

DEPARTMENT OF ZOOLOGY

COURSE STRUCTURE & SYLLABI (For the students admitted from year 2023-2024 onwards)

Programme : B.Sc. Zoology



JAMAL MOHAMED COLLEGE (AUTONOMOUS)
Accredited with A++ Grade by NAAC (4th Cycle) with CGPA 3.69 out of 4.0
(Affiliated to Bharathidasan University)
TIRUCHIRAPPALLI – 620 020

B.SC. ZOOLOGY

Sem	Course Code	Part	Course Category	Course Title	Ins. Hrs/ Week	Credit	Marks		Total
							CIA	ESE	
I	23U1LT1/LA1/LF1/LH1/LU1	I	Language - I		6	3	25	75	100
	23UCN1LE1	II	English - I	English for Communication - I	6	3	25	75	100
	23UZO1CC1	III	Core - I	Biology of Invertebrates	5	5	25	75	100
	23UZO1CC2P		Core - II	Biology of Invertebrates - Practical - I	3	3	20	80	100
	23UCH1AC1:2		Allied - I	Inorganic, Organic and Physical Chemistry - I	5	4	25	75	100
	23UCH1AC2P		Allied - II	Volumetric Estimations - Practical	3	2	20	80	100
	23UCN1AE1	IV	AECC - I	Value Education	2	2	-	100	100
	Total				30	22			700
II	23U2LT2/LA2/LF2/LH2/LU2	I	Language - II		6	3	25	75	100
	23UCN2LE2	II	English - II	English for Communication - II	6	3	25	75	100
	23UZO2CC3	III	Core - III	Biology of Chordates	6	6	25	75	100
	23UZO2CC4P		Core - IV	Biology of Chordates - Practical - II	3	3	20	80	100
	23UCH2AC3:2		Allied - III	Inorganic, Organic and Physical Chemistry - II	4	4	25	75	100
	23UCH2AC4P		Allied - IV	Organic Analysis - Practical	3	2	20	80	100
	23UCN2SS	IV	Soft Skills Development	Soft Skills Development	2	2	-	100	100
	23UCN2CO	V	Community Outreach	JAMCROP	-	@	-	-	@
	23U2BT1 / 23U2AT1		Basic Tamil - I / Advanced Tamil - I	எழுத்தும் இலக்கியமும் அறிமுகம் - I / தமிழ் இலக்கியமும் வரலாறும் - I	-	-	-	100 [#]	-
	@Only grades will be given Total				30	23			700
III	23U3LT3/LA3/LF3/LH3/LU3	I	Language - III		6	3	25	75	100
	23UCN3LE3	II	English - III	English for Communication - III	6	3	25	75	100
	23UZO3CC5	III	Core - V	Cell & Molecular Biology	4	4	25	75	100
	23UZO3CC6P		Core - VI	Cell & Molecular Biology - Practical - III	3	3	20	80	100
	23UBO3AC5		Allied - V	Applied Botany - I	4	4	25	75	100
	23UBO3AC6P		Allied - VI	Laboratory Course for Applied Botany - I - Practical	3	2	20	80	100
	23UZO3GE1	IV	Generic Elective - I		2	2	-	100	100
	23UCN3AE2		AECC - II	Environmental Studies	2	2	-	100	100
	Total				30	23			800
IV	23U4LT4/LA4/LF4/LH4/LU4	I	Language - IV		6	3	25	75	100
	23UCN4LE4	II	English - IV	English for Communication - IV	6	3	25	75	100
	23UZO4CC7	III	Core - VII	Animal Physiology and Ethology	5	5	25	75	100
	23UZO4CC8P		Core - VIII	Animal Physiology and Ethology - Practical - IV	3	3	20	80	100
	23UBO4AC7		Allied - VII	Applied Botany - II	5	4	25	75	100
	23UBO4AC8P		Allied - VIII	Laboratory Course for Applied Botany - II - Practical	3	2	20	80	100
	23UZO4GE2	IV	Generic Elective - II		2	2	-	100	100
	23UCN4EL		Experiential Learning	Internship	-	2	-	100	100
	23UCN4EA	V	Extension Activities	NCC, NSS, etc.	-	1	-	-	-
	23U4BT2 / 23U4AT2		Basic Tamil - II / Advanced Tamil - II	எழுத்தும் இலக்கியமும் அறிமுகம் - II / தமிழ் இலக்கியமும் வரலாறும் - II	-	-	-	100 [#]	-
	Total				30	25			800
V	23UZO5CC9	III	Core - IX	Biostatistics, Bioinformatics & Computer Application in Biology	6	6	25	75	100
	23UZO5CC10		Core - X	Genetics	5	5	25	75	100
	23UZO5CC11		Core - XI	Microbiology and Parasitology	5	5	25	75	100
	23UZO5CC12		Core - XII	Developmental Biology	5	5	25	75	100
	23UZO5DE1AP/BP	IV	Discipline Specific Electives - I		5	4	20	80	100
	23UZO5SE1		Skill Enhancement Course - I	Applied Zoology & Entomology	2	1	-	100	100
	23UZO5SE2		Skill Enhancement Course - II	Poultry Science	2	1	-	100	100
	23UZO5EC1		Extra Credit Course - I*	Online Course	-	*	-	-	-
	Total				30	27			700
VI	23UZO6CC13	III	Core - XIII	Biochemistry and Biophysics	6	6	25	75	100
	23UZO6CC14		Core - XIV	Immunology	6	6	25	75	100
	23UZO6CC15		Core - XV	Environmental Biology and Evolution	5	5	25	75	100
	23UZO6PW		Project Work	Project Work	3	2	-	100	100
	23UZO6DE2AP/BP		Discipline Specific Electives - II		5	4	20	80	100
	23UZO6DE3A/B		Discipline Specific Electives - III		4	4	25	75	100
	23UCN6AE3	IV	AECC - III	Gender Studies	1	1	-	100	100
	23UZO6EC2		Extra Credit Course - II**	Online Course	-	*	-	-	-
	23UZOECA		Extra Credit Course for all**	Online Course	-	**	-	-	-
	23UCN6ECA1		Extra Credit Course for all*	Entrepreneurship Development	-	+	-	-	-
	* Programme Specific Online Course for Advanced Learners ** Any Online Course for Enhancing Additional Skills + Course for Enhancing Entrepreneurial Skills Total				30	28			700
Grand Total					148				4400

GENERIC ELECTIVE COURSES

Semester	Course Code	Course Title
III	23UZO3GE1	Human Nutrition and Health
IV	23UZO4GE2	Vermiculture Technology and Organic Farming

Self-Study Course – Basic and Advanced Tamil

Applicable to the candidates admitted from the academic year 2023 -2024 onwards)

Semester	Course Code	Course Title
II	23U2BT1	Basic Tamil – I (எழுத்தும் இலக்கியமும் அறிமுகம் - I)
	23U2AT1	Advanced Tamil – I (தமிழ் இலக்கியமும் வரலாறும் - I)
IV	23U4BT2	Basic Tamil – II (எழுத்தும் இலக்கியமும் அறிமுகம் - II)
	23U4AT2	Advanced Tamil – II (தமிழ் இலக்கியமும் வரலாறும் - II)

Mandatory

Basic Tamil Course - I and II are offered for the students who have not studied Tamil Language in their schools and college.

Advanced Tamil Course - I and II are offered for those who have studied Tamil Language in their schools but have opted for other languages under Part - I.

DISCIPLINE SPECIFIC ELECTIVES

Semester	Course Code	Course Title
V	23UZO5DE1AP	Biostatistics, Bioinformatics & Computer application in Biology, Genetics, Microbiology and Developmental Biology - Practical - V
	23UZO5DE1BP	Bioinstrumentation - I Practical
VI	23UZO6DE2AP	Biochemistry and Biophysics, Immunology, Economic Entomology and Environmental Biology and Evolution - Practical - VI
	23UZO6DE2BP	Bioinstrumentation - II - Practical
	23UZO6DE3A	Biotechnology
	23UZO6DE3B	Introduction to Research Methodology

ALLIED ZOOLOGY FOR B.Sc. BOTANY

Sem	Course Code	Part	Course	Course Title	Ins. Hrs/ Week	Credit	Marks		Total
							CIA	ESE	
III	23UZO3AC5	III	Allied - V	General Zoology	4	4	25	75	100
	23UZO3AC6P		Allied - VI	General Zoology - Practical - I	3	2	20	80	100
			Total		7	6			200
IV	23UZO4AC7	III	Allied - VII	Economic Zoology	5	4	25	75	100
	23UZO4AC8P		Allied - VIII	Economic Zoology - Practical - II	3	2	20	80	100
			Total		8	6			200
			Grand Total		15	12			400

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
I	23UZO1CC1	Core – I	5	5	25	75	100

Course Title	BIOLOGY OF INVERTEBRATES						
SYLLABUS							
Unit	Contents						Hours
I	Taxonomy & Protozoa Principles and methods of taxonomy: Concepts of species and hierarchical taxa, biological nomenclature, classical and quantitative methods of animal taxonomy. Protozoa : General characters and classification of Protozoa up to classes Type study: Paramecium - general organization, nutrition, and reproduction. General topics: Plasmodium life cycle, Protozoan diseases in Man; Malaria, Leishmaniasis * Trichomoniasis, and Amoebiasis. *						15
II	Porifera & Coelenterata General characters and classification up to classes. Type study: Sycon- general organization and reproduction. Type study: Obelia- Structure of Obelia colony, Medusa and reproduction in Obelia. General topics: Canal system in Sponges, Corals and * coral types * and Coral Reefs. Polymorphism in Coelenterates						15
III	Platyhelminthes & Aschelminthes General characters and outline classification up to classes. Type study: Liver fluke (Fasciola)-Morphology, excretory and reproductive System and lifecycle. Type study: Ascaris- Morphology, excretory and reproductive system. General topics: Helminth parasites in Man. *Economic importance of Nematodes*. Regeneration in Planaria						15
IV	Annelida & Arthropoda General characters and classification up to classes. Type study: Earthworm-Morphology, digestive, excretory and reproductive System. Type study: Grass Hopper morphology, digestive, Excretory and reproductive systems. General topics: Larval Forms in Crustacea, Mouth parts in Insects. * Evolutionary significance of Peripatus*						15
V	Mollusca & Echinodermata General characters and classification up to classes. Type study: Snail (Pila) – Morphology, Digestive, Respiratory, Excretory, and Reproductive systems. Type study: Starfish - Morphology, Water vascular system. Nutrition. General topics: Larval forms of Echinoderms. *Economic importance of Molluscs and Echinoderms *. Minor phyla: General account on Rotifera and Ectoprocta						15
VI	Current Trends (For CIA only) Hydra as experimental organism, Invertebrate fauna count in aquatic system, Pathological importance, Bio chemicals extraction from sepia, Glochidium larva culture and sauce preparation. Sea cucumber and its values, Protozoa and rotifers as bio indicators.						

..... Self Study

Text Book(s):
1. Ekambaranatha Ayyar, Outlines of Zoology. Vols. I & II S. Viswanathan (Printers & Publishers) Pvt. Ltd., Chennai. 1993.
Reference Book(s):
1. Jordan, E.L. and Verma. P. S. Invertebrate Zoology, S. Chand & Co. 3 rd Edition, 2007. 2. Kotpal, R.L. Invertebrates, Rastogi Publication, Meerut. 11 th Edition, 2017.
Web Resource(s):
1. Invertebrates NOAA Fisheries 2. Invertebrate - an overview Science Direct Topics 3. Invertebrate - New World Encyclopedia 4. DOCCM-3000682 Invertebrates: invertebrate identification aids 5. Biology of Invertebrate Chordates (thoughtco.com)

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Acquire knowledge on animal taxonomy and biology of Protozoans. Ability to classify Protozoans.	K1
CO2	Classify Porifera and Coelenterata and acquire knowledge on Poriferans and Coelenterates.	K2
CO3	Describe taxonomy of Platyhelminthes and Aschelminthes and acquire knowledge on the biology of Platyhelminthes and Aschelminthes.	K3
CO4	Classify Annelida and Arthropoda and acquire knowledge on the biology of Annelids and Arthropods.	K4
CO5	Report the classifying features of Mollusca and Echinodermata and acquire knowledge on the biology of Molluscs and Echinoderms.	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	3	3	2	2	3	2	2.7
CO2	3	3	3	3	3	3	2	2	3	2	2.7
CO3	3	3	3	3	3	3	2	2	3	2	2.7
CO4	3	3	3	3	3	3	2	2	3	2	2.7
CO5	3	3	3	3	3	3	2	2	3	2	2.7
Mean Overall Score											2.7
Correlation											High

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Mr. S.N. Sheik Umar Sahith

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
I	23UZO1CC2P	Core – II	3	3	20	80	100

Course Title	BIOLOGY OF INVERTEBRATES - PRACTICAL - I
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SYLLABUS	
Contents	Hours
Major Practical: Cockroach / Silk moth /Silkworm/ Earthworm -Nervous, Digestive and Reproductive systems Prawn – Nervous system	45
Minor Practicals: Identification of Mosquitoes (At genera level) Earthworm - Body setae & Penial setae Mouth parts -Honey Bee, Housefly, Mosquito, and Cockroach. Prawn - Appendages	
Spotters: a) Classify giving reasons: Entamoeba, Paramecium, Euglena, Sycon, Hydra, Obelia, Aurelia, Sea anemone, Planaria, Taenia, Ascaris, Nereis, Palaemon, Penaeus, Crab, Spider, Butterfly, Rhinoceros beetle, Pila, Freshwater mussel, Octopus, Chiton, Dentalium, Sepia, Starfish, Sea urchin and Sea cucumber b) Draw Labelled Sketch: T.S. of Taenia, T.S. of Fasciola, Ephyra larva, Nauplius larva, Zoea larva	
Spotters: c) Biological Significance: Sponge – Gemmule, Physalia, Leech, Peripatus, Limulus, Bipinnaria, d) Relate structure and function: Taenia –Scolex, Nereis – Parapodium, Penaeus –Petasma, Star fish –Tube feet and Pedicellariae, Earthworm - Body setae and Penial setae	
Group Project: Culture of Brine shrimp/ Drosophila/ Chironomous/ Plankton Record: A record of lab work shall be maintained and submitted at the time of Practical examination for valuation. Field study: Visit to any ecological park and submission of report with photographs Mosquito species identification Larval culture and importance	

Text Book(s):
1. Lal S S Practical Zoology of Invertebrates, Rastogi publications India 2010.
Reference Book(s):
1. Brusca&Brusca. Invertebrates, Second Edition. Sinauer Assoc., Inc. Sunderland, MASS, USA.2003. 1. Meglitsch,P.A. and Schram,F.R. Invertebrate Zoology (Third Edition). Oxford 2. UniversityPress,New York. 1991..
Web Resource(s):
1. http://www.itis.usda.gov/itis/status.html 2. http://www.bishop.hawaii.org/bishop/HBS/hbs1.html

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Understand the different functional systems of Cockroach, Silk moth through dissection	K1
CO2	Identify and prepare slides of various Invertebrate species to study their structures	K2
CO3	Classify providing apt features for the taxonomy, draw labelled sketches along with their biological significance	K3
CO4	Relate the structure and functions of selected Invertebrates	K4
CO5	Culture a few live feed organisms; make a thorough study on given ecosystem.	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	3	2	2	3	3	2	2.7
CO2	3	3	3	3	3	2	2	3	3	2	2.7
CO3	3	3	3	3	3	2	2	3	3	2	2.7
CO4	3	3	3	3	3	2	2	3	3	2	2.7
CO5	3	3	3	3	3	2	2	3	3	2	2.7
Mean Overall Score											2.7
Correlation											High

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Mr. S.N. Sheik Umar Sahith

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
I	23UCH1AC1:2	Allied – I	5	4	25	75	100
Course Title		Inorganic, Organic and Physical Chemistry – I					

SYLLABUS		
Unit	Contents	Hours
I	PERIODIC PROPERTIES, INDUSTRIAL GASES AND INSECTICIDES 1.1 Periodic properties: Ionization potential, *electron affinity* and electro negativity - Definition, factors affecting and variation in the periodic table. 1.2 Industrial Gases: Fuel gases composition and Preparation of Water gas, Producer gas, LPG, Gobar gas and Natural gas. 1.3 Insecticides: Introduction – Lists of various pesticides, methods of pest control, methods of using pest control chemicals. Insecticides – Arsenic compounds, Bordeaux mixture DDT and BHC.	15
II	BIOMOLECULES 2.1. Carbohydrates: Classification. Glucose and fructose – Preparation, properties and uses. Sucrose – Manufacture and properties. Starch and cellulose – uses. 2.2. Amino Acids and Proteins: Amino acids – Definition, classification – Essential and non essential, preparation and properties of glycine – Peptide bond – Proteins – Classification based on physical properties and biological functions. 2.3. Nucleic acids: DNA and RNA – Differences between DNA and RNA, functions - *Structure of DNA*.	15
III	BLOOD AND POLYMERS 3.1. Blood and Haematological agents: Blood – Composition of blood, Blood grouping and matching, Clotting of blood. Haematological agents – Coagulants – Vitamin K and Protamine sulphate. Anticoagulants – Coumarine and Heparin. 3.2. Polymers: Definition, classifications of polymers – Natural and synthetic polymers, Thermoplastic and thermosetting polymer. Addition and condensation polymerization. Preparation, properties and uses of polyethylene, *PVC, Teflon*, polystyrene, nylon 6, 6, and Bakelite.	15
IV	SEPARATION AND PURIFICATION TECHNIQUES 4.1 Separation Techniques: Distillation-steam, *fractional* and azeotropic distillation, crystallization – principles, working techniques and applications. 4.2 Chromatography – Paper, thin layer chromatography, HPLC and GC-MS - principle, experimental techniques and applications.	15
V	ACIDS - BASES AND CATALYSIS 5.1. Acids-Bases: Arrhenius, Lowry-Bronsted and Lewis concepts of acids and bases, pH, buffer solution, Henderson-Hasselbalch equation and its importance (no derivation) - Biological importance of pH and buffer solutions in living system. 5.2 Catalysis: Catalysis – Importance of catalysis. Types of catalysis - Homogeneous and heterogeneous catalysis, factors affecting catalysis. Definitions of catalytic promoter, *catalytic inhibitor, catalytic poison*. Theory of enzyme catalysis.	15

..... Self Study

Text Book(s):
1. P. L. Soni, Text book of Inorganic Chemistry, S. Chand & Co., New Delhi, Revised Edition, 2017 2. Jayashree Ghosh, Fundamental Concepts of Applied Chemistry, S. Chand & Co., New Delhi, First Edition, 2006 3. B.R. Puri, L.R. Sharma and M.S. Pathania, Principles of Physical Chemistry, Vishal Publications, Jalandhar, 48 th Edition, 2019

