social organization (colonies and caste system), honey bee care and management of bee hive - Lac insects-life history, lac cultivation; Pollinators, predators, parasitoids, scavengers, weed killers, soil-builders.	
III	Destructive insects: Insect pests - definition - Categories of pests - Types of damage to plants by insects - Causes of pest outbreak - Economic threshold level - Biology of the insect pests - Pests of paddy, cotton, sugarcane, vegetables, coconut and stored grains cereals.	
IV	t management/Control strategies: Methods and principles of pest control - Natural control, Artificial control, Merits and demerits or limitations of these methods in pest control - Development and uses of pest resistant plant varieties - Integrated pest management - Concepts and practice.	
V	Vector biology: Vectors of veterinary and public health importance - Mosquitoes as potential vectors of human diseases-control measures	

Course Outcomes

Course Outcomes	On completion of this course, students will be able;
CO1	Understand taxonomy, classification and life of insects in the animal kingdom.
CO2	Know the life cycle, rearing and management of diseases of beneficial insects.
CO3	Know the type of harmful insects, life cycle, damage potential and management of pests including natural pest control
CO4	Recognize insects which act as vectors causing diseases in animals and human.
CO5	Overall understanding on the importance of insects in human life.

Text Books (Latest Editions)

1. Chapman, R.F., S.J. Simpsonand A.E.Douglas. 2012. The Insects: Structure and Function, Fifth Edition, Cambridge University Press, pp-959.
2. Imms, A.D., O.W.Richards and R.G. Davies (Eds.) IMMS' General Textbook of Entomology, Volume I: Structure, Physiology and Development, pp-418; Volume 2: Classification and Biology, pp-934, Springer Netherlands.
3. Daly, H.V., J.T. Doyen and P.R. Ehrlich. 1978. Introduction to Insect Biology and Diversity. Mc Graw-Hill Kogakusha Ltd., Tokyo, pp-564.
4. Hill, D.S. 1974. Agricultural Insect Pests of the Tropics and Their Control. Cambridge University Press, New York, pp-746.
5. Krishnaswami, S. 1973. Sericulture Manual, Vol. I & II, Silkworm rearing, FAO Agricultural Science Bulletin, Rome.
6. Mani, M.S. 1982. General Entomology. Oxoford & IBH Publishing Co., pp-912.
7. Wigglesworth, V.B. 1972. The Principles of Insect Physiology, ELBS & Chapman and Hall, London, pp-827.

References Books
(Latest editions, and the style as given below must be strictly adhered to)

1. Ayyar, L.V. R. 1936. Hand book of Economic Entomology for South India. Narendra Publishing House. New Delhi, pp- 528.
2. Vasantharaj David, B. and V.V. Ramamurthy. 2016. Elements of Economic Entomology, Eighth Edition, Brillion Publishing, New York, pp-400.
3. Ross. H.H. 1965. A Text Book of Entomology, John Wiley & Sons Inc., New York, pp-746.

Mapping with Programme Outcomes*

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	M	S	M	M	M	S	L	M
CO2	S	S	M	S	S	S	S	S	S	L
CO3	S	M	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	M	S	M	M
CO5	S	S	S	M	M	S	M	L	S	M

*S - Strong; M - Medium; L-Low

Title of the Course		**Research Methodology**						
Category	EC IV	**Year**	I	**Credits**	3	**Course Code**	**232304205**	
		Semester	II					
Instructional Hours per week		**Lecture**	**Tutorial**	**Lab Practice**	**Total**	**CIA**	**External**	**Total**
		5	-	--	5	25	75	100

Pre-requisite:

Students should know the fundamentals of basic methods employed in experimental biology.

Learning Objectives

	dents understand the basic principle, methodology and applications of widely used instruments in biological sciences.