Reference Book(s):	
1. Puri B.R., Sharma L.R., Kalia K.K., Principles of Inorganic Chemistry, Shoban Lal, Nagin Chand & Co. New Delhi, 23 rd , 1993 2. Bahl and Arun Bahl, Advanced Organic Chemistry, S.Chand & Co., New Delhi, 19 th Edition, 2005 3. R. L. Madan, G.D. Tuli, Simplified Course in Physical Chemistry, S. Chand & Co., New Delhi, 5 th Revised and Enlarged, 2009	
Web Resource(s):	
1. https://onlinecourses.nptel.ac.in/noc22_cy03/preview 2. https://www.toppr.com/ 3. https://byjus.com/chemistry/	

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Describe the periodic properties, polymers and catalysis	K1
CO2	Classify the carbohydrates, amino acids, proteins and appraise their applications.	K2
CO3	Apply chromatographic techniques	K3
CO4	Analyse the blood groups	K4
CO5	Evaluate the value of pH of a solution	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	3	3	3	3	3	3	3
CO2	2	2	2	2	2	2	2	2	2	2	2
CO3	2	2	2	2	2	2	2	2	2	2	2
CO4	2	2	2	2	2	2	2	2	2	2	2
CO5	2	2	2	2	2	2	2	2	2	2	2
Mean Overall Score											2.2
Correlation											Medium

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinators: Mr. M. Varusai Mohamed

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
I	23UCH1AC2P	Allied – II	3	2	20	80	100
Course Title		VOLUMETRIC ESTIMATIONS - PRACTICAL					

List of Practicals	Hours
Volumetric Estimation Practicals 1. Estimation of Sodium Hydroxide (Na_2CO_3 Vs HCl Vs NaOH) 2. Estimation of Hydrochloric Acid ($\text{H}_2\text{C}_2\text{O}_4$ Vs NaOH Vs HCl) 3. Estimation of Oxalic Acid (FeSO_4 Vs KMnO_4 Vs $\text{H}_2\text{C}_2\text{O}_4$) 4. Estimation of Ferrous Sulphate ($\text{H}_2\text{C}_2\text{O}_4$ Vs KMnO_4 Vs FeSO_4) 5. Estimation of Ferrous Ammonium Sulphate ($\text{H}_2\text{C}_2\text{O}_4$ Vs KMnO_4 Vs $(\text{NH}_4)_2\text{Fe}(\text{SO}_4)_2 \cdot 6\text{H}_2\text{O}$) 6. Estimation of KMnO_4 ($\text{K}_2\text{Cr}_2\text{O}_7$ Vs FAS Vs KMnO_4) 7. Estimation of Zinc by EDTA (MgSO_4 Vs EDTA Vs ZnSO_4) 8. Estimation of Magnesium by EDTA (MgSO_4 Vs EDTA Vs MgSO_4) <div style="text-align: right;"> <u>Scheme of valuation</u> Record – 10 Marks Procedure writing – 10 Marks For Estimation – 60 Marks <u>For Estimation Results:</u> 1-2% - 60 marks 2-3% - 50 marks 3-4% - 40 marks >4% - 30 marks </div>	45

Text Books:
1. Peter McPherson, Volumetric Analysis, Royal Society of Chemistry, 1 st Edition 2014. 2. K.B. Baliga et al., College Analytical Chemistry, Himalaya Publishing House, 19 th Edition, 2011 3. Venkateswaran V. Veerasamy R. Kulandaivelu A.R, Basic Principles of Practical Chemistry, S. Chand & Co Pvt. Ltd, New Delhi, 2 nd Edition 1997.
Reference Books:
1. Handbook Of Inorganic Qualitative Analysis by Maharudra Chakraborty, Scifinity Publication; 1 st Edition 2019. 2. Vogel, Text Book of Quantitative Chemical Analysis,, Pearson Education, 6 th edition ,2009. 3. Day R A., Underwood A l., Quantitative Analysis, New York: Pearson Emory University. Print. 6 th edition, 1991
Web Resources:
1. https://www.studiestoday.com/useful-resources-chemistry-class-12-chemistry-practicals-volumetric-analysis-estimation-oxalic-0 2. https://ncert.nic.in/pdf/publication/sciencelaboratorymanuals/classXI/chemistry/kelm206.pdf

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Recall the principle of volumetric techniques and to classify the methods of preparation of solutions with different concentration.	K1
CO2	Estimate the concentration of a various solution	K2
CO3	Apply the principle of volumetric concept in the estimation	K3
CO4	Analyze the quality of portability of water	K4
CO5	Assess the quantity of chemical substance in a solution	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	2	3	3	1	2	2	2.5
CO2	3	3	3	3	1	3	3	2	2	2	2.5
CO3	3	3	3	2	2	3	3	2	3	1	2.5
CO4	2	1	2	3	3	3	3	3	3	3	2.6
CO5	3	3	2	2	3	3	3	3	3	2	2.7
Mean Overall Score											2.56
Correlation											High

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. S. K. Periyasamy

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
I	23UCN1AE1	AECC - I	2	2	-	100	100
Course Title		Value Education for Men					

SYLLABUS		
Unit	Contents	Hours
I	VALUES IN LIFE: Purpose and philosophy of life – Need for values –five fold moral culture. Values: truth, loyalty, integrity, humility, trustworthy, considerate, not being greedy, clean habits, punctuality, kindness, gratitude, patience, respect and character building.	6
II	PERSONAL WELLBEING: Social responsibility - taming a healthy mind and body – personal hygiene - Balanced diet – meditation – yoga - positive thinking – introspection - a passion for Nature- Win-win strategy.	6
III	ROLE OF MEN IN FAMILY: As a responsible student – committed employee - loyal husband - dedicated father – fatherhood- sacrificing human – considerate true friend.	6
IV	MAN A SOCIAL BEING: A friendly neighbour - living a life with definite motives – emotions and moral desire- uncompromising will power- puberty-secondary sexual characters- marriage: Purpose – marital life- Harmony with spouse- fidelity towards spouse.	6
V	PROFESSIONAL VALUES: More of a giver than a taker - being compassionate – patriotism - respecting culture - dependence on God – avoiding worry-professional ethics.	6

Hours of Teaching: 5 Hours and Hours of Activity: 25 Hours

Textbook(s):
1. Value Education for health, Happiness and harmony, the world community service centre, Vethathri Publications 2. N. Venkataiah, Value Education, APH Publishing Corporation, New Delhi, 1998 3. K.R. Lakshminarayanan and M. Umamageshwari, Value Education, Nalnilam Publication, Chennai.
Web References:
1. https://www.slideshare.net/humandakakayilongranger/values-education-35866000 2. https://www.ananda.org/blog/5-secrets-to-a-harmonious-marriage/ 3. https://www.un.org/esa/socdev/family/docs/men-in-families

Activity:

- Assignment on Values (not less than 20 Pages)
- Multiple Choice Questions and Quiz
- Elocution - (Manners and good Habits for 3 to 5 minutes)
- Field Visit
- Debating - Current issues
- Essay writing: Proper use of e-gadgets, Ethics, Cyber ethics, Social media, etc.,
- Case Study / Album Making / Poster Presentation / Documentary- Celebrating National Days, Drug abuse & illicit trafficking, Independence Day, Secularism, Teachers Day, National Youth Awakening Day, Father's Day / Mother's Day and etc.,

EVALUATION COMPONENT: TOTAL: 100 MARKS**Component I:**

Documentary (or) Poster Presentation (or) Elocution - 25 marks

Component II:

Quiz (or) Multiple choice questions Test - 25 marks

Component III:

Album Making (or) Case Study on a topic (or) Field visit - 25 marks

Component IV:

Assignment (or) Essay Writing (or) Debating - 25 marks

Course Coordinator: Dr. M. Purushothaman

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
I	23UCN1AE1	AECC - I	2	2	-	100	100
Course Title		Value Education for Women					

SYLLABUS		
Unit	Contents	Hours
I	VALUES IN LIFE: Purpose and philosophy of life – Need for values –five fold moral culture - Imbibing values: truth, loyalty, integrity, humility, trustworthy, considerate, not being greedy, clean habits, punctuality, kindness, gratitude, patience, respect and character building.	6
II	FAMILY: Nuclear – cluster – significance - social functions - changing trend - role of women in family - obedient daughter - purposeful youth- dedicated wife - caring mother.	6
III	PUBERTY: Need of knowledge of menstruation- menstrual symptoms – handling – menstrual disorder - maintaining good personal hygiene - motherhood- Stages of pregnancy- post pregnancy care.	6
IV	MARRIAGE: Types of marriage - purpose of marriage- love and infatuation – need for marital preparation - pre and post marital counselling - conflicts in marital life - divorce single parenthood.	6
V	HARMONY WITH SPOUSE: Husband and wife relationship - fidelity towards spouse-relationship among the family members. Tenets of bride for healthy family – kindness, respect, patience, care, love.	6

Hours of Teaching: 5 hours and Hours of Activity: 25 hours

Textbook(s):
1. Value Education for health, Happiness and harmony, the world community service centre, Vethathri Publications 2. N. Venkataiah, Value Education, APH Publishing Corporation, New Delhi, 1998 3. Betty, Carten and Meg Goldric, The Changing family life style - A Framework for Family Therapy, 2 nd Edition, 2000. 4. Marie, Madearentas, Family Life Education, CREST-Centre for research education service training for family promotion, Bangalore, 1999.
Web References:
1. https://www.slideshare.net/humandakakayilongranger/values-education-35866000 2. https://www.ananda.org/blog/5-secrets-to-a-harmonious-marriage/ 3. https://www.nap.edu/read/2225/chapter/14

Activity:

- Assignment on Values (not less than 20 Pages)
- Multiple Choice Questions and Quiz
- Elocution - (Manners and good Habits for 3 to 5 minutes)
- Field Visit
- Debating - Current issues
- Essay writing: Proper use of e-gadgets, Ethics, Cyber ethics, Social media, etc.,
- Case Study / Album Making / Poster Presentation / Documentary- Celebrating National Days, Drug abuse & illicit trafficking, Independence Day, Secularism, Teachers Day, National Youth Awakening Day, Father's Day / Mother's Day and etc.,

EVALUATION COMPONENT: TOTAL: 100 MARKS**Component I:**

Documentary (or) Poster Presentation (or) Elocution - 25 marks

Component II:

Quiz (or) Multiple choice questions Test - 25 marks

Component III:

Album Making (or) Case Study on a topic (or) Field visit - 25 marks

Component IV:

Assignment (or) Essay Writing (or) Debating - 25 marks

Course Coordinator: Dr. M. Purushothaman

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
II	23UZO2CC3	Core – III	6	6	25	75	100
Course Title BIOLOGY OF CHORDATES							

SYLLABUS		
Unit	Contents	Hours
I	Protochordates and Pisces General characters and outline classification. Type study: Amphioxus – Digestive, excretory and reproductive systems. Type study: Scoliodon & Mullet - External characters, Digestive, Respiratory, Circulatory, Nervous and Urinogenital systems General Topic: Retrogressive Metamorphosis in Urochordates, Evolutionary significance of Ostracoderms, * Fish migration*, Accessory respiratory organs in Fishes, Edible fishes of India.	18
II	Amphibia General characters and outline classification. Type study: Frog - External characters, Digestive, Respiratory, Circulatory, Nervous and Urinogenital systems General Topic: *Parental care in Amphibians*, Neoteny and Paedogenesis.	18
III	Reptilia General characters and outline classification. Type study: Calotes - External characters, Digestive, Respiratory, Circulatory, Nervous and urinogenital systems. General Topic: *Snakes of India*; Identification of Venomous and Non-venomous snakes. Evolutionary significance of Archaeopteryx.	18
IV	Aves General characters and outline classification. Type study: Pigeon - External Characters, Digestive, Respiratory, Circulatory and Urinogenital systems. General Topic: Flight adaptation and Migration in Birds, Beak, Feet & *Nesting* in Aves.	18
V	Mammalia General characters and outline classification. Type study: Rabbit - External characters, Digestive, Respiratory, Circulatory, Nervous and Urinogenital systems. General Topic: Dentition in Mammals, Adaptations of Aquatic Mammals & *Flying mammals*.	18
VI	Current Trends (For CIA only) – Recent discoveries in Chordate phyla IUCN Status of Chordates	

..... Self Study

Text Book(s):

1. EkambaranathaAyyar.M&Ananthakrishnan.T.N., A Manual of Zoology Vol.II- Part I & II., S.VishwanathanPvt.Ltd, Chennai, 2010.

Reference Book(s):

1. Kotpal, R.L. Modern text book of Zoology - VERTEBRATA, 4 th Edition, Rastogi Publication, Meerut., 2017-2018.
2. Jordan, E.L. & Verma, P.S. Chordate Zoology. New Delhi: S. Chand. (2013).
3. Springer, J.T. & Holley, D. An Introduction to Zoology: Investigating the Animal World. Massachusetts. Jones& Bartlett Learning (2013)

Web Resource(s):

1. www.earthlife.net
2. www.iaszoology.com
3. www.sanctuaryasia.com
4. www.oercommons.org

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Understand the general and specific characteristics of different classes and organization of Chordates	K1
CO2	Identify the general characters of Amphibians and relate them to their lifestyle.# - Self Study Portions	K2
CO3	Understand the taxonomy and morphology of Reptiles with reference to snakes in India	K3
CO4	Classify Aves and acquire knowledge on the biology and adaptations of Birds.	K4
CO5	Compare the Mammalian features with systems and significant adaptations.	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	3	1	2	1	3	3	3	3	2	2.3
CO2	2	3	1	2	1	3	3	3	3	1	2.3
CO3	2	3	1	2	1	3	3	3	3	2	2.4
CO4	2	3	1	2	1	3	3	3	3	2	2.4
CO5	2	3	1	2	1	3	3	3	3	1	2.3
Mean Overall Score											2.34
Correlation											Medium

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: P. A. ASHIQUE

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
II	23UZO2CC4P	Core – IV	3	3	20	80	100
Course Title		BIOLOGY OF CHORDATES – PRACTICAL - II					

SYLLABUS	
Contents	Hours
Major Practicals: Virtual laboratory technique: Arterial system, Venous system, Digestive system and Reproductive system of Frog/ Rabbit. Dissection: Digestive system, Nervous system and Reproductive system of Fish. Demo : Taxidermy	45
Minor Practicals: Mounting: Placoid, Ctenoid, Cycloid scales, Gill of fish, Fins of fish, Quill feather	
Spotters: a) Classify giving reasons: Balanoglossus, Ascidia, Amphioxus, Anabas, Tilapia, Eel, Exocetus, Echeneis, Rhacophorus, Ambystoma, Hemidactylus, Viper, Cobra, Duck, Eagle, Owl, Bat, Loris. b) Draw Labelled Sketches: T.S of Amphioxus, Poison apparatus of Snake; Frog - Pectoral girdle, Pigeon - Pelvic girdle c) Biological Significance: Ascidian tadpole larva, Ichthyophis, Chameleon, Exocetus – flying fish d) Relate structure and function: Echeneis- Sucker, Symsacrum in Bird, Rabbit - Dentition.	
Field Visit Visit to any biodiversity centre / spots and submission of report. Survey of Vertebrates in college campus and submission of report.	
Record Note * A record of lab work shall be maintained and submitted at the time of Practical Examination for valuation.	

Text Book(s):
1. Jayasurya., Arumugam, N., Thangamani., Prasannakumar., Narayanan.L.M. Practical Zoology Volume -2. Saras publication, Nagercoil. 2013.
Reference Book(s):
1. Ekambaranatha Ayyar, Outlines of Zoology. Vol. I & II S.Viswanathan (Printers &Publishers) Pvt. Ltd., Chennai,1993
Web Resource(s):
1. https://books.google.co.in/books?id=tEhO

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Compare different functional systems of Frog through virtual laboratory techniques	K1
CO2	Evaluate the patterns of Contours of scales in different fishes; and describe the types of Feathers in birds	K2
CO3	Classify and provide reasons for taxonomy; Sketch and label parts together with their biological significance	K3
CO4	Relate the structure and function of fishes, birds and mammals	K4
CO5	Compare and report the ecosystem	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	2	3	2	3	2	2	2.6
CO2	2	3	3	3	2	3	3	3	2	2	2.6
CO3	3	3	3	3	2	3	3	3	3	2	2.8
CO4	3	3	3	3	1	3	3	3	3	2	2.7
CO5	3	2	3	3	3	2	3	2	3	3	2.7
Mean Overall Score											2.68
Correlation											High

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: P.A. ASHIQUE

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
II	23UCH2AC3:2	Allied – III	4	4	25	75	100
Course Title		Inorganic, Organic and Physical Chemistry – II					

SYLLABUS		
Unit	Contents	Hours
I	INDIAN MEDICINAL PLANTS AND BIOLOGICALLY IMPORTANT COMPOUNDS 1.1 Indian Medicinal Plants: Hibiscus Rosa Sinesis - Adathoda Vasica - Azadirachta Indica – Solanum Trolobatum – Active Constituents and Medicinal uses. 1.2 Biologically important compounds: Haemoglobin and Chlorophyll- structure and biological role.	12
II	NUCLEAR CHEMISTRY 2.1 Structure of nucleus - Composition of nucleus, nuclear forces, nuclear stability-mass defect, binding energy, n/p ratio and magic numbers, *Definition of isotopes, isobars, isotones and isomers* 2.2 Radioactivity- Definition, types of radioactivity, Properties of α , β and γ rays: Detection and measurement – Wilson cloud chamber and G.M. Counter, nuclear fusion and fission reactions, applications of radio isotopes – in analytical chemistry, in medicine, rock dating and carbon dating	12
III	VITAMINS AND DRUGS 3.1 Vitamins – Definition, classification. Sources and deficiency diseases of vitamins A, D, E, K, B ₆ , B ₁₂ and C. 3.2 Drugs: Sulpha drugs - Definition, structure and uses of sulphapyridine and sulphathiazole. Antibiotics – Definition, structure and uses of penicillin and Chloromycetin. Antipyretics - Definition, structure and uses of paracetamol and aspirin. Anti inflammatory - Definition, structure and uses of ibuprofen and Naproxen.	12
IV	ENZYMES AND HORMONES 4.1 Enzymes- Classification of enzymes, chemical nature, factors affecting rate of enzyme action, specificity of enzyme action, mechanisms of enzyme action – lock and key, biological functions of enzymes, applications of enzymes- therapeutic, analytical, industrial uses. 4.2. Hormones- introduction, structure and physiological functions - Adrenaline, thyroxine, oxytocin and insulin.	12
V	COLLOIDS 5.1. Colloids: Definition, colloidal solution and suspension, phases of colloidal solution-Electrical properties – *Electrophoresis and Electro osmosis (definition and uses only)* - protection of colloids – Gold number- medicinal applications of colloids. 5.2 Emulsion: definition, types, preparation, properties and applications. 5.3. Gels: definition, types, preparation, properties and applications.	12