UNIT	**Details**	**No. of Periods for the Unit**
I	Good laboratory practice (GLP) - pH, Electrodes and pH meter - Colorimeter and Spectrophotometry.	
II	Histology, Histochemistry, Bioinformatics and Electron microscopy.	
III	Light Microscopy, Bright field, Phase contrast, DIC & Fluorescence microscopy, wide field and Confocal microscopy.	
IV	Centrifuges, Chromatography, Electrophoresis, ELISA and blotting.	
V	Principles and Applications of tracer techniques in biology, Animal cell culture techniques.	

Course Outcomes

Course Outcomes	On completion of this course, students will be able;
CO1	Understand the implications of GLP
CO2	Learn the working principles of different instruments
CO3	Gain the knowledge on techniques of histology and histochemistry
CO4	Acquire knowledge on the basic principle and application of various modules of light and electron microscopy

Text Books (Latest Editions)

1. Chandler, D.E. and Roberson R.W. 2009. Bioimaging: Current Concepts in Light and Electron Microscopy, Jones and Bartlet Publishers, Sudbury, MA, USA, pp440.
2. Engelbert, B. 1960. Radioactive Isotopes in Biochemistry, Elsevier Applied Science, pp-376.
3. Wolf, G. 1964. Isotopes in Biology, Academic Press, pp-173.
4. Srivastava, B. B. 2005. Fundamentals of Nuclear Physics, Rastogi Publications, pp-500.
5. Pantin, C. F. A. 1948. Microscopical Techniques, Cambridge University Press, London.

References Books
(Latest editions, and the style as given below must be strictly adhered to)

1. Pearse, A.G. 1968. Histochemistry: Theoretical and Applied, Vol. I, Third Edition, J & A Churchill Ltd, pp-758.
2. Lillie, R.D. 1954. Histopathologic Technic and Practical Histochemistry, Second Edition, Blakiston, New York, pp-715.
3. Hoppert, M. 2003. Microscopic Techniques in Biotechnology, Wiley-VCH GmbH, Weinheim, Germany, pp-330.

Mapping with Programme Outcomes*										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	M	S	M	S	M	S	M	S	M	M
CO2	S	S	M	S	S	S	M	M	M	S
CO3	S	M	S	S	S	S	S	S	S	L
CO4	S	S	S	S	S	M	S	S	S	M
CO5	S	S	S	M	M	S	M	L	S	M

*S - Strong; M - Medium; L-Low

Title of the Course		**Poultry Farming**						
Category	SEC - II	**Year**	I	**Credits**	2	**Course Code**	**232304206**	
		Semester	II					
Instructional Hours per week		**Lecture**	**Tutorial**	**Lab Practice**	**Total**	**CIA**	**External**	**Total**
		3	-	--	3	25	75	100

Pre-requisite:

Students should be aware of economic and cultural importance of Poultry farming.

Learning Objectives		
	Students should know basic concepts in Vermiculture.	
UNIT	**Details**	**No. of Periods for the Unit**
I	General introduction to poultry farming - Definition of Poultry - Past and present scenario of poultry industry in India - Principles of poultry housing - Poultry houses - Systems of poultry farming	
II	Management of chicks - growers and layers - Management of Broilers. - Preparation of project report for banking and insurance.	
III	Poultry feed management-Principles of feeding, Nutrient requirements for different stages of layers and broilers - Feed formulation and Methods of feeding.	
IV	Poultry diseases-viral, bacterial, fungal and parasitic (two each); symptoms, control and management; Vaccination programme.	
V	Selection, care and handling of hatching eggs - Egg testing. Methods of hatching.- Brooding and rearing -. Sexing of chicks. - Farm and Water Hygiene - Recycling of poultry waste.	

Course Outcomes	
Course Outcomes	On completion of this course, students will be able;
CO1	To understand the various practices in Poultry farming. To know the needs for Poultry farming and the status of India in global market.
CO2	To be able to apply the techniques and practices needed or Poultry farming.
CO3	To know the difficulties in Poultry farming and be able to propose plans against it.

Text Books (Latest Editions)	
	1. Ismail, S.A., 1997. Vermitechnology, The biology of earthworms, Orient Longman,India.