..... Self Study

Text Book(s):
1. Puri B.R., Sharma L.R., Kalia K.K., Principles of Inorganic Chemistry, Shoban Lal, Nagin Chand & Co. New Delhi, 23 rd , 1993
2. P. L. Soni and H.M. Chawla, Text Book of Organic Chemistry, S. Chand & Co., New Delhi, 28 th Edition, 1999
3. Jayashree Ghosh, Fundamental Concepts of Applied Chemistry, S. Chand & Co., New Delhi, First Edition, 2006

Reference Book(s):
1. R. D Madan, Modern Inorganic Chemistry, S. Chand & Co., New Delhi, 2 nd reprint, 1987
2. A .K. Srivastava, Organic Chemistry, New Age International Publishers, New Delhi, 1 st Edition, 2002
3. R. L. Madan, G.D. Tuli, Simplified Course in Physical Chemistry, S. Chand & Co., New Delhi 5 th revised and enlarged Edition, 2009
Web Resource(s):
1. https://onlinecourses.nptel.ac.in/noc22_cy20/preview
2. https://www.toppr.com/
3. https://byjus.com/chemistry/

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Describe the Indian medicinal plants, types of radioactivity and physiological functions of hormones	K1
CO2	Discuss the properties of alpha, beta and gamma rays	K2
CO3	predict the sources and deficiency diseases of vitamins and illustrate the various drugs	K3
CO4	Classify the enzymes and explain the mechanism of enzyme action	K4
CO5	Compare the phases of colloidal solutions and predict the applications	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	3	3	3	3	3	3	3
CO2	2	2	2	2	2	2	2	2	2	2	2
CO3	2	2	2	2	2	2	2	2	2	2	2
CO4	2	2	2	2	2	2	2	2	2	2	2
CO5	2	2	2	2	2	2	2	2	2	2	2
Mean Overall Score											2.2
Correlation											Medium

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinators: Dr. R. Abdul Vahith

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
II	23UCH2AC4P	Allied - IV	3	2	20	80	100
Course Title		Organic Analysis - Practical					

List of Practicals	Hours
Qualitative analysis of the following organic compounds: <ol style="list-style-type: none"> Carbohydrate Amide Aldehyde Ketone Monocarboxylic acid Dicarboxylic acid Amine <p style="text-align: center;"><u>Scheme of valuation</u></p> <p>Record – 10 Marks Procedure writing – 10 Marks For Organic Analysis – 60 Marks</p> <p><u>For Organic Analysis Results Marks Distribution:</u></p> <p>(i) Special Elements Present/ Absent - 20 marks (ii) Aromatic/ Aliphatic - 10 marks (iii) Saturated/ Unsaturated - 10 marks (iv) Functional Group Present - 20 marks</p>	45

Text Books:
1. Ganapragasm N S and Ramamurthy G, Organic Chemistry Lab Manual, S. Vishwanathan Printers and Publishers (P) Ltd., Chennai, 2 nd Edition, 2007. 2. Venkateswaran V. Veerasamy R. Kulandaivelu A.R, Basic Principles of Practical Chemistry, S. Chand & Co Pvt. Ltd, New Delhi, 2 nd Edition, 1997. 3. Furniss B S, et al., Vogel's Textbook of Practical Organic Chemistry, ELBS Longman, London, 7 th Edition, 1984.
Reference Books:
1. A. I. Vogel's, Text Book of Practical Organic Chemistry, Prentice Hall, 5 th Edition, 1989.
Web Resources:
1. https://jru.edu.in/studentcorner/lab-manual/bpharm/Lab%20Manual%20-%20%20Pharmaceutical%20Organic%20Chemistry.pdf 2. https://ncert.nic.in/pdf/publication/sciencelaboratorymanuals/classXII/chemistry/lelm108.pdf 3. https://faculty.chas.uni.edu/~manfredi/860-121/ORG%20LAB%20MAN%20S08.pdf

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Recall the preliminary tests of organic qualitative analysis.	K1
CO2	Differentiate the aliphatic and aromatic nature of the organic compounds	K2
CO3	Examine the nature of the organic compound	K3
CO4	Separate the functional groups through appropriate chemical reactions	K4
CO5	Summarize their results of the organic analysis in a scientific way.	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	2	3	3	3	2	2	2.7
CO2	3	2	3	3	3	3	3	2	3	1	2.6
CO3	3	2	3	3	2	3	3	3	2	2	2.4
CO4	3	2	1	3	3	3	3	3	3	2	2.6
CO5	3	2	3	1	2	3	3	2	3	1	2.3
Mean Overall Score											2.52
Correlation											High

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. S. Syed Abuthahir

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
II	23UCN2SS	Soft Skills Development	2	2	-	100	100
Course Title		Soft Skills Development					

SYLLABUS		
Unit	Contents	Hours
I	Communication Skills: Verbal and Non - Verbal communication - The active vocabulary - Conversational Etiquette - KOPPACT syndrome	6
II	Emotional Skills: Emotional Intelligence - The five steps to Emotional Quotient - Self Awareness and Regulation - Empathy - Social Intelligence - stress management - coping with failures	6
III	Functional Skills: Using the tools of communicatory and emotional skills - Resume writing - Preparation of Curriculum Vitae - interview skills - Acing the interview - Group dynamics - Mock interviews and Group discussions	6
IV	Interpersonal Skills: Synergising relationships - SWOT analysis - SOAR analysis - The social skills - Time Management - Decision making - problem solving - prioritising and Implementation	6
V	Personality Skills: Leadership skills - Attributes and Attitudes - Social leader Vs The Boss - critical and creative thinking	6

Hours of Teaching : 5 hours and Hours of Activity: 25 hours

Textbook(s):
1. Social intelligence: The new science of human relationships - Daniel Goleman; 2006. 2. Body Language in the workplace - Allan and Barbara Pease; 2011. 3. Student's Hand Book: Skill Genie - Higher education department, Government of Andhra Pradesh.
Web References:
1. https://nptel.ac.in/courses/109105110

EVALUATION CRITERIA

Work Book (Each unit carries 10 marks)	-	50 Marks
Examination	-	50 Marks

1. Teacher who handles the subject will award 50 marks for work book based on the performance of the student.
2. On the day of examination the examiners (Internal & External) will jointly award the marks for the following categories:
 - Self-Introduction - 20 Marks
 - Resume - 10 Marks
 - Mock Interview - 20 Marks

To assess the self-introduction, Examiners are advised to watch the video presentation submitted by the students. If they failed to submit the video presentation, the Examiners may direct the student to introduce himself orally and a maximum 10 marks only will be awarded.

Mock Interview Marks Distribution

(20-Marks)

Attitude (self interest, confidence etc.) (4 Marks)	Physical appearance including dress code (4 Marks)	Communication Skills (6 Marks)	Answering questions asked from the resume and work book (6 Marks)
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Course Coordinator: Dr. M. Syed Ali Padusha

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
III	23UZO3CC5	Core - V	4	4	25	75	100
Course Title		CELL & MOLECULAR BIOLOGY					

SYLLABUS		
Unit	Contents	Hours
I	Cell Organization: Prokaryote and Eukaryote cell - Cell organization and components, Ultra structure of Plasma membrane – *Unit membrane*, Fluid mosaic model and functions. Cytoplasm: Components and functions.	12
II	Cell Organelles: Ultra structure and functions of Endoplasmic Reticulum, Ribosomes, Golgi complex, *Lysosomes* and Mitochondria.	12
III	Nucleus and Cell Division: Structure and functions of Nucleus, Nucleolus, Nuclear envelope, *Nuclear pore complex* and Chromosomes. Cell Cycle and Cell division - Mitosis and Meiosis.	12
IV	Nuclear Material and Protein Synthesis: DNA and RNA: Molecular structure, Types and functions of DNA and RNA. DNA replication. Protein synthesis: Transcription and *Translation*.	12
V	Cancer Biology: Cancer cells: Characteristics, causes and types, treatment and prevention- Oncogenes – *Apoptosis*- <u>Theories on Carcinogenesis</u> -Tumor suppressor Gene.	12
VI	Current Trends * (For CIA only) – DNA Finger Printing Technology, <u>Nano based delivery system in Cancer treatment.</u>	

*.....*Self-study

Text Book(s):
1. Verma, P.S. and Agarwal, V.K., Cytology, 3 rd Edition, Chand & Co., Ltd. Delhi. 2020. 3. Ajoy Paul. Text Book of Cell and Molecular Biology. IV Edition, Books and Allied (P)Ltd.2015 4. Gupta, P.K. Cell and molecular Biology. Rastogi Publications, Meerut, 2004
Reference Book(s):
1. De Robertis, E.D.P., and De Robertis, E.M.F., Cell and Molecular Biology, VIII Ed., Lippincott Williams & Wilkins, A Wolters Kluwer India Pvt., Ltd. 2020, 2. Geoffrey, M. Cooper and Robert E. Hausman., The Cell – A Molecular Approach. 5th Edition. Asm Press, Sinauer, Washington D.C. USA. 2007. 3. Alberts et al., Molecular Biology of the Cell. 4th Edition, Garland Science, A Member of the Taylor and Francis group, New York, USA. 2002. 4. Cooper, G. M. “The Cell – A Molecular Biological Approaches”. ASM Press, Washington, 2013.
Web Resource(s):
1. https://en.wikipedia.org/wiki/Cell_(biology) 2. https://www.ncbi.nlm.nih.gov/books/NBK9940/ 3. http://marjoriebrandlab.com/sitebuildercontent/sitebuilderfiles/hfspworkshop.pdf 4. http://genome.tugraz.at/MolecularBiology/WS11_Chapter_12.pdf 5. https://en.wikipedia.org/wiki/Cell_cycle

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Analyse the mechanism of cell organization and regulation of cellular components how cells are functioning.	K1, K2
CO2	To construct and simulate the role of different cytological tools to explain the structure and complexity of cells and cell organelles.	K2, K3
CO3	Integrate the knowledge of Nucleus and their components and Define the cell cycle processing and division of Mitosis and Meiosis..	K3,K5
CO4	Generate the knowledge of the Nucleic acids and Analyse the role of DNA and RNA and Advanced knowledge of the protein synthesis.	K4, K5
CO5	Compare the different tissue samples of cancer cells and processing and chemistry of cancer cells	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	2	2	2	3	2	2	2	3	3	2.3
CO2	1	2	2	2	3	1	2	2	2	3	2.0
CO3	2	2	2	2	3	3	3	3	3	3	2.6
CO4	2	2	3	3	3	2	2	3	3	3	2.6
CO5	1	2	2	2	3	2	2	2	3	3	2.2
Mean Overall Score											Medium
Correlation											2.34

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. K. Prabakar

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
III	23UZO3CC6P	Core - VI	3	3	20	80	100
Course Title CELL & MOLECULAR BIOLOGY – PRACTICAL - III							

SYLLABUS		
Unit	Contents	Hours
	<p>Major Practical:</p> <ol style="list-style-type: none"> 1. Squash preparation of Onion root tip for study of Mitotic stages. 2. Squash preparation of grasshopper testis for Meiotic stages. 3. Smear preparation of human blood for RBC and WBC studies. 4. Isolation of DNA from blood samples <p>Minor Practical:</p> <ol style="list-style-type: none"> 1. Squash preparation of Salivary gland of Chironomous larva for Polytene Chromosome studies 2. Squash preparation of Salivary gland of Drosophila larva for Polytene Chromosome studies. <p>Mounting:</p> <ol style="list-style-type: none"> 1. Mounting of muscle fibers 2. Measurement of cell dimensions by using stage and ocular micro meter 4. Skeletal muscle: Sarcomeres and myofibrils Cardiac muscles: Heart muscles Smooth muscles: CS of artery Fibrous muscles: CS of tendon <p>Demo:</p> <ol style="list-style-type: none"> 1. Study of Compound Microscope: Setting and Handling Procedure. 2. Separation of DNA using Agarose gel electrophoresis <p>Models:</p> <ol style="list-style-type: none"> 1. DNA, tRNA and DNA replication. 2. Cancer <p>Spotters:</p> <p>Types of Microscope: Compound microscope, Electron microscope (TEM & SEM), Phase contrast microscopy, Confocal microscopy, Dark-field microscopy, Fluorescence microscopy, Scanning probe microscopy.</p> <p>Epithelial, Muscular, Vascular tissues. Cancer cells, sarcoma, myeloma, Lymphoma and Leukemia</p> <p>Record Work</p> <p>A record of lab work shall be maintained and submitted at the time of Practical Examination for valuation.</p>	45
	Current Trends (For CIA only) – Nutrient composition of vermicompost – Advantages of sea food – Health benefits of egg.	

Text Book(s):
1. Chaitanya, K.V. A Lab Manual of Cell and Molecular Biology, Prentice Hall India Learning Private,2013.
Reference Book(s):
1.Trigunayat, M.M. A Manual of Practical Zoology: Biodiversity, Cell Biology, Genetics & Developmental Biology, Scientific Publishers 2019. 2.Mehdi Laboratory Procedures In Haematology Manual, Jaypee Brothers Medical Publishers 2006.
Web Resource(s):
1 https://www.bjcancer.org/Sites_OldFiles/_Library/UserFiles/pdf/Cell_Biology 2. https://sjce.ac.in/wp-content/uploads/2018/04/Cell-Biology-Genetics-Labor 3. https://byjus.com/physics/types-of-microscope/

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Apply the knowledge on Microscope and Analyse the stages of Onion root tip of Mitotic and Meiotic stages.	K1, K2
CO2	Analyse the Human blood to study of blood components	K2, K3
CO3	Integrate the knowledge of Salivary gland of Chironomous Larva and Drosophila processing of polytene chromosome	K3,K4
CO4	Analyse the DNA by Blood samples and separate the molecules by using AGE	K4, K5
CO5	Compare the different muscles and creating models of bio molecules	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	2	2	2	3	2	2	2	3	3	2.3
CO2	1	2	2	2	3	1	2	2	2	3	2.0
CO3	2	2	2	2	3	3	3	3	3	3	2.6
CO4	2	2	3	3	3	2	2	3	3	3	2.6
CO5	1	2	2	2	3	2	2	2	3	3	2.2
Mean Overall Score											Medium
Correlation											2.34

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. K. Prabakar

Semester	Course Code	Course Category	Hours / Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
III	23UBO3AC5	Allied – V	4	4	25	75	100
Course Title	Applied Botany – I						
Syllabus							
Unit	Contents						Hours
I	Algae: General characteristics and outline classification of algae (F. E. Fritsch, 1935). Thallus organization, food reserve and habitats of algae. A detailed study of structure, reproduction, life cycle (excluding development stages) and economic uses of the following genera – *Oscillatoria*, Chlorella, Sargassum and Gracilaria. Cultivation methods of fresh water (Spirulina), and marine (Kappaphycus) algae.						12
II	Fungi and Lichens: General characteristics and outline classification of fungi (Alexopoulos and Mims, 1979). Detailed study of occurrence, morphology, reproduction and life cycle of the following genera – Albugo, Brief account on cultivation of edible mushroom (Pleurotus). Introduction to medicinal mushrooms (Ganoderma) and antibiotic producing fungi (Penicillium). Brief account on production of citric acid and acetic acid from fruit peel waste. *Lichens – General characters, types and economic importance of Lichens*.						12
III	Bryophytes: General characteristics and outline classification of Bryophytes (Watson, 1971). Structural description (excluding development stages) of the following genera – Marchantia and Polytrichum. A brief mention of use of bryophytes for antibiotics, anti-cancer, food, ornamental, non-absorbant bandage and pesticides. Environmental importance of mosses in pedogenesis and *peat bog*.						12
IV	Pteridophytes: General characteristics and outline classification of Pteridophytes (Sporne, 1975). Structural description (excluding developmental stages) of the following genera – Lycopodium and Adiantum. and *Economic importance of Pteridophytes*. Cultivation of Azolla.						12
V	Gymnosperms: General characters and outline classification of gymnosperms (Sporne, 1967). Morphology, anatomy, reproduction, life cycle (excluding developmental stages) and economic uses of Cycas. Importance of gymnosperms as wood and resins (Pinus), anti-cancer drug (Taxus and Ephedra). A brief study of types and application of fossil plants in paleoclimatology and *climate models*.						12

..... Self-Study

Text Book(s):
1. Vasishta PC, Sinha AK and Kumar A, Botany for Degree Students (Volumes), 2 nd Edition, Chand & Company Pvt Ltd, New Delhi, India, 2010.
2. Hait G, Bhattacharya K and Ghosh AK, A Text Book of Botany, 5 th Edition, New Central Book Agency Pvt Ltd, Kolkata, India, 2011.
3. Sharma OP, Plants and Human Welfare, Prakathi Prakashan Publications Pvt Ltd, Meerut, India, 2015.

Reference Book(s):

1. Alexopoulos CJ, Mims CW and Blackwell M, Introductory Mycology, 4th Edition, Wiley Publishers, New Delhi, India, 2007.
2. Sharma OP, A Text Book of Algae, 1st Edition, Tata McGraw Hill Education Pvt Ltd, New Delhi, India, 2011.

Course Outcomes

Course Outcomes: Upon successful completion of this course, the student will be able to:

CO No.	CO Statement	Cognitive Level (K-level)
CO1	Outline the diversity of cryptogams and seed plants.	K1
CO2	Identify the economic uses of natural wealth from cryptogams and seed plants.	K2
CO3	Perceive the alternative uses of and applications of cryptogams and seed plants.	K3
CO4	Appraise the values of natural wealth from cryptogams and seed plants.	K4
CO5	Recommend alternative bio resources for human welfare.	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	2	2	1	1	3	1	1	3	2
CO2	2	2	2	2	1	3	1	1	3	2	1.9
CO3	1	1	3	3	2	1	1	2	2	1	1.7
CO4	2	2	2	3	1	1	1	1	1	1	1.5
CO5	2	2	2	3	1	1	1	1	1	1	1.5
Mean Overall Score											1.7
Correlation											Medium

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. A. Aslam

Semester	Course Code	Course Category	Hours / Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
III	23UBO3AC6P	Allied - VI	3	2	20	80	100
Course Title		Laboratory Course for Applied Botany - I – Practical					

Syllabus		
	Contents	Hours
	<ol style="list-style-type: none"> Generic level identification of algal specimens in a mixture. <ol style="list-style-type: none"> <i>Oscillatoria</i> <i>Chlorella</i> <i>Spirulina</i> <i>Sargassum</i> <i>Gracilaria</i> Identification of following fungi in both host as well as permanent slides <ol style="list-style-type: none"> <i>Albugo</i> <i>Saccharomyces</i> Observation of external and internal structure of <ol style="list-style-type: none"> <i>Marchantia</i> <i>Polytrichum</i> <i>Lycopodium</i> <i>Adiantum</i> <i>Cycas</i> <i>Pinus</i> Identification of spotters related to economic uses of species mentioned in theory 	45

Text Book(s):
<ol style="list-style-type: none"> Santra SC, Chatterjee TP and Das AP, College Botany Practical (Volume II), 1st Edition (Reprinted), New Central Book Agency Pvt Ltd, Kolkata, India, 2001. Pandey BP, Modern Practical Botany, 1st Edition (Reprinted), Chand & Company Pvt Ltd, New Delhi, India, 2011. Sharma OP, Practical Botany, 7th Edition, Pragati Prakashan Educational Publishers Pvt Ltd, Meerut, India, 2014.

Course Outcomes		
Course Outcomes: Upon successful completion of this course, the student will be able to:		
CO No.	Course Outcomes	Cognitive Level (K-level)
CO1	Experience laboratory skills of handling botanical specimens.	K1
CO2	Describe diversity of plants.	K2
CO3	Demonstrate preparation and curation of botanical specimens.	K3
CO4	Identify commercial potential of cryptogams.	K4
CO5	Appraise the traits and key characters of cryptogams.	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	1	3	1	3	1	3	3	2	1	1	1.9
CO2	1	3	1	1	2	3	3	2	1	1	1.8
CO3	2	1	1	3	1	1	3	2	1	1	1.6
CO4	1	3	2	1	1	1	3	2	1	1	1.6
CO5	1	3	1	3	1	1	3	2	1	1	1.7
Mean Overall Score											1.7
Correlation											Medium

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. A. Aslam

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
III	23UZO3GE1	Generic Elective - I	2	2	-	100	100
Course Title		Human Nutrition and Health					

SYLLABUS		
Unit	Contents	Hours
I	UNIT I: Human Nutrition: Definition – Dimensions of health. Health education: Definition – objectives – principles. Nutrition and health: -Balanced diet: macronutrients – micronutrients – vitamins and minerals, Malnutrition - Hygiene Practices of the different categories of family members Food hygiene: perishable – nonperishable – shelf life – sterilization – *food poisoning*.	6
II	UNIT II: Environment and Health: Water, Air and Noise pollution. Pollutants: Effects, prevention and control -- Effects of smoking and alcoholism. Causes effects and control measures of Life style diseases: Stroke - Obesity – type 2 diabetes - Food adulteration: common adulterants, and health hazards. *Food standards and food laws*. National and International; PFA, FSSAI, HACCP, ISI.	6
III	UNIT III: Concept of Disease: Phases of disease – Pre-pathogenesis and Pathogenesis –concept of prevention and control – Common Protozoan, Helminthic and *Arthropod borne diseases* Communicable and Non-communicable diseases. Immunity: Types of vaccinations– Live – Attenuated – Killed – Toxoid – Transgenic. Immunization schedule in India.	6
IV	UNIT IV: Communicable Diseases: Bacterial and Viral diseases – Causative agents and control measure. Mode of transmission: air – water – droplets – contact - Symptoms and treatment of Cholera, Tuberculosis, Typhoid, Hepatitis A & B and AIDS. Environmental Sanitation - *Family planning*: Definition – scope – contraceptive devices - Vitamin deficiencies.	6
V	UNIT V: Mental Health: Definition - characteristics – causes and prevention of mental health - Occupational health & hazards– prevention. Basic aspects of personal hygiene – Alzheimer - Parkinson's. Health care services – Primary health care – Super Speciality Hospitals – *Principles of First Aid* – First aid procedures for Accidents, food poisoning, snakebites and heart attacks.	6
VI	Current Trends * (For CIA only) – Contemporary developments related to the course during the semester concerned.	

..... Self-Study

Text Book(s):
1. E. Park & Park: Textbook of Preventive and Social Medicine, Published by Banarsidos Bhanot, 2019
2. Ananthanarayanan,R and Jayaram Panicker, C. K. Text Book of Microbiology, Orient Longman, Chennai-2000.
3. Sharma.P.D Environmental Biology and Toxicology, Rastogi Publication 2003
Reference Book(s):
1. Richard.t Wright, Dorothy F,Boorse, Environmental Science, PHI Learning Publication, New Delhi,2011.
2. Dubey R.C and Maheswari D.K. Text book of Microbiology, S.Chand and Company Ltd, New Delhi.2009.
3. Thomas, C.G.A. Medical Microbiology, ELBS Publications. 1988.
4. Sarada Subramanyam and Madavankutty.K, Text book of Human Physiology S.Chand Publication-2014.

Web Resource(s):	
1.	https://Mal
2.	https://bio.libretexts.org/Bookshelves/Microbiology/Book%3A_Microbiology_(Kaiser)
3.	https://www.pdfdrive.com/medical-microbiology-d18737002.html
4.	https://markmanson.net/5-books-for-dealing-with-anxiety-and-depression .
5.	https://protect.iu.edu/environmental-health/public-health/communicable-diseases/index.html .

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	1. Understand the dimensions of Health education, importance of Balanced diet and Food hygiene.	K3
CO2	2. Demonstrate the relationship between Environment and Health and control measures of Life style diseases.	K2
CO3	3. Classify the common infectious disease & control and preventive measures.	K4
CO4	4. List the basic principles of medical microbiology; it covers mechanisms of disease transmission, diagnosis and control.	K2
CO5	5. Acquire knowledge on Human Mental Health and able to apply these principles to understanding and provide First Aid.	K3

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	1	2	2	2	3	2	2	3	2	2	2.1
CO2	3	3	3	3	2	3	2	2	2	2	2.5
CO3	2	2	3	3	3	2	3	3	3	3	2.7
CO4	3	3	2	3	2	2	3	2	2	3	2.5
CO5	3	2	3	2	3	3	2	3	3	3	2.7
Mean Overall Score											2.50
Correlation											High

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator : Dr. R. Krishnamoorthy

Semester	Course Code	Course Category	Hours / Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
III	23UCN3AE2	AECC – II	2	2	-	100	100
Course Title		Environmental Studies					

Unit	Contents	Hours
I	The multidisciplinary nature of environmental studies Definition, scope, importance, awareness and its consequences on the planet.	6
II	Ecosystems: Definition, structure and function of ecosystem; Energy flow in an ecosystem: food chain, food web and ecological succession. Case studies of the following ecosystems: a) Forest ecosystem b) Grassland ecosystem c) Desert ecosystem d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)	6
III	Natural Resources: Land use change; Land degradation, soil erosion and desertification. Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations. Water: Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter-state). Heating of earth and circulation of air; air mass formation and precipitation. Energy resources: Renewable and non-renewable energy sources, use of alternate energy sources, growing energy needs, case studies. renewable energy resources significance of wind, solar, hydal, tidal, waves, ocean thermal energy and geothermal energy.	6
IV	Biodiversity and Conservation: Levels of biological diversity: genetic, species and ecosystem diversity; Biogeography zones of India; biodiversity hot spots. mega-biodiversity countries; Endangered and endemic species of India. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; Conservation of biodiversity: <i>In situ</i> and <i>Ex situ</i> conservation of biodiversity. Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value.	6
V	Environmental Pollution & Conservation: Environmental pollution: types, causes, effects and controls; Air, water, soil, chemical and noise pollution Waste to wealth - Energy from waste, value added products from waste, fly ash utilization and disposal of garbage, solid waste management in urban and rural areas, Swachh Bharat Abhiyan, recent advances in solid waste management, modern techniques in rain water harvesting and utilization.	6

Text books:

1. Asthana DK and Meera A, Environmental studies, 2nd Edition, Chand and Company Pvt Ltd, New Delhi, India, 2012.
2. Arumugam N and Kumaresan V, Environmental studies, 4th Edition, Saras Publication, Nagercoil, Tamil Nadu, India, 2014.

Activity – I:

1. Assignments – Titles on Environmental awareness to be identified by teachers from the following (scripts not less than 20 pages)
2. Elocution – (Speech on “Environment beauty is the fundamental duty” of citizen of the country for 3 to 5 minutes)
3. Environment issues – TV, Newspaper, Radio and Medias messages – Discussion ∞ Case Studies/Field Visit/Highlighting Day today environmental issues seen or heard
4. Debating/Report Submission – Regarding environment issues in the study period Activity II
5. Environmental awareness through charts, displays, models and video documentation.

Celebrating Nationally Important Environmental DaysNational Science Day – 28th FebruaryWorld wild life Day – 3rd MarchInternational forest Day – 21st MarchWorld Water Day – 22nd MarchWorld Meteorological Day – 23rd MarchWorld Health Day – 7th AprilWorld Heritage Day – 18th AprilEarth / Planet Day – 22nd AprilPlants Day – 26th MayEnvironment Day – 5th June Activity III Discipline specific activities**EVALUATION COMPONENT:**

Component I: (25 Marks) Document (or) Poster presentation or Elocution

Component II: (25 Marks) Album making (or) case study on a topic (or) field visit

Component III: (25 Marks) Essay writing (or) Assignment submission

Component IV: (25 Marks) Quiz (or) multiple choice question test

Course Outcomes**Course Outcomes:** Upon successful completion of this course, the student will be able to:

CO No.	CO Statement	Cognitive Level (K-level)
CO1	To understand the multi-disciplinary nature of environmental studies and its importance	K1
CO2	To obtain knowledge on different types of ecosystem	K2
CO3	To acquire knowledge on Renewable and non-renewable resources, energy conservation	K3
CO4	To understand biodiversity conservation	K4
CO5	To analysis impact of pollution and conversion waste to products	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	02	02	02	02	02	03	03	03	03	03	2.5
CO2	02	03	03	02	03	03	03	03	03	03	2.8
CO3	02	03	03	03	03	03	03	03	03	03	2.9
CO4	02	02	03	03	03	03	03	03	03	03	2.8
CO5	02	03	03	03	03	03	03	02	03	03	2.8
Mean Overall Score											2.7
Correlation											High

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. B. Balaguru

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
IV	23UZO4CC7	Core - VII	5	5	25	75	100
Course Title		Animal Physiology and Ethology					

SYLLABUS		
Unit	Contents	Hours
I	Nutrition and Digestion Nutritional requirements and Balanced Diet – Carbohydrates, Proteins, Lipids, Minerals and Vitamins. Human digestive System – Digestive glands and enzymes – Physiology of Digestion – Absorption – *Assimilation*.	15
II	Respiration and Circulation Respiration: External and Internal respiration – Respiratory organs and pigments - Transport of O ₂ and CO ₂ – Respiratory Quotient – Anaerobiosis – Adaptations to high altitude and diving. Circulation: Types, Composition and functions of Blood. Human heart - Cardiac Cycle and Rhythm – *ECG and Blood Pressure*.	15
III	Excretion and Homeostasis Excretion: Types and products - Human Kidney - Structure of Nephron – Ornithine cycle - Physiology of Urine formation – Dialysis. Homeostasis: Regulatory mechanisms: Osmoregulators and Osmoconformers – Osmoregulation in Crustaceans and fishes – Mechanism of Thermoregulation – *Acclimation and acclimatization*.	15
IV	Muscle, Nerve and Endocrine Types of muscles – Ultra structure of skeletal muscle – Mechanism of muscle contraction. Neuron: Structure and types – Transmission of nerve impulse through neuron – Endocrine glands : Pituitary , Hormonal regulation in human reproduction. – *Reflex action and reflex arc* –Photo, Phono, Tango and Mechanoreceptors.	15
V	Ethology Introduction to ethology – Mechanism of behavior – Learning and Instinct : Conditioning , habituation, Sensitization, reasoning – Social organization : Honey bee colony, foraging – Bee dance Communication: Songs of Birds & behavior – territory defending – Alarm calls in animals – signals , Crypsis & Mimicry.	15
VI	Current Trends (For CIA only) – National Organ Transplantation Programme – Medical achievement.	

..... Self Study

Text Book(s):
1. Rastogi, S.C., Essentials of Animal Physiology, IV Edition, New Age International (P) Ltd, Publishers, 2007.
2. P.D.Sharma., Ecology and Environment, Rastogi Publication, Meerut. 2012
Reference Book(s):
1. R. Nagabhushanam, M.S. Kodarkar, R. Sarojini, Textbook of Animal Physiology. Second Edition, Oxford & IBH Publishing Co. PVT. LTD. 2002
3. Guyton and Hall, Text book of Medical Physiology- Elsevier Health – INR; second Edition (2016).
4. Hoar, W.S., General and Comparative Physiology (3 rd Edition), Prentice Hall of India, New Delhi. 1991,
5. Ladd, C. Prosser and Frank A. Brown, Comparative Animal Physiology, W.B. Saunders Co., Philadelphia, 2002.
6. Schmit - Nelson.K.(1997) Animal Physiology Adaptation and environment, Cambridge Univ. Press.
7. Beck, Human Design, Harcourt Brace Jorandrich Inc. 1971.
8. Dawson, H. General Physiology, Little Brown Co. Boston. . 1964.
9. Echert, R. and Randall, D., Animal Physiology, CBS Publishers and Distributors,1987.

10. Prosser, CL. and Brown Fo. Comparative Animal Physiology Second Edition. WB Saunders Co Philadelphia, Toppa Co Tokyo, Japan (1961).
11. Reena mathur., Animal Behaviour, Rastogi Publication, Meerut. 2010
12. Mohan P. Arora., Animal Behavior, Himalaya Publishing House, 1995.

Web Resource(s):

1. <https://nptel.ac.in/courses/102/104/102104042/>
2. <https://courses.lumenlearning.com>digestive system/Anatomy and Physiology>
3. <https://www.lung.ca>lung .infor>respiratory system>
4. <https://www.khanacademy.org/science/biology/behavioral-biology/animal-behavior/a/intro-to-animal-behavior>
5. <https://www.nature.com/scitable/knowledge/library/an-introduction-to-animal>

Course Outcomes

Upon successful completion of this course, the student will be able to:

CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Record the significance of nutrition and balanced diet; report the physiology of digestion, absorption and assimilation.	K3
CO2	Appraise the components of the respiratory and circulatory systems and their role.	K2
CO3	Summarize the excretory products; demonstrate the structure and functions of kidney and homeostatic mechanisms.	K3
CO4	Interpret the muscle types, mechanisms in neurotransmission and hormonal role in reproductive physiology	K4
CO5	Social organization and behavior patterns in animal	K3

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	3	3	3	2	2	3	2.7
CO2	3	3	3	3	3	3	3	2	2	3	2.7
CO3	3	3	3	3	3	3	3	2	2	3	2.7
CO4	3	3	3	3	3	3	3	2	2	3	2.7
CO5	3	3	3	3	3	3	3	2	2	3	2.7
Mean Overall Score											2.7
Correlation											High

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. A. Sadiq Bukhari

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
IV	23UZO4CC8P	Core - VIII	3	3	20	80	100
Course Title ANIMAL PHYSIOLOGY AND ETHOLOGY – PRACTICAL - IV							

SYLLABUS		
Unit	Contents	Hours
	<p><u>Experiments:</u></p> <ol style="list-style-type: none"> 1. Human Salivary Amylase activity in relation to Temperature and pH. 2. Identification of Nitrogenous Waste Products. 3. Total count of RBC in human blood. 4. Total count of WBC in human blood. 5. Differential count of WBC in human blood. 6. Quantitative tests for Carbohydrates, Proteins, and Lipids. 7. Simple tests for Sugar, Albumin, and Urea in Human Urine. 8. Estimation of Haemoglobin in human blood. 9. Estimation of the rate of O₂ consumption in fish with reference to body weight. 10. Focal animal sampling & preparation of ethogram. 11. Multimedia demonstration of social behaviour in monkeys, lions & elephants. 12. Multimedia demonstration of courtship and brood behaviour in birds. <p><u>SPOTTERS</u> Centrifuge, pH meter, Colorimeter, ECG, Sphygmomanometer, pregnancy test kit, Haemoglobinometer, Haemocytometer, Amino acids Model, Mimicry Model.</p> <p>Record Work</p> <p>A record of lab work shall be maintained and submitted at the time of Practical Examination for valuation.</p>	45
	Current Trends * (For CIA only) – Nutrient composition of vermicompost – Advantages of sea food – Health benefits of egg.	

* A record of lab work to be maintained and submitted at the time of Practical examination for valuation.

Text Book(s):
1. Verma. P.S and Srivastava. P.C Advanced Practical Zoology, S .Chand Publication, 2000.