References Books **(Latest editions, and the style as given below must be strictly adhered to)**
01. Sreenivasaiah., P. V., 2015. Textbook of Poultry Science. 1st Edition. Write & Print Publications, New Delhi. 02. Jull A. Morley, 2007. Successful Poultry Management. 2nd Edition. Biotech Books, New Delhi" 03. Hurd M. Louis, 2003. Modern Poultry Farming. 1st Edition. International Book Distributing Company, Lucknow." 04. Life and General Insurance Management"
Web Resources
01. http://www.asci-india.com/BooksPDF/Small%20Poultry%20Farmer.pdf 02. https://nsdcindia.org/sites/default/files/MC_AGR-Q4306_Small-poultry-farmer-.pdf 03. http://ecoursesonline.iasri.res.in/course/view.php?id=335 04. https://swayam.gov.in/nd2_nou19_ag09/preview

Mapping with Programme Outcomes*										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	L	L	L	L	L	S	S	L	L
CO2	S	L	M	M	S	M	M	M	S	S
CO3	S	M	M	M	S	S	S	S	M	M
CO4	S	S	S	L	S	S	S	S	S	S
CO5	S	S	M	S	S	S	M	L	S	M

*S - Strong; M - Medium; L – Lo

Title of the Course		**Apiculture**						
Category	AECC II	**Year**	I	**Credits**	2	**Course Code**	**232304207**	
		Semester	II					
Instructional Hours per week		**Lecture**	**Tutorial**	**Lab Practice**	**Total**	**CIA**	**External**	**Total**
		2	-	--	2	25	75	100

Pre-requisite:

Students should be aware of importance of honey bees and their impacts on the ecosystem.

Learning Objectives

	Students should know basic concepts in Apiculture.

UNIT	**Details**	**No. of Periods for the Unit**
I	Introduction to Apiculture. History, classification, types, life Cycle of different species of Honey Bees and their behavioural patterns. Social organization of bee colony	
II	Bee-keeping system, tools and equipment's needed for bee keeping. Types of bee hives, structure and functional features. Criteria for site selection for apiculture and factors affecting them.	
III	Identification and characteristics and Preventive measures to be taken against of different bee enemies. Diseases affecting honey bees and their control measures. Colony collapse disorder and its management.	
IV	products, uses and importance- Honey, Royal jelly, Propolis, Pollen and Bee venom. Harvesting, Processing, Packaging and Marketing of bee products.	
V	culture industry around the world and Role of Central Bee Research & Training institute in India. Apiculture as an Entrepreneurial venture.	

Course Outcomes

Course Outcomes	On completion of this course, students will be able;
CO1	Clear understanding of morphology, life cycle, characteristics of honey bees and bee keeping.
CO2	Acquired skills to perform bee keeping from managing colonies of bees in order to harvest honey and other Bee related by-products in different setups and as an Entrepreneurial venture.
CO3	Knowledge on the harvesting, preserving and processing of bee products and identification of the appropriate markets to sell the produce.

Text Books (Latest Editions)

01. Caron, D.W. 2013 (revised from 1999). Honey Bee Biology and Beekeeping. Wicwas Press. Cheshire, CT, 368 pp.
2. Kaspar, R., C. Cook, and M. D. Breed. 2018. Animal Behaviour 142: 69-76.
3. Hendriksma, H. P., A. L. Toth, and S. Shafir. 2019. Individual and Colony Level Foraging decisions of Bumble Bees and Honey Bees in Relation to Balancing of Nutrient Needs. Frontiers in Ecology and Evolution 7: 177.
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Mapping with Programme Outcomes*

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	L	L	S	L	S	S	L	M
CO2	S	S	S	S	S	S	L	L	S	S
CO3	S	L	M	M	S	M	M	L	L	L
CO4	M	S	L	S	L	M	L	M	M	M
CO5	S	L	L	S	L	M	L	L	M	L

*S - Strong; M - Medium; L-Low