Reference Book(s):
Rastogi, S. C. Essentials of Animal Physiology. Wiley Eastern Limited. New Delhi.1979. 2. Hoar, S. Williams. General and Comparative Physiology. Prentice Hall.1987. 3. Parameswaran, R., Anantha Krishnan, T. N. Anantha Subramanian. Outlines of Animal Physiology, K. S. Viswanathan Pvt. Ltd. Chennai. 4. Singh, H. R. Animal Physiology and Related Biochemistry. SHOBAN Lal Nagin Chand and co., Educational Publishers, New Delhi. 5. Rajan .S and Selvi Christy. Environmental Procedure in Life Sciences, Anjanaa Book House, Chennai, 2012 6. Chausgari. A.R, Text book of Practical Physiology, Paras Publication, Bangalore, 200
Web Resource(s):
1. http://www.phys.szote.u-szeged.hu/edu/angla/labprac1+2.pdf 2. https://www.slideshare.net/vidhyakalaivani29/animal-physiology-and-biochemistry-lab-manual-647180

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Analyze the physiological processes that regulates body functions	K3
CO2	Understand and evaluate the physiology of circulation, respiration and excretion.	K2
CO3	Analyse the adaptations, mechanism of homeostasis in invertebrates and vertebrates.	K4
CO4	Estimate the quantum of different nutrients and the determine nitrogenous waste products	K3
CO5	Adopting sampling process and demonstration of social behaviour through Multimedia.	K2

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	2	2	2	3	2	2	2	3	3	2.3
CO2	1	2	2	2	3	1	2	2	2	3	2.0
CO3	2	2	2	2	3	3	3	3	3	3	2.6
CO4	2	2	3	3	3	2	2	3	3	3	2.6
CO5	1	2	2	2	3	2	2	2	3	3	2.2
Mean Overall Score											2.3
Correlation											Medium

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. A. Sadiq Bukhari

Semester	Course Code	Course Category	Hours / Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
IV	23UBO4AC7	Allied – VII	5	4	25	75	100
Course Title		Applied Botany – II					

Syllabus		
Unit	Contents	Hours
I	<p>Plant morphology: Parts of a plant – root, Stem and Leaf and their modifications with examples – Simple and compound leaves - Phyllotaxy - Inflorescence - Racemose, Cymose, Mixed and Special types - Terminology of floral parts, diagram and formula.</p> <p>Anatomy: Primary internal structure of root and stem in dicots and monocot.</p>	15
II	<p>Systems of Classification: Artificial (Linnaeus system) - Natural (Outline of Bentham and Hooker's system; its merits and demerits). Plant Nomenclature - Brief account of ICN, Herbarium technique. Study of the general characteristics and economic importance of Annonaceae, Rutaceae, Caesalpiniaceae, Rubiaceae, Cucurbitaceae, Apocynaceae, Euphorbiaceae and Arecaceae.</p>	15
III	<p>Economic Importance of plants: Plant diet for cardio, renal, hypertension, aging, bone, detox and mental health. Non-alcoholic beverage plants – Coffee, Tea therapy (green tea) Tea extract capsules, Cocoa, Chocolate, Gano-coffee, herbal 'teas' (<i>Psidium</i>, <i>Mangifera</i>). Prebiotic fibre plants (<i>Murayya</i>, <i>Cyamopsis</i>), Cereals, pseudo-cereals and *small grain cereal and their value addition as food supplements and snacks*.</p>	15
IV	<p>Oil yielding plants: Essential oils – applications – perfumes (rose, ylang-ylang, jasmine, lemon grass oil, rosemary and sandalwood oil). Food supplement oils – linseed, flax seed oils as source of omega-3-fatty acid. Vegetable oils – coconut, palm oil. Soapbark, soapwort, soap berries, soap pods. Preparation of organic herbal soap. *Importance of herbal cosmetics*.</p>	15
V	<p>Plant physiology Water relations in plants – osmosis, transpiration and hydrological cycle. Types and factors affecting transpiration. Water footprint of products and processes. Photosynthesis: apparatus, pigments – light (z-scheme) and dark reaction – outline of Calvin cycle. A brief mention of difference between C3, C4 and CAM pathway and their relevance to indoor gardening. Introduction to carbon sequestration and *carbon banking*. – Aerobic and anaerobic respiration (fermentation - and its importance). Plant growth regulators – types. *Commercial application of auxin in horticulture*.</p>	15

..... Self-Study

Text Book(s):
<ol style="list-style-type: none"> 1. Rao KN, Krishnamurthy KV and Rao GS, Ancillary Botany, 1st Edition, Viswanathan Pvt Ltd, New Delhi, India, 1983. 2. Shukla RS and Chandel PS, Ecology and utility of plants, 2nd Edition, Chand & Company Pvt Ltd, New Delhi, India, 2008 3. Sharma OP, Plants and Human Welfare, 2nd Edition, Prakathi Prakashan Publications Pvt Ltd, Meerut, India, 2015.

Reference Book(s):
1. Jeffrey C. An Introduction to Plant Taxonomy, 1 st Edition, Cambridge University Press, United Kingdom, 1982. 2. Pandey BP. Taxonomy of Angiosperms, 2 nd Edition, Chand & Company Pvt Ltd, New Delhi, India, 1999.

Course Outcomes		
Course Outcomes: Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-level)
CO1	Outline the diversity of cryptogams and seed plants.	K1
CO2	Identify the economic uses of natural wealth from cryptogams and seed plants.	K2
CO3	Perceive the alternative uses of and applications of cryptogams and seed plants.	K3
CO4	Appraise the values of natural wealth from cryptogams and seed plants.	K4
CO5	Recommend alternative bio resources for human welfare.	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	2	1	1	1	2	1	1	2	1.6
CO2	3	2	2	1	1	2	1	1	3	2	1.8
CO3	1	1	2	1	1	1	1	3	3	1	1.5
CO4	3	2	2	1	1	1	1	1	3	2	1.7
CO5	3	2	2	1	1	1	1	1	3	2	1.7
Mean Overall Score											1.6
Correlation											Medium

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. A. Aslam

Semester	Course Code	Course Category	Hours / Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
IV	23UBO4AC8P	Allied - VIII	3	2	20	80	100
Course Title	Laboratory Course for Applied Botany - II – Practical						

Syllabus	
Contents	Hours
<p>List of Practical</p> <p>A. Angiosperm morphology and taxonomy (drawing and description of specimens only):</p> <ol style="list-style-type: none"> 1. Parts of a dicot plant (<i>Amaranthus</i>) 2. Phyllotaxy (<i>Annona</i>, <i>Psidium</i>, <i>Quisqualis</i>, <i>Nerium</i>, <i>Allamanda</i>, <i>Acalypha</i> and <i>Mollugo</i>) 3. Compound leaves (<i>Azadirachta</i>, <i>Butea</i>, <i>Albizzia</i>, <i>Moringa</i>, <i>Cleome</i>) 4. Parts of a flower (<i>Tribulus</i>) 5. Racemose inflorescence (<i>Crotalaria</i>, <i>Mangifera</i>, <i>Caesalpinia</i>, <i>Achyranthes</i>, <i>Cocos</i>, <i>Allium</i>, <i>Tridax</i>) 6. Cymose inflorescence (<i>Jasmine</i>, <i>Clerodendron</i>, <i>Hamelia</i>, <i>Heliotropium</i>, <i>Mollugo</i>) 7. Mixed and special (<i>Ficus</i>, <i>Leucas</i>, <i>Euphorbia cyathophora</i>, <i>Ocimum</i>, <i>Zizyphus</i>) 8. Description and identification features for the families (Annonaceae, Rutaceae, Caesalpiniaceae, Rubiaceae, Apocynaceae, Cucurbitaceae, Euphorbiaceae, and Arecaceae). <p>B. T.S of stem and root in dicots (<i>Tridax</i>) and monocots (<i>Zea mays</i>)</p> <p>C. Nutritional quality analysis of plants (Minor experiments):</p> <ol style="list-style-type: none"> 1. Analysis of nutritional quality of plants using chart 2. Estimation of ascorbic acid (vitamin-C) 3. Determination of moisture content in plant samples. 4. Observation of oxidative darkening of vegetables and fruits. 5. Observation of gluten formation in natural foods. <p>D. Physiology experimental set up</p> <ol style="list-style-type: none"> 1. Ganong's photometer 2. Light screen experiment 3. Demo of paper chromatography 4. Bell jar experiment for oxygen evolution 5. Observation of Kranz anatomy of leaves 6. Observation of transpiration in leaves. 	45

<p>Text Book(s)</p> <ol style="list-style-type: none"> 1. Mehta AS and Verma AP, Experiments in Plant Physiology, 1st Edition, Chand & Company Pvt Ltd, New Delhi, India, 1987. 2. Pandey BP, Modern Practical Botany, 1st Edition (Reprinted), Chand & Company PvtLtd, New Delhi, India, 2011. 3. Sharma OP, Plants and Human Welfare, 2nd Edition, Prakathi Prakashan Publications PvtLtd, Meerut, India, 2015.

Course Outcomes		
Course Outcomes: Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-level)
CO1	Illustrate the external characters of flowering plants.	K1
CO2	Classify the flowering plants based on their external characters.	K2
CO3	Appraise the plants as useful resources for human use and welfare.	K3
CO4	Recommend unique food supplements and herbal value-added products.	K4
CO5	Solve the problems related with human environment applying physiology principles.	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	1	1	2	3	1	3	1	2	1	1.8
CO2	3	1	1	2	3	1	3	1	2	1	1.8
CO3	3	2	1	2	3	1	3	1	2	1	1.9
CO4	3	2	1	2	3	1	3	1	2	1	1.9
CO5	3	1	1	2	3	1	3	1	2	1	1.8
Mean Overall Score											1.8
Correlation											Medium

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. A. Aslam

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
IV	23UZO4GE2	Generic Elective - II	2	2	-	100	100

Course Title	VERMICULTURE TECHNOLOGY AND ORGANIC FARMING
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SYLLABUS		
Unit	Contents	Hours
I	Distribution- Different types of earthworms. General body structure- External characters- Body Setae- Food and feeding habits, digestive system - *Gut microflora and their importance* - Reproductive system..	6
II	Advantages of Vermiculture – Vermicast - Decomposition of bio - degradable Wastes and vermicomposting - Selection of suitable species - Basic characteristics of suitable species - Description of suitable species Maintenance of Base culture	6
III	Vermicomposting - Advantages of vermicomposting - small scale and large scale vermicomposting. Type of Vermicomposting - Worm-casts, vermicompost, vermiwash- production techniques. Requirements for Vermicomposting - maintenance of vermicomposting.	6
IV	Recycling of different wastes by vermicomposting - Organic wastes - Solid wastes - Municipal wastes - Animal Dung - Agricultural wastes. Application of Vermicompost - In horticulture and agriculture.	6
V	Role of earthworms in sustainable agriculture - organic farming - Earthworm activities - soil fertility and texture - soil aeration. Effect of vermicompost application on soil and plant growth, Vermicompost and organic manure and a good substitute for chemical fertilizers.	6
VI	Current Trends (For CIA only) – Contemporary developments related to the course during the semester concerned.	

..... Self study

Text Book(s):
1.Seethalekshmy,M. & Dr.R. Santhi. Vermitechnology, Saras Publications, Nagercoil. 2012.
Reference Book(s):
1. Edwards CA & Bater JE. Biology of Earthworms. Chapman and Hall.1977 2. Edwards CA. Earthworm Ecology. CRC Press.1998. 3. Sultan Ahmed Ismail,. The Earthworm book. 2nd Revised Edition. India Press, Goa, India.2005.
Web Resource(s):
1. https://www.researchgate.net/publication/281632191_Vermiculture_Technology_An_Option_for_Organic_Recycling .

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Remember the concepts on the significance of earthworms.	K1
CO2	Understand the importance of Basic characteristics of suitable species	K2
CO3	Apply the significance of Vermicomposting methods.	K3
CO4	Analyze the importance of Recycling different wastes	K4
CO5	Evaluate the role of earthworms in sustainable agriculture and organic farming	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	2	3	2	2	3	2	2.6
CO2	2	3	2	3	3	3	2	2	3	2	2.5
CO3	3	3	3	2	3	3	2	2	3	2	2.6
CO4	3	3	2	3	3	2	2	2	3	2	2.5
CO5	3	3	3	3	3	3	2	2	3	2	2.7
Mean Overall Score											2.58
Correlation											High

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. S. Mohamed Hussain

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
V	23UZO5CC9	Core – IX	6	6	25	75	100

Course Title	BIostatistics, Bioinformatics & Computer Application in Biology
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SYLLABUS		
Unit	Contents	Hours
BIostatistics		
I	Descriptive Statistics Statistical data: Sources and types – Collection and Tabulation of data - Presentation of data: Line diagram, Bar diagram, Histogram, *Frequency Polygon*, Pictogram and Pie chart, Cube diagram, Box plot and line plot – Concept of Population and sample. Sample and sampling Measures of central tendency: Mean, Median, and Mode.	18
II	Descriptive and Inferential Statistics Measures of dispersion: *Mean deviation*, Standard Deviation and Standard Error – Moments, Kurtosis and Skewness, – Null Hypothesis – Test of significance: Chi square test Student ‘t’ test – Probability types – Theoretical distribution: Binomial, Poisson and Normal.	18
Bioinformatics		
III	Biological Databases Definition, History, Scope, and Importance – Symbols used in databases – Primary databases: GENBANK, NCBI, PIR, DDBJ and *EMBL* – Secondary databases: MMDB and OMIA, OMIM, and PDB – Composite databases: Expasy– Sequence retrieval system – Relationship between databases.	18
IV	Bioinformatics tools Classification – Sequence alignment methods- Features and application BLAST, FASTA, Swiss Model, RasMol – Phylogenetic analysis: Phylogenetic Tree, Structure, construction and interpretation – DNA barcoding – Genomes and *proteomes*.	18
COMPUTER APPLICATION IN BIOLOGY		
V	Computers and its Application in Biology Generations of Computers – Types of computers – Components of computer and properties – Computer applications : Computers in remote sensing, Scanning, Microscopy, Microarray technology, Chromatography, and in DNA sequencing. Statistical packages – *MS EXCEL in Statistics*	18
VI	Current Trends * (For CIA only) Artificial intelligence in bioinformatics, Bioinformatics in molecular medicines	

..... Self Study For Theory Core Course, wherever possible

Text Book(s):
<ol style="list-style-type: none"> 1. Rastogi, V.B., Fundamentals of Biostatistics. Ane's books ltd., New Delhi. 2006. 2. Ram, B. Computer Fundamentals – Architecture and organization – Wiley Eastern Ltd. New Delhi. 1995. 3. Sundaralingam R and Kumaresan Bioinformatics, Saras Publications, Nagercoil. 2015 <p>EXCEL BIBLE</p>

Reference Book(s):
1. Arora, P.N., Biostatistics, Himalaya Publishing House. 1998. 2. Ramakrishnan, P., Biostatistics, Saras Publications, Nagercoil. 1996. 3. Ravikant, T., PC Software made simple, Tata McGraw Publishing Co Ltd. 1995. 4. V. Rajaraman. Fundamentals of Computer, Prentice Hall of India. 1985. 5. Murthy, C.S.V., Bioinformatics, Himalaya Publishing House, Mumbai, India. 2003
Web Resource(s):
Web references: 1. https://en.wikipedia.org/wiki/Bioinformatics 2. https://www.roseindia.net/bioinformatics/history_of_bioinformatics.shtml 3. https://www.coursera.org/lecture/bioinformatics-pku/history-of-bioinformatics-0i4EF 4. http://bioinformaticshistory.blogspot.com/ 5. https://bioinf.comav.upv.es/courses/biotech3/theory/databases.html 6. http://bioinformaticssoftwareandtools.co.in/bio_database.php 7. http://bioinformaticssoftwareandtools.co.in/bio_tools.php 8. https://www.sciencedirect.com/topics/medicine-and-dentistry/dna-barcoding 9. https://www.toppr.com/bytes/collection-of-data/ 10. https://statisticsbyjim.com/basics/measures-central-tendency-mean-median-mode/ 11. https://statistics.laerd.com/statistical-guides/measures-central-tendency-mean-mode-median.php 12. https://www.abs.gov.au/websitedbs/a3121120.nsf/home/statistical+language+-+measures+of+central+tendency 13. https://www.computerscience.org/resources/computer-programming-languages/ 14. https://en.wikibooks.org/wiki/Computer_Programming 15. https://en.wikibooks.org/wiki/Statistics/Methods_of_Data_Collection

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Explain descriptive statistics	K1-K5
CO2	Describe and discuss inferential statistics in biology	K1-K5
CO3	Acquire and analyze the different biological databases and their applications	K1-K5
CO4	Evaluate and apply the tools of bioinformatics and their methods of application in molecular Biology	K1-K5
CO5	Illustrate computers and their applications in biology	K1-K3

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	3	3	3	2	2	3	2.7
CO2	3	3	3	3	3	3	3	2	2	3	2.7
CO3	3	3	3	3	3	3	3	2	2	3	2.7
CO4	3	3	3	3	3	3	3	2	2	3	2.7
CO5	3	3	3	3	3	3	3	2	2	3	2.7
Mean Overall Score											2.7
Correlation											High

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Mr. S. N. SHEIK UMAR SAHITH

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
V	23UZO5CC10	Core - X	5	5	25	75	100
Course Title		Genetics					

SYLLABUS		
Unit	Contents	Hours
I	Mendelian Principles Law of Segregation and law of Independent Assortment - Monohybrid and Dihybrid Experiments – * Test cross and Back cross * — Multiple alleles – Mendelian traits in animals - Genetics of ABO blood group, Rh Blood group in man- linkage and crossing over – Gene mapping by crossing over experiments.	15
II	Sex Determination Chromosomal theory of sex determination - Mechanism of sex determination (Drosophila and Man)–Genetic balance theory - Hormonal theory of sex determination(Free martin, Sex reversal in man and chicken) *Environmental determination of sex * - Sex linked inheritance and Types - Colour blindness and Haemophilia – Y-linked inheritance	15
III	Gene Concepts Structure of Chromosome and Gene – Cistron , Muton, and Recon - DNA as the genetic material (<i>Hershey and Chase</i> Experiment) - Fine structure of gene – Gene regulation: ‘Lac’ and ‘His’ Operon- Gene mutation Chromosomal aberration – (Numerical and structural) – Mutable and mutator genes - Causes of mutation.- Types of mutation:Point mutation, Frameshift mutation - Gene mutation Mutation – * Chemical mutagens *- DNA damage and DNA repair mechanism.	15
IV	Microbial Genetics Introduction of microbial genetics – Bacterial genome - Recombination in Bacteria, Transformation, * Conjugation *, Sexduction and Transduction. T4 Bacteriophage – Complementation test in Bacteriophage – Transposable elements in prokaryotes: IS elements, Transposons, Transposon 3A family.	15
V	Human Genetics Human chromosomes and human Karyotypes - Syndromes in man: Turner, Klinefelter’s, and Downs Syndrome - Pedigree analysis. Dizygotic and Monozygotic twins - Inborn Errors of Metabolism and genetic disorders in Man: Phenylketonuria, Alkaptonuria, Albinism, * Thalassemia *, Sickle cell anaemia - Genetic counseling (Eugenics, Euthenics and Euphenics) - Human genome project	15
VI	Current Trends * (For CIA only) – Diagnostic of Genetic diseases and Gene therapy.	

..... Self Study For Theory Core Course, wherever possible

Text Book(s):
1. Verma. P.S. and V.K.Agarwal. Concept of Genetics, Human Genetics andEugenics. & . S. Chand & Company Ltd, New Delhi.1998.
2. Benjamin Pierce, (2015) Genetics- A Conceptual Approach, 5th edition, WH Freeman publication
Reference Book(s):
1. Gardner, E.J., Simmons, M.J., Snustad, D.P., Principles of genetics,8 th edition, John Wiley and Sons.1991.
2. Strickberger., Genetics, 3rd edition, Prentice Hall of India.2002.
3. Benjamin Lewin., Genes VII, Oxford University Press.2000.
4. Sarin, C., Genetics, Tata Mc Graw – Hill publishing Co., Ltd., New Delhi.1990
5. Gupta PK., Genetics, Rastogi Publication, Meerut, India.).1996
6. Principles of genetics,8 th edition, Garder EJ, Simmons MJ, Snustad DP,1991, John Wielely andsonsGenetics, 3rd edition, 2002, Strickberger, Prentice Hall of India

Web Resource(s):
1. http://www.dnafb.org/1/bio.html 2. https://www.karger.com/Article/Fulltext/452637 3. https://www.toppr.com/ask/en-ae/question/explain-the-mechanism-of-sexdetermination-in-humans 4. https://pubmed.ncbi.nlm.nih.gov/7688132/ 5. https://medlineplus.gov/geneticdisorders.html

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Describe the basic principles of Mendelian inheritance	K3
CO2	Explain the cell division & chromosome segregation and sex determination.	K4
CO3	Understand and debate the various concepts in genetics, Chromosome structure.	K3
CO4	Analyze the microbial genetics with special reference to bacteriophages	K5
CO5	Investigate the different kinds of disease affecting genes in Man and his welfare	K4

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	2	2	2	2	3	2	3	2.5
CO2	2	3	3	p2	3	2	3	3	3	2	2.6
CO3	3	2	2	3	2	3	3	2	2	2	2.4
CO4	3	2	2	2	3	2	3	3	3	2	2.5
CO5	2	2	3	3	2	3	3	3	2	3	2.6
Mean Overall Score											2.5
Correlation											Medium

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr P.RAJASEKAR

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
V	23UZO5CC11	Core - XI	5	5	25	75	100
Course Title		MICROBIOLOGY AND PARASITOLOGY					

SYLLABUS		
Unit	Contents	Hours
I	Concept and Classification in Microbiology: History, Scope and Application of microbiology. Outline classification of - Prokaryotes and Eukaryotes. Basic structure and salient features of Bacteria, Fungi and Virus. Collection and isolation of Bacteria- Staining techniques: Simple Staining and Gram Staining. Types of media, Types of bacterial culture- *Pure culture*. Bacterial growth curve and sterilization Methods.	15
II	Industrial, Agricultural and Food Microbiology: Industrially useful Microorganisms – Fermentation for Alcoholic beverage, Production of Biodiesel- Uses of microorganisms in Agriculture: Nitrogen fixers, Biofertilizers, Biopesticides. Role of Microbes in Sewage treatment. Dairy products, preservation of food, food spoilage, food poisoning– *foodborne diseases*- fermented food products/ Concept IPR and Biosafety Guideline.	15
III	Medical Microbiology: Microbial Diseases of Man – Symptoms, Mode of Transmission, Prevention and Treatment: Viral disease: HIV, *Hepatitis* and Corona - Bacterial disease: TB and Tetanus. Fungal disease: Mycotoxicosis - Vector borne disease: Malaria and Dengue.	15
IV	Basics in Parasitology: Basic principles - nomenclature aspects of parasites. Properties of parasites. Host specificity - Mammalian host parasite inter-relationship. Kinds of parasites, *Hyperparasitism*, Parasitoids. Relation of parasite fauna with the food, age and migration of the host and season of the year.	15
V	Parasitic Zoonoses: Feeding habit and effect of bites of arthropod vectors. Method of pathogen transmission, causal organisms, remedies and prevention of following forms: Bed-bug (<i>Trypanosomacruzi</i>), *Mosquito (<i>Plasmodium malariae</i>)*, Fleas (<i>Yersinia pestis</i>), Lice (<i>Pediculus humanus</i>), Toxoplasmosis (<i>Toxoplasma gondii</i>) and mites (<i>Sarcoptes scabiei</i>), Zoonosis in pet animals- Reverse Zoonosis.	15
VI	Current Trends * (For CIA only) Current status and future trends of vaccine development	

..... Self Study For Theory Core Course, wherever possible

Text Book(s):
1. Dubey R.C and Maheswari D.K. Text Book of Microbiology, S. Chand and Company Ltd, New Delhi, 2009. 2. Imtiyaz Wani Textbook of Medical Microbiology, PV Books, Jalandhar, 2017.
Reference Book(s):
1. Pelczar, Chan and Krieg, Microbiology, Tata Mc Graw Hill Pub. Co. Ltd. 1993. 2. Sharma, P.D., Microbiology, Rastogi Publications, 1998. 3. Ananthanarayanan, R and Jayaram Panicker, C.K. Text Book of Microbiology, Orient Longman, Chennai and Hyderabad, 2000. 4. Subash C. Text Book of Medical Parasitology. Pariya and All India Publishers & Distributions, Madras, 1996. 5. Rajesh P. Karyakarte and Ajit S. Damle, Medical Parasitology, Books and Allied Publication, Kolkata, 2012.

Web Resource(s):
1. https://www.moscomm.org/pdf/Ananthanarayan%20microbio.pdf 2. https://www.pdfdrive.com/essentials-of-medical-microbiology-e33538815.html 3. https://www.pdfdrive.com/medical-microbiology-e18737002.html 4. https://www.pdfdrive.com/review-of-medical-microbiology-and-immunology-e187714521.html 5. https://books.google.co.in/books?id=ZnISuwEACAAJ&printsec=copyright&redir_esc=y#v=onepage&q&f=false 6. https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture_notes/health_science_students/medicalparasitology.pdf

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Describe the history, basic structure and salient features of microbe and theoretical skill in Bacterial Culture.	K3
CO2	Transform the knowledge on Industrial, Agricultural and Food Microbiology.	K5
CO3	Asses the basic principles of medical microbiology and infectious diseases.	K4
CO4	Introduce general Parasitology and parasites life.	K2
CO5	Impart knowledge on various important parasites and control measures.	K3

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	3	3	2	2	3	2	2.7
CO2	3	3	3	3	1	3	3	2	2	2	2.5
CO3	2	1	2	3	3	3	3	3	3	3	2.6
CO4	3	3	3	2	2	3	3	2	3	1	2.5
CO5	3	3	2	2	3	3	3	3	3	2	2.7
Mean Overall Score											2.6
Correlation											High

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator :Dr.R. Krishnamoorthy

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
V	23UZO5CC12	Core - XII	5	5	25	75	100
Course Title DEVELOPMENTAL BIOLOGY							

SYLLABUS		
Unit	Contents	Hours
I	BASIC EMBRYOLOGY AND REPRODUCTIVE CYCLE Gametogenesis: Historical concepts and theories in Embryology. Spermatogenesis. Oogenesis. Structure of Sperm and ovum –Estrous and Menstrual cycles. Egg membranes - Types of egg. Ovulation in Hen - Hormonal control and factors affecting Ovulation - Semination.	15
II	FERTILIZATION Fertilization: Significance - Physical, Chemical and Cytological factors involved in fertilization - Sperm motility, capacitation - Acrosome reaction – activation of ovum – cortical reaction - metabolic activation -Amphimixis- Physiological changes in Fertilization - Activation of Egg –Parthenogenesis- *Natural and artificial parthenogenesis*.	15
III	CLEAVAGE AND GASTRULATION Cleavage: Patterns and Planes of Cleavage – Types of Cleavage - Blastula - - Fate map and its construction – *Mammalian fate map*; uses of fate map - Cell lineage. Gastrulation in Rabbit - Morphogenetic movements:Epiboly - Emboly. Organizer: Concepts and Induction process – Spemann and Mangold experiment.	15
IV	ORGANOGENESIS Development of Brain, Eye, Ear, Heart and kidney in Mammals. Derivation of three germinal layers - Differentiation: Types - factors causing differentiation - Classification and functions of Placenta. Regeneration: Types - *regeneration in Planarians*.	15
V	TECHNIQUES IN DEVELOPMENTAL BIOLOGY Pregnancy tests - Infertility - causes impotency (sterility) in female and Male – ART Technology:IVF - IUF - GIFT - ZIFT - ICSI -Artificial Insemination - Test tube baby - Embryo Transfer- Stem cell biology *Birth control: Methods of contraception in human*.	15
VI	Current Trends (For CIA only) – Semen Cryopreservation	

..... Self Study For Theory Core Course, wherever possible

Text Book(s):
1. Verma, P.S. and Agarwal,V.K. (2009) Chordata Embryology, S. Chand &Company Ltd., New Delhi. 2009.
Reference Book(s):
1. Dr. Subramanian. M. A, Developmental Biology, MJP publishers, (2019) 2. Subramaniam. T, Molecular Developmental Biology, NarosaPublishing House, (2008) 3. Bruce M Carlson., Foundations of Embryology. 6 th edition, The McGrawHill publishing company ltd. (2007) 4. Lewis Wolpert, Principles of Development (III edition) Oxford University Press, UK. (2007) 5. Indebir Singh & G. P. Pal, Human Embryology, 8 th Edition, Rajiv Beri for Macmillan India Ltd. (2007) 6. Gilbert, F.S. Developmental Biology, 8 th edition, Sinauer Associates, Inc. Publishers, Massachusetts. (2006) 7. Werner A. Muller., Developmental Biology, Springer, (2005) 8. Balinsky, B.I. An Introduction to Embryology, 5th edition, Thomas Asia Pvt. Ltd, Chennai. (2004) 9. Khanna, D.R. Molecular Embryology, Discovery publishing house, New Delhi. (2004) 10. Kalthoff. Analysis of Biological Development, McGraw-Hill. (2000) 11. Austin. C. R., and Short. R. V., Embryonic and fetal development, Cambridge University Press, 1972.

Web Resource(s):	
1.	https://teachmephysiology.com/reproductive-system/embryology/gametogenesis .
2.	https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/fertilization .
3.	https://bio.libretexts.org/Bookshelves/Introductory_and_General_Biology
4.	https://elifesciences.org/articles/15657
5.	https://www.medicalnewstoday.com/articles/165748#causes_in_men

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Understand the basic concepts in Embryology	K3
CO2	Explore the various events takes place during fertilization	K4
CO3	Acquire knowledge on Cleavage and gastrulation process of growth	K6
CO4	Analyse the development of body organs in animals	K5
CO5	Understand infertility and Highlight the relevance and uses of modern fertility techniques	K6

Relationship Matrix:

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

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr.M. Salahudeen

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
V	23UZO5DE1AP	DSE- I	5	4	20	80	100
Course Title BIOSTATISTICS, BIOINFORMATICS & COMPUTER APPLICATION IN BIOLOGY, GENETICS, MICROBIOLOGY AND DEVELOPMENTAL BIOLOGY – PRACTICAL - V							

Practical Contents							
BIOSTATISTICS, BIOINFORMATICS AND COMPUTER APPLICATION IN BIOLOGY							
1. Measurement of the length and weight of fish and Leaf. To Calculate the mean, mode, median & SD. 2. MS Office EXCEL: Drawing the bar diagram and pie chart for exploring the data. 3. Retrieval of nucleotide sequences and amino acid sequences from NCBI, EMBL, DDBJ, SWISS- PROT & PDB 4. Spotters: Input devices: mouse, keyboard, and scanner. Output devices: monitor, printer & CPU							
GENETICS							
1. Mendelian traits in Man 2. Human Genetics: Karyotypes-Syndromes. 3. Pedigree analysis (Autosomal Dominant, Autosomal Recessive, X-Linked Dominant, X- Linked Recessive, Y-LinkedPedigree). 4. Calculation of gene frequencies. 5. Male and Female identification of Drosophila and observation of wild type and mutant phenotypes.							
DEVELOPMENTAL BIOLOGY							
1. Examination of prepared slides to study the following:Frog: Egg – cleavage – blastula – yolk plug stage. 2. Pregnancy Test by using medical kit (Demo). 3. Spotters: Chick: Egg – 24hrs, 48hrs, & 72hrs.							
MICROBIOLOGY							
1. Analyses of sewage water samples for identification of fecal indicator bacteria (<i>Escherichia coli</i>). 2. Culture techniques of bacteria: Inoculum preparation, liquid media and solid media. 3. Gram Staining: Identification of Gram positive and Gram negative bacteria. 4. Spotters: Inoculation loop, Petri dish, Autoclave, Laminar flow hood and Bacteriological incubator.							
PARASITOLOGY							
1. Collection and identification of Lice, House fly & Bed bug. 2. Spotters: Hookworm(Ancylostoma) w.m., Head Louse w.m. Tick Soft w.m. Bed Bug w.m. & Mite w.m. (w.m-Whole Mount; c.s.-Cross Section)							

Field Visit: To visit clinical microbiology, parasitology lab and submission of the field report is mandatory
OBSERVATION RECORD * A record of lab work shall be maintained and submitted at the time of Practical examination for valuation.

Text Book(s):
1. Sundaralingam R and Kumaresan Bioinformatics, Saras Publications, Nagercoil. 2015 2. Pelczar, Chan and Krieg, Microbiology, Tata Mc Graw Hill Pub. Co. Ltd. 1993. 3. Verma, P.S. and Agarwal,V.K. (2009) Chordata Embryology, S. Chand &Company Ltd., New Delhi. 2009. 4. Deepika Fernando, Sharmini Gunawardena, Sanath Senanayake, 2010. Parasitology Practical Handbook.
Reference Book(s):
1. Arora, P.N., Biostatistics, Himalaya Publishing House. 1998. 2. Sharma,P.D., Microbiology , Rastogi Publications. 1998. 3. Strickberger., Genetics, 3rd edition, Prentice Hall of India.2002. 4. Subramaniam. T, Molecular Developmental Biology, NarosaPublishing House, (2008) 5. Maheshwari D.K. and R C Dubey. 2018. Practical Microbiology, S Chand & Company.

Web Resource(s):

1. <https://teachmephysiology.com/reproductive-system/embryology/gametogenesis>.
2. <https://www.moscomm.org/pdf/Ananthanarayan%20microbio.pdf>
3. <https://www.pdfdrive.com/essentials-of-medical-microbiology-e33538815.html>
4. <https://www.pdfdrive.com/medical-microbiology-e18737002.html>
5. <https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/fertilization>
6. <https://en.wikipedia.org/wiki/Bioinformatics>
7. https://www.roseindia.net/bioinformatics/history_of_bioinformatics.shtml
8. <https://www.coursera.org/lecture/bioinformatics-pku/history-of-bioinformatics-0i4EF>
9. https://uomosul.edu.iq/public/files/datafolder_2912/20191228_083834_930.pdf
10. <https://med.cmb.ac.lk/wp-content/uploads/2018/03/Practical-Handbook-2020.pdf>

Course Outcomes

Upon successful completion of this course, the student will be able to:

CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Acquire knowledge about soft wares of statistics, bioinformatics and	K1
CO2	Explore the Biological applications of computers	K2
CO3	Understand the Human genetics and culture methods of Drosophila	K3
CO4	Learn the Microbial Culture Staining methods Explore developmental stages of frog and chick	K4
CO5	Analyse the different types pathogens from Arthropods	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	3	3	2	3	3	2	2.8
CO2	3	2	3	3	2	3	2	3	3	3	2.7
CO3	3	3	2	3	2	3	3	3	3	3	2.8
CO4	3	3	2	3	3	2	3	2	3	2	2.6
CO5	3	3	2	3	3	3	3	2	2	3	2.7
Mean Overall Score											2.72
Correlation											High

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. PRABAKAR K.

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
V	23UZO5DE1BP	DSE - II	5	4	20	80	100

Course Title	BIOINSTRUMENTATION – I PRACTICAL
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SYLLABUS		
	Contents	Hours
	1. Microscopy – Light microscopy: principles, parts & function 2. Micrometry- principle and measurement of microscopic objects: Low power and highpower. 3. Principle & operation of Centrifuge 4. Preparation of standard acid and alkali and their standardization. 5. Preparation of various solutions (normal, molar, and percent) and ppm/ppb by serial dilutions 6. Study of principle and working of pH meter and Measurement of pH of Milk, Lemon juice etc. 7. Study of principle of Chromatography and separation of amino acids mixture by ascending Paper. 8. Principle & operation of Colorimeter 9. PCR - The Polymerase Chain Reaction (protocol) –demonstration.	45

Text Book(s):
1. Bajpai, P.K. 2006. Biological Instrumentation and methodology. 2. S. Chand & Co. Ltd. P. Palanivelu (2017) Analytical Biochemistry and Separation techniques – A laboratory manual, 5 th Edition, Twentyfirst century publishers.
Reference Book(s):
1. Upadhyay and Nath (2019) Biophysical chemistry: Principles and Techniques, Himalaya publishing house, 4 th Review Edition. 2. M.L. Srivastava (2011) Bioanalytical Techniques, Narosa Publishing House, New Delhi.
Web Resource(s):
Web references: 1. https://www.ncbi.nlm.nih.gov/home/tutorials/ 2. https://www.ebi.ac.uk/training/ 3. https://www.edx.org/learn/bioinformatics 4. www.onlinelabs.in

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Understand the structure and functioning of various biological instruments.	K1-K5
CO2	Understand the concentration methods of biomolecules.	K1-K5
CO3	Acquire and analyse separation technique of biomolecules.	K1-K5
CO4	Evaluate and apply Bioinstruments and their methods of application in molecular Biology	K1-K5
CO5	Apply the technique of PCR for diagnosing biological disorders.	K1-K3

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	3	3	3	2	2	3	2.7
CO2	3	3	3	3	3	3	3	2	2	3	2.7
CO3	3	3	3	3	3	3	3	2	2	3	2.7
CO4	3	3	3	3	3	3	3	2	2	3	2.7
CO5	3	3	3	3	3	3	3	2	2	3	2.7
Mean Overall Score											2.7
Correlation											High

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: P A ASHIQUE

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
V	23UZO5SE1	Skill Enhancement Course – I	2	1	-	100	100
Course Title APPLIED ZOOLOGY & ENTOMOLOGY							
SYLLABUS							
Unit	CONTENTS						Hours
I	APICULTURE AND SERICULTURE Apiculture: Classification- Species - colonial structure– Biology of Honey bee –Bee hives (Newton hive, Langstroth hive) –Honey : Extraction – Nutritive and medicinal values. Sericulture: Classification; Species; Life cycle(Bombyx mori). Rearing of silk worm: Paraffin paper rearing – Box rearing. Diseases of silk worm: Protozoan (Pebrine) – Bacterial (Septicemia) - Reeling of silk – *Economic importance of silk*.						6
II	PISCICULTURE Freshwater fishes (Indian major carps) – Site selection and construction of pond – Fish feed (Live feed and formulated) – Induced breeding – rearing methods. Fish diseases – : Furunculosis, Epizootic Ulcerative Syndrome (EUS) and *Vibriosis – Fresh water Prawn culture - Ornamental fish culture*.						6
III	PESTS OF MEDICAL IMPORTANCE Pests of Medical Importance:- Biology of housefly, mosquito, human flea, human louse. *Veterinary Pests –Buffalofly, Cattle biting louse, Equine Botflies*.						6
IV	PEST OF CROPS Biology and lifecycle of Insects: Paddy (Stem borer and Gallfly), Sugarcane (Stem borer and leaf hopper), Cotton (Spotted bollworm and Cotton Jassid) ,Coconut (Rhinoceros beetle and Red palm weevil), *Vegetables– Brinjal (Shoot borer and Spotted hadda beetle),* Tomato (Potato tuber moth), Cabbage(caterpillar)- Pests of stored grains ,Pulses (Greasy cutworm and Plumemoth Caterpillar).						6
V	INSECT CONTROL Principles of Insect control methods: physical, mechanical, chemical, biological and Integrated methods of pest control.						6
VI	Current Trends * (For CIA only) – Contemporary developments related to the course during the semester concerned.						

..... Self Study For Theory Core Course, wherever possible

Text Book(s):
1. Arumugam N, Murugan T, Johnson Rajeswar J, Ram Prabu R. Applied Zoology, Saras Publication, Fifth edition 2015
2. D.B. Tembhare. Modern Entomology. Himalaya Publishing House, Mumbai. 2005.
Reference Book(s):
1. Ganga. G and Sulochana Chetty. J., An introduction to Sericulture (2nd edition) Oxford & IBH Publishing company. 2019.
2. Ahsan, J and Sinha, S.P. A handbook on economic zoology, S.Chand& Co., 2010.
3. Nayar,K.K., Ananthakrishnan, T.N and David V.D, General and applied Entomology, Tata Mc Graw Hill, New Delhi. 1990.
4. Arumugam N. Aquaculture, Saras Publication, Fifth edition 2014

Web Resource(s):

1. <https://www.veterinaryentomology.org/>
2. <https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/vertebrate-pests>
3. <https://www.knowledgebank.irri.org/step-by-step-production/growth/pests-and-diseases>
4. <https://onlinesciencenotes.com/sericulture-life-cycle-silkworm/>
5. www.fishfarming.com › services › aquaculture-farm-m...
6. www.fao.org › FAO_Training › FAO_Training › Genera
7. www.fao.org/3/cb5353en/cb5353en.pdf (For beekeeping)

Course Outcomes

Upon successful completion of this course, the student will be able to:

CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Learn the benefits and economic value of animal products from apiculture and sericulture	K1-k3
CO2	Record the significance of Aquaculture and fish farming.	K1-K3
CO3	Understand and manage the pests of medical importance	K1-K3
CO4	Report the various pests of agricultural crops	K1-K3
CO5	Recommend the suitable method of pest management	K1-K2

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	3	3	3	2	2	3	2.7
CO2	3	3	3	3	3	3	3	2	2	3	2.7
CO3	3	3	3	3	3	3	3	2	2	3	2.7
CO4	3	3	3	3	3	3	3	2	2	3	2.7
CO5	3	3	3	3	3	3	3	2	2	3	2.7
Mean Overall Score											2.7
Correlation											High

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: DR. M.I. HUSSAIN SYED BAVA

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
V	23UZO5SE2	Skill Enhancement Course - II	2	1	-	100	100
Course Title		POULTRY SCIENCE					

SYLLABUS		
Unit	Contents	Hours
I	INTRODUCTION Poultry development in India - Scope and objective - Poultry breeds and classes of fowls –General principles in building Poultry house – Poultry housing: Deep litter and cage rearing – *Poultry equipment*.	6
II	CULTURE PRACTICE Rearing of Fowls – Chicken Farming – Selection of Breeds – Breeding procedure: Incubation & Hatching-Methods of rearing Growers, Layers and Broilers – Growth and management of fowls in summer and winter. Different system of fowl farming (Free range, semi intensive, folding unit, intensive) – *Quail & Turkey Rearing *– Breeds of Quail & Turkey.	6
III	POULTRY NUTRITION Poultry nutrition – Food and Feeding - Nutritional requirement offowls – Composition of feed – Feed formulation for Chicks, Growers, Layers, Broilers & Breeders– Balanced Diet- * Nutrition deficiency symptoms * – Non-nutritive feed additives – Quality Control.	6
IV	DISEASE MANAGEMENT Poultry diseases –Etiology -Viral Disease: Ranikhet disease and Fowl pox. Bacterial Disease: Salmonellosis and Fowl Cholera. Parasitic Diseases: Coccidiosis and Ticks – Sanitation & Hygiene – Vaccination programme – Prevention and Precaution for diseases – * Fowl health products *.	6
V	POULTRY PRODUCTS Poultry products& Entrepreneurship – Composition and nutritive value of eggs – Role of egg in human nutrition – Poultrymeat processing – value addition - Marketing of poultry products – * Use of feathers – Poultry manure * - Economics ofPoultry Keeping. Field visit: Plan to promote Poultry Keeping for Entrepreneurship.	6
VI	Current Trends * (For CIA only) –	

..... Self study topics

Text Book(s):
1. M.R. Gnanamani, Poultry Keeping, GIRI Publication, Madurai. 2003. 2. G. S. Shukla, V. B. Upadhyay, Economic Zoology, Rastogi publications, 2009. 3. Jull Morley, A, Poultry Husbandry, Tata – McGraw Hill Publ. Co New Delhi. 1971.
Reference Book(s):
1. The Rearing of Pullets – Bulletin No. 54, Her Majesty's Stationary office, London. 2. Intensive Poultry Management for Egg Production. Bulletin No. 152. Her Majesty's Stationary office London. 3. Nutrition of the Chicken – M.L.Scott et al. 4. Diseases of Poultry – Biester – Oxford & IBH.
Web Resource(s):
1. https://www.brainkart.com/article/Poultry-Breeds_811/ 2. https://www.britannica.com/topic/poultry-farming 3. http://www.omafra.gov.on.ca/ 4. https://agritech.tnau.ac.in/animal_husbandry 5. http://apeda.gov.in/apedawebsite/SubHead_Products

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Acquire Knowledge on Poultry industry and the general principles involved	K3
CO2	Describe the Rearing of Fowl and the techniques in Chick & Duck Culture	K4
CO3	Apply Poultry nutrition, the types of feeds and feeding methods	K6
CO4	Comprehend Poultry diseases and curative measures	K5
CO5	Develop Entrepreneurial skills and become fit to earn livelihood	K6

Relationship Matrix:

Course Outcome s (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	2	2	2	2	3	2	3	2.5
CO2	2	3	3	2	3	2	3	3	3	2	2.6
CO3	3	2	2	3	2	3	3	2	2	2	2.4
CO4	3	2	2	2	3	2	3	3	3	2	2.5
CO5	2	2	3	3	2	3	3	3	2	3	2.6
Mean Overall Score											2.5

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. I. Joseph A Jerald

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
VI	23UZO6CC13	Core - XIII	6	6	25	75	100
Course Title		BIOCHEMISTRY AND BIOPHYSICS					

SYLLABUS		
Unit	Contents	Hours
I	Basic Biochemistry Scope of Biochemistry – Elements of Life- Atomic structure – Chemical bonds – pH and buffers: Acid-base reactions – *Role of buffers in biological systems*. Water and its functions – Dissolved gases and their properties.	18
II	Biomolecules and Vitamins: Classification-Aldoses, Ketoses, Monosaccharide, Disaccharides, Polysaccharides (homo, hetero). Proteins–Types of Aminoacids, Primary, Secondary, Tertiary Structure of Proteins. Lipids – Simple lipids, *Complex lipids*, Phospholipids, Glycolipids, Lipoproteins. Vitamins: Water and Fat soluble vitamins – source, function and deficiency diseases.	18
III	Enzymes and Metabolisms: Enzymes: Classification – Characteristics – Enzyme action –Mechanism of Enzyme Action – Factors affecting enzyme activity- Energy rich compounds. Metabolisms: Types – Glycolysis - TCA cycle – *Oxidative phosphorylation*- Glycogenesis – Glycogenolysis–Glyconeogenesis.	18
IV	Concept of Biophysics Introduction to Biophysics – Nature and Properties of Light –Electromagnetic spectrum – Absorption and Emission spectrum – fluorescence and phosphorescence. Bioluminescence – Bio energetics: Free energy concepts – Laws of thermodynamics – *Redox potential* – ATP.	18
V	Bio instruments&Application Principle, Working Procedure and Applications of: UV spectrophotometer, Centrifuge, Atomic Absorption Spectroscopy, Refractometer. Chromatography: Thin Layer – Column – Ion exchange and HPLC.Electrophoresis, *Polymerase Chain Reaction*	18
VI	Current Trends (For CIA only) Properties, applications of Nanoparticles and Nano toxicology	

..... Self Study

Text Book(s): 1. Jain J.L.,(2016) Fundamentals of Biochemistry. S.Chand& Co. New Delhi 2. Banerjee P.K. (2008) Introduction to Biophysics, , S. Chand Publishing, New Delhi.
Reference Book(s): 1. David L. Nelson., (2021)Lehninger,L. Biochemistry. 8 th edition. W.H Freeman & Co. 2021. 2. Eric E. Conn, (2006) Outlines Of Biochemistry, 5Ed. Outlines of Biochemistry, John Wiley & Sons. 3. Arumugam, N., (2013). Biochemistry and Biophysics – Saras Publication;Nagarcoil, 4. Daniel., (1992) M. Basic Biophysics for Biologists, Wiley International, New Delhi. 5. Das.D.(1996) Biophysics and Biological Chemistry, Academic Publishers, Calcutta. 6. Ackerman,E., (1962) Biophysical Science, Prentice Hall, New Delhi.
Web Resource(s): 1. https://en.wikipedia.org/wiki/Biochemistry 2. https://www.britannica.com/science/biochemistry 3. https://en.wikipedia.org/wiki/Biophysics 4. https://www.britannica.com/science/biophysics

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Define and explain the scope and principles of Biochemistry	K1
CO2	Relate and differentiate biochemical molecules and vitamins	K2
CO3	Comprehend the various enzymes and their activities	K3 &K4
CO4	Describe the principles and properties of light and instrumentation	K2
CO5	Estimate and evaluate the working procedure and uses of bioinstrumentation	K3

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	3	3	2	2	3	2	2.7
CO2	3	3	3	3	1	3	3	2	2	2	2.5
CO3	2	1	2	3	3	3	3	3	3	3	2.6
CO4	3	3	3	2	2	3	3	2	3	1	2.5
CO5	3	3	2	2	3	3	3	3	3	2	2.7
Mean Overall Score											2.6
Correlation											High

Mean Overall Score = Sum of Mean Score of Cos / Total Number of Cos

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. M. Meeramaideen

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
VI	23UZ06CC14	Core - XIV	6	6	25	75	100
Course Title		IMMUNOLOGY					

SYLLABUS		
Unit	Contents	Hours
I	Introduction to immune system: Scope and historical background of Immunology – Immunity types - Innate immunity - Acquired immunity: Active and Passive - Primary Lymphoid organs: Thymus – Bone Marrow- Secondary lymphoid organs: Spleen – Lymph node – Cells of Immune System: Lymphocytes – Types – T and B Lymphocytes - Macrophages – *Antigen Presenting Cells* –Mast cells - granulocytes – NK cells -.	18
II	Concepts of antigen and antibody: Antigens: Structure - Types - Characteristics–Immunoglobulin: Types – Structure - Functions- Biological properties – Theories of antibody production- its regulation and diversity. Adjuvants – Characteristics – Common adjuvants - Vaccines: Common vaccines –types- Attenuated – Killed vaccines – *Importance of vaccines*	18
III	Overview of immune response: Generation of immune response - Types of immune response – Primary and Secondary immune response – Humoral immune response -Cell mediated Immune response - factors causing immune response— Cytokines: Types and functions. *Role of lymphokines and chemokines in immune response*	18
IV	Basics of immune system disorders: Immune Deficiencies: primary and secondary deficiencies- causes and types - Hypersensitivity – Factors causing hypersensitivity-types- mechanisms - Auto Immune diseases –Causes and types - Human Leukocyte Antigen (HLA) in man - fine structure and functions –Complement system – mode of activation- Classical and Alternate pathways, biological functions.	18
V	Overview of immunological techniques: Principles of precipitation - Precipitin curve- Agglutination: Direct and Indirect -Double and Radial immunodiffusion - Immunoelectrophoresis – Rocket – Ouchterlonyimmuno diffusion - ELISA –western blot- *RIA - principles and applications* - WIDAL – VDRL test – Hybridoma technology – Applications Immuno-fluorescence	18
VI	CURRENT TRENDS: (For CIA only) -Nanobody Structure, Advantages, Development and Production.	

..... Self Study

Text Book(s):
1. Chakravathy, A.K., (1993) Immunology, Tata McGraw Hill Publishing Company, New Delhi.
Reference Book(s):
1. Roitt, Immunology, (3 rd Edition) Crover Medical Publishing Company, London
2. Barret, J. T. (1983) Text Book of Immunology (5 th Edition), The C.V. MoslyCompany.
3. Richard, H.M. (1992), Immunology (2 nd Edition), Williams and Wilkins, Baltimore Maryland.
4. Hidemann, W.H. (1980) Essentials of Immunology, Elsevier Science Publishing Co. Inc.
5. Weinn. D.M. and Steward, L. (1993), Immunology, Singapore Publishers Private Limited.
Web Resource(s):
1. https://www.ncbi.nlm.nih.gov/books/NBK279395/
2. https://www.sciencedirect.com/topics/medicine-and-dentistry/organs-of-the-immune-system
3. https://www.immunology.org/public-information/bitesized-immunology/systems-and-processes/complement-system
4. https://www.immunopaedia.org.za/immunology/archive/type-i-iv-hypersensitivity-reactions/immune-complex-formation/hypersensitivity-reactions/
5. https://courses.lumenlearning.com/boundless-microbiology/chapter/the-major-histocompatibility-complex-mhc/

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Remember the fundamental concepts of immunity and contributions of the immune organs and cells in immune responses.	K1
CO2	Understand on the structure and properties of Antigens and Antibodies	K2
CO3	familiarise the concepts of humoral and cell mediated immune response	K2 &K3
CO4	Analysethe significance of the Immune system on health	K4
CO5	Evaluate and apply the basic Immunological techniques	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	2	2	2	3	2	2	2	3	3	2.3
CO2	1	2	2	2	3	1	2	2	2	3	2.0
CO3	2	2	2	2	3	3	3	3	3	3	2.6
CO4	2	2	3	3	3	2	2	3	3	3	2.6
CO5	1	2	2	2	3	2	2	2	3	3	2.2
Mean Overall Score											Medium
Correlation											2.34

Mean Overall Score = Sum of Mean Score of COs / Total Number of COs

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: **Dr. M. Aneez Mohamed**

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
VI	23UZO6CC15	Core - XV	5	5	25	75	100
Course Title		Environmental Biology and Evolution					

SYLLABUS		
Unit	Contents	Hours
I	Environmental Factors Abiotic and biotic factors- Light, Water, Temperature, Soil, Biota and their impact on environment. Ecosystem: Dynamic ecosystem (Food chain, Food web, Trophic level, Energy flow, Ecological pyramids and Biogeochemical cycle (Carbon and Nitrogen), Pond, River and *Forest Ecosystem*.	15
II	Population and Community Ecology Population Ecology – Definition – Characteristics. Community Ecology – Definition – Characteristics. Process of Succession, types of Succession and Significance of Succession. Animal relationships – Symbiosis: Commensalism and Mutualism – Antagonism: Antibiosis, Predation, Parasitism and Competition – *Intraspecific and Interspecific competition*.	15
III	Natural Resources & Pollution Natural Resources - Renewable and Non-renewable resources- Resource Management. Wild life Conservation and Management. Biodiversity – Types – Mega diversity and hotspots with reference to India – Conservation of Biodiversity- Environmental Pollution: Air and Water – Green House gases – Solid waste management - Global Warming and Climate change – *Ozone Layer depletion*.	15
IV	Concept and Theories of Evolution Evolution: Concept and Theories: Lamarckism – Darwinism. Evidence of Evolution: Embryological evidences, Palaeontological, Physiological Morphological and Anatomical changes (Homologous, Analogous and Vestigial organs) and Biochemical evidences - Convergent, Divergent evolution and Atavism – *Micro and Macroevolution*, Mimicry and colouration.	15
V	Geological Time Scale and Evolution of Man Geological time scale: Eras, Periods and Epochs. Fossils: Types and Formation – Dating of fossils. Extinction: Types, causes. Extinct animals- Living fossils – Indian fossils – Connecting Links – Missing Links. Evolution of Man – Cultural and Biological evolution – *evolution of horse*.	15
VI	Current Trends * (For CIA only) – Future evolution of Man	

..... Self Study For Theory Core Course, wherever possible

Text Book(s):
1. Odum, E.P. Fundamentals of Ecology (III Edn.), Natraj Pub. Dehradun. 1996. 2. Arumugam, N. Organic Evolution, Saras Publication, Nagercoil. 2006.

Reference Book(s):	
1. Clarke, G.L. Elements of Ecology. John Wiley & Sons, New York, 3rd Edition, 1954. 2. Kendeigh, S.C. Animal Ecology. Prentice Hall. 2 nd Edition, 1961. 3. Rastogi, V.B. and M.S. Jayaraj. Animal Ecology and Distribution of Animals, Kedarnath Ramnath. 1989. 4. Sharma, P.D., Ecology and Environment. Rastogi Publications. Meerut. 1990. 5. Southwick, C.H., Ecology and the quality of Environment. D. Van Nostrand Co. 1976. 6. Verma, P.S. and V.K. Agarwal, Principles of Ecology. S. Chand & Co. New Delhi. 1996. 7. Savage. Evolution, Modern Biology Series, 3 rd Edition, 1969. 8. Dowdeswell, P.M. The Mechanism of Evolution, Heinemann London 2 nd Edition, 1956. 9. Simpson, G.G., The major features of Evolution, CUP. 1953.	
Web Resource(s):	
1. https://en.wikipedia.org/wiki/River_ecosystem 2. http://www.easternlocal.com/userfiles/251/Classes/8642/animal%20relationships%20notes.pdf?id=4361 3. http://www.aagasc.edu.in/Unit%203%20EVS.pdf 4. http://sciencenetlinks.com/student-teacher-sheets/lamarck-and-darwin-summary-theories/	

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Analyze and relate the significance of abiotic factors and their ecological effects	K3
CO2	Discuss the biotic community and ecosystem dynamics	K4
CO3	Investigate the different Natural Resources, Biodiversity & Conservation	K4
CO4	Understand and Explain the Concept and Theories of Evolution	K5
CO5	Appraise the Evolutionary Time Scale and Evolution of Man	K4

Relationship Matrix:

Course Outcome s (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	2	2	2	2	3	2	3	2.5
CO2	2	3	3	2	3	2	3	3	3	2	2.6
CO3	3	2	2	3	2	3	3	2	2	2	2.4
CO4	3	2	2	2	3	2	3	3	3	2	2.5
CO5	2	2	3	3	2	3	3	3	2	3	2.6
Mean Overall Score											2.5
Correlation											Medium
Mean Overall Score						Correlation					
< 1.5						Low					
≥ 1.5 and < 2.5						Medium					
≥ 2.5						High					

Course Coordinator: Dr P. RAJASEKAR

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
VI	23UZO6DE2AP	DSE- II	5	4	20	80	100
Course Title		Biochemistry and Biophysics, Immunology, Economic Entomology and Environmental Biology and Evolution - Practical –VI					

SYLLABUS		Hours
Biochemistry i) Preparation and testing of buffers: Acetate and Phosphate buffers. ii) Quantification of sugar in fruits juice by refractometer. iii) Quantitative estimation of reducing sugars by Anthrone method. iv) Quantitative estimation of amino acids by Ninhydrin method. v) Quantitative estimation of protein by Lowry et al. method. Spotters: Models of Haemoglobin, ATP and TCA cycle		45
Biophysics i) Verification of Beer Lambert’s Law using Colorimeter ii) Separation of Sugars by Thin Layer Chromatography iii) Separation of Amino acids by Column chromatography Spotters: Spectrophotometer, Centrifuge, Electrophoresis and Colorimeter.		
Immunology i) Dissection of Primary and Secondary Lymphoid organs in fish ii) Quantitative estimation of antigen by ELISA (Demonstration). iii) Agglutination test using Blood group iv) Precipitation test using Blood Serum v) Single Immuno diffusion vi) Double Immuno diffusion vii) WIDAL test Spotters: Immunoelectrophoresis –: Western blotting technique.		
Environmental Biology Estimation of pH, Dissolved Oxygen, Salinity and Nitrate Examination of Plankton: Qualitative and Quantitative Examination of Intertidal fauna: Rocky shore, Sandy shore, Muddy shore. Spotters: Animal association, pH meter, Secchi disc, Turbidity meter, Electrical conductivity meter,		
Evolution Human and Ape skull Orthogenesis in limb Fossil identification Colouration and Mimicry Spotters: Nautiloid, Ammonoid, wood fossils; Connecting link: <u>Archaeopteryx</u>		
Field Trip Visit to Sea shore to study Intertidal fauna and their adaptations or Fossil park. Submission of a Field Report is mandatory. Record Work A record of lab work should be maintained and submitted at the time of Practical Examination for valuation.		

Text Book(s):
1. Jain J.L. Fundamentals of Biochemistry. S.Chand & Co, 2010. 2. Daniel, M. Basic Biophysics for Biologists, Wiley International, New Delhi, 1992 3. Chakravarty, A.K., Immunology, Tata McGraw Hill Publishing Company, New Delhi, 1993 4. Odum, E.P. Fundamentals of Ecology (III Edn.), Natraj Pub. Dehradun, 1996. 5. Arumugam, N. Organic Evolution, Saras Publication, Nagercoil, 2006.

Web Resource(s):

1. <https://www.britannica.com/science/biochemistry>
2. <https://en.wikipedia.org/wiki/Biophysics>
3. [https://repository.poltekkes-kaltim.ac.id/1154/1/Microbiology%20and%20Immunology%20Textbook%20of%202nd%20Edition%20\(%20PDFDrive%20\).pdf](https://repository.poltekkes-kaltim.ac.id/1154/1/Microbiology%20and%20Immunology%20Textbook%20of%202nd%20Edition%20(%20PDFDrive%20).pdf)
4. https://mycollegevcampus.com/dmaseu/MODULES-MANAGEMENT/test_upload/779BO24.pdf

Course Outcomes

Upon successful completion of this course, the student will be able to:

CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Acquire knowledge on the basic procedures in biochemical estimation	K4
CO2	Describe the procedure and working principles in Biophysics	K4
CO3	Demonstrate the immunological techniques	K3
CO4	Estimate water quality parameters and examine Intertidal fauna	K2
CO5	Understand the Concepts of Evolution Theories and their significance.	K3

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	3	3	2	2	3	2	2.7
CO2	3	3	3	3	2	2	3	2	3	2	2.6
CO3	2	2	1	3	3	3	3	3	3	3	2.6
CO4	3	3	3	2	3	3	3	2	3	1	2.6
CO5	3	2	3	2	3	3	3	3	3	2	2.7
Mean Overall Score											2.7
Correlation											High

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator : Dr. R. Krishnamoorthy

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
VI	23UZO6DE2BP	DSE - II	5	4	20	80	100

Course Title	BIOINSTRUMENTATION – II - PRACTICAL
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SYLLABUS		
	Contents	Hours
	<ol style="list-style-type: none"> 1. Laboratory safety rules and Introduction to basic instruments and its uses (Weighing balance, pH meter, Laminar Airflow Chamber, Autoclave, Cyclomixer, Shaker incubator. 2. Application of UV – Visible spectroscopy in identifying a compound – Pigment 3. Determine an unknown protein concentration by using UV – Visible spectroscopy. 4. Subcellular fractionation by differential centrifugation. 5. Separation of biomolecules by paper chromatography 6. Separation of Lipids by TLC 7. Demo of Agarose gel electrophoresis of DNA 8. Demo of Gel permeation chromatography 9. Measure absorbance in Spectrophotometer 10. Demonstration of DNA extraction from blood or tissue samples. 	45

Text Book(s):
<ol style="list-style-type: none"> 1. Bhomwik (2011) Analytical techniques in Biotechnology – A complete laboratory manual, MGH Publisher, 2. P. Palanivelu (2017) Analytical Biochemistry and Separation techniques – A laboratory manual, 5th Edition, Twentyfirst century publishers.
Reference Book(s):
<ol style="list-style-type: none"> 1. Upadhayay and Nath (2019) Biophysical chemistry: Principles and Techniques, Himalaya publishing house, 4th Review Edition. 2. M.L. Srivastava (2011) Bioanalytical Techniques, Narosa Publishing House, New Delhi.
Web Resource(s):
<p>Web references:</p> <p>https://www.ncbi.nlm.nih.gov/home/tutorials/</p> <p>https://www.ebi.ac.uk/training/</p> <p>https://www.edx.org/learn/bioinformatics</p> <p>www.onlinelabs.in</p>

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Record lab safety rules and apply the same in safe access of laboratory wares.	K1-K5
CO2	Practice, experiment with and apply the basic instruments in the laboratory such as weighing balance, pH meter, shaker, incubator etc. in various research processes.	K1-K5
CO3	Acquire and analyse the different Bioinstrumentation tools and their applications	K1-K5
CO4	Employ the separation techniques for separating biomolecules based on centrifugal force by centrifugation and chromatography by molecular weight, charge etc.	K1-K5
CO5	Apply electrophoretic techniques to qualify nucleic acid and to identify various proteins based on their molecular weight.	K1-K3

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	3	3	3	2	2	3	2.7
CO2	3	3	3	3	3	3	3	2	2	3	2.7
CO3	3	3	3	3	3	3	3	2	2	3	2.7
CO4	3	3	3	3	3	3	3	2	2	3	2.7
CO5	3	3	3	3	3	3	3	2	2	3	2.7
Mean Overall Score											2.7
Correlation											High

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: P A ASHIQUE

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
VI	23UZO6DE3A	DISCIPLINE SPECIFIC ELECTIVE- III	4	4	25	75	100
Course Title	BIOTECHNOLOGY						

SYLLABUS		
Unit	Contents	Hours
I	BASICS OF BIOTECHNOLOGY Biotechnology: Scope, Importance and History –Indian and Global scenario- Biotechnology in Environment, Agriculture,*Animal Husbandry* and Medicine - scope for future development,International safety guidelines, Patent law and intellectual property rights.	12
II	GENETIC ENGINEERING Recombinant DNA technology: Enzymes- Exonucleases, Endonucleases, Restriction enzymes, DNA Ligase, DNA Polymerase - Cloning vectors; plasmid, cosmid, artificial chromosomes and shuttle vector - Gene cloning Strategy; principles and methods- *DNA cloning*construction of genomic libraries - cDNA preparation and uses of DNA probes.	12
III	MOLECULAR TECHNIQUES PCR, RT-PCR, RFLP, RAPD and AFLP and its application - *DNA finger printing*- Agarose gel electrophoresis- SDS-PAGE. Blotting Techniques- SouthernBlotting, Northernand Western Blotting.	12
IV	INDUSTRIAL BIOTECHNOLOGY Fermentation: Principles - Design of Bioreactors: types-Batch, Continuous and Stirred Tank Fermenter- Scale up and Downstream Processing- Production of Ethanol, Penicillin, Hepatitis B Vaccine and *Vitamin B12*by fermentation.	12
V	ENZYME BIOTECHNOLOGY Extraction and purification of enzymes- Production, recovery, stability and formulation of bacterial and fungal enzymes-amylase, protease, penicillin acylase, *glucose isomerase* - Enzyme immobilization- Applications.	12
VI	Current Trends * (For CIA only)– Ion torrent sequencing.	

..... Self study

Text Book(s):
1. R C Dubey, (2019).Text Book of Biotechnology, S.Chand& Company Ltd.
Reference Book(s):
1. Gupta, P. K., (2010).Biotechnology and Genomics. Rastogi Publications, Meerut. 2.Primrose SB and Twyman RM. (2006). Principles of Gene Manipulation and Genomics, 7th edition. Blackwell Publishing, Oxford, U.K. 3.Primrose, S. B. (1989).Modern Biotechnology. Blackwell Scientific Publications, Oxford,London. 4.Brown, C.M., (1988). Campbell, I. and Priest, F.G. Introduction to Biotechnology. Blackwell Scientific Publications, U.K.
Web Resource(s):
1. ebookpdf.com/recombinant-dna-technology 2. www.khanacademy.org › tag › pcr 3.www.khanacademy.org › science › biology › biotech-dna-technology 4. www.vanderbilt.edu › viibre › CellCultureBasicsEU

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Understand the scope and importance in Biotechnology	K2
CO2	Demonstrate the concepts of Recombinant DNA technology and Cloning techniques	K2
CO3	Acquire knowledge on molecular techniques involved in Biotechnology	K3
CO4	Analyse the Principles and Process of Industrial Biotechnology	K4
CO5	Evaluate the mechanism of Enzymes action, immobilization and applications	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	3	3	2	3	3	2	2.8
CO2	3	2	3	3	2	3	2	3	3	3	2.7
CO3	3	3	2	3	2	3	3	3	3	3	2.8
CO4	3	3	2	3	3	2	3	2	3	2	2.6
CO5	3	3	2	3	3	3	3	2	2	3	2.7
Mean Overall Score											2.72
Correlation											High

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. S. Mohamed Hussain

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
VI	23UZO6DE3B	Discipline Specific Elective -III	4	4	25	75	100
Course Title		INTRODUCTION TO RESEARCH METHODOLOGY					

SYLLABUS		
Unit	Contents	Hours
I	Literature survey and Thesis writing Research – Objectives – Types - Importance and Processes – Literature survey – Printed and online journals– Refereed journals, Impact Factor, Citation Index. Abstracts and Indices – Technical papers – Reviews – Monographs – Use of Internet in Literature survey.	12
II	Components of Research design Identification and selection of Research Problem – Experimental design – Preparation and Writing of Thesis: Components of thesis - Research Seminar - workshops – Internships – Writing proposal for financial assistance – Plagiarism.	12
III	IPR and Innovation in Research Intellectual Property rights – Patent law – Ethical committees (Animal and Human) – commercialization - copy right – royalty - trade related aspects of intellectual property rights (TRIPS) – Innovation and incubation cell.	12
IV	Scientific Writing and Publication Journals – types of articles – Report writing – Manuscript preparation and submission - publication ethics - Software and Tools: Reference alignment: Zotero, Mendeley. Paper formatting: LaTeX, MS office. Detection of Plagiarism: iThenticate, turnitin– Grammarly – H' index – i10 index.	12
V	Tools in Research Statistical Methods: Hypothesis testing. Tests of Significances: Student's "t" test, F– Test – One way and Two-way ANOVA with interpretation of data – Correlation and regression: Correlation (Pearson's and Spearman's Rank) – use of SPSS for statistical analysis.	12
VI	Current Trends * (For CIA only) – AI tools in research in Animal Science	

* For Theory Core Course, wherever possible

Text Book(s):
1. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An introduction to Research Methodology, RBSA Publishers.
2. Kothari, C.R., 2004. Research Methodology: Methods and Techniques. New Age International. 418p
Reference Book(s):
1. Anthony, M., Graziano, A.M. and Raulin, M.L., 2009. Research Methods: A Process of Inquiry, Allyn and Bacon.
2. Carlos, C.M., 2000. Intellectual property rights, the WTO and developing countries: the TRIPS agreement and policy options. Zed Books, New York.
3. Coley, S.M. and Scheinberg, C. A., 1990, "Proposal Writing", Sage Publications.
4. Day, R.A., 1992. How to Write and Publish a Scientific Paper, Cambridge University Press.
Web Resource(s):
1. https://gradcoach.com/what-is-research-methodology/
2. https://dst.gov.in/sites/default/files/E-BOOK%20IPR.pdf

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Understand the basic techniques in framing hypothesis.	K3
CO2	Acquire knowledge on research paper collection and review.	K4
CO3	Analyze the process of IPR and innovation in research field.	K6
CO4	Understand the methods and paper writing and publishing skills.	K5
CO5	Identify, Infer and Interpret the different tools in research methodology.	K6

Relationship Matrix:

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

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr.M. Salahudeen

Allied Zoology for B.Sc. Botany

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
III	23UZO3AC5	Allied – V	4	4	25	75	100
Course Title		GENERAL ZOOLOGY					

SYLLABUS		
Unit	Contents	Hours
I	Invertebrates Classification of Invertebrates upto phyla with salient features and suitable examples. Cockroach: *External morphology*, mouth parts, Digestive system, respiratory system, circulatory system, nervous system and reproductive system.	12
II	Chordates General classification of Chordates – salient features of chordates with suitable examples. Frog – *External features*, digestive system, respiratory system, circulatory system, Nervous system and urino-genital system.	12
III	Animal Physiology Physiology of digestion, Composition and functions of human blood, Respiration; Transport of oxygen and carbon-dioxide, Structure of neuron, nerve impulse conduction, *Structure of kidney* and nephron in Human – Reproduction in man.	12
IV	Endocrinology Endocrine glands, Structure and functions of Pituitary, Thyroid, Islets of Langerhans, Adrenal and Sex glands – *Menstrual cycle*.	12
V	Embryology & Evolution Gametogenesis – spermatogenesis and oogenesis, Fertilization, cleavage - cleavage patterns. Blastulation, Gastrulation in Frog. Origin of life and evolution of cell - Theories on evolution by Lamarck and Charles Darwin, organic evolution, *Evidences of evolution*.	12

..... Self-Study

Text Book(s):
<ol style="list-style-type: none"> 1. Nair,N.C., Leelavathy,S., Soundara Pandian, N., Murugan,T., Thangamani, A., Prasannakumar,S., Narayanan,L.M., and Arumugam,N., Animal Diversity Invertebrata and Chordata. Saras Publication, Nagercoil. Fifth Ed., 2013 2. Arumugam, N. and Mariakuttikan,A., Animal Physiology. Saras Publication, Nagercoil. 2011. 3. Arumugam, N, A Text Book of Embryology, Saras Publication, Nagercoil. Fourteenth Ed., 2013. 4. Arumugam, N, Organic Evolution, Saras publication, Nagercoil. 2010
Reference Book(s):
1. Ekambaranatha Ayyar, Outlines of Zoology. Vol. I & II S.Viswanathan (Printers & Publishers) Pvt. Ltd., Chennai,1993
Web Resource(s):
<ol style="list-style-type: none"> 1. http://www.itis.usda.gov/itis/status.html 2. http://www.bishop.hawaii.org/bishop/HBS/hbs1.html 3. http://www.itis.usda.gov/itis/status.html 4. http://www.bishop.hawaii.org/bishop/HBS/hbs1.html 5. https://nptel.ac.in/courses/102/104/102104042/ 6. https://courses.lumenlearning.com/digestive system/Anatomy and Physiology 7. lung .infor>respiratory system">https://www.lung.ca>lung .infor>respiratory system

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Understand the emergence and diversity of Invertebrate fauna and to realize the structural features and physiological processes in Invertebrates.	K1 & K2
CO2	Classify the taxonomy among chordates and to study the structure and function of chordate systems.	K2
CO3	Develop knowledge on physiological processes in human beings and role of organ systems.	K3
CO4	Analyze the integrated functions of endocrine glands in reproduction.	K4
CO5	Evaluate the biological processes involved in development and the fundamental complex processes leading to evolutionary changes	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	3	2	2	3	3	2	2.7
CO2	3	3	3	3	3	2	2	3	3	2	2.7
CO3	3	3	3	3	3	2	2	3	3	2	2.7
CO4	3	3	3	3	3	2	2	3	3	2	2.7
CO5	3	3	3	3	3	2	2	3	3	2	2.7
Mean Overall Score											2.7
Correlation											High

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. H. E. Syed Mohamed

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
III	23UZO3AC6P	Allied – VI	3	2	20	80	100
Course Title		GENERAL ZOOLOGY - PRACTICAL - I					

SYLLABUS		
Unit	Contents	Hours
	<p>DISSECTION:</p> <p><u>Invertebrates</u> Cockroach: Mouthparts, Digestive and Nervous systems.</p> <p><u>Chordates</u> Frog – Pro-dissector software: Digestive, Arterial and Venous systems.</p> <p><u>Animal Physiology</u> Blood Grouping Preparation of Blood Smear and Observation of RBC and WBC. Qualitative estimation of excretory products: Ammonia, Urea and Uric acid.</p> <p>SPOTTERS:</p> <p><u>Invertebrates</u> <i>Paramecium, Ascon, Obelia, Aurelia, Fasciola hepatica, Taenia solium,</i> Ascaris male and female, <i>Nereis</i>, Earthworm, Prawn, Butterfly, Freshwater Mussel, Snail, Sea urchin, Starfish.</p> <p><u>Chordates</u> Shark, Tilapia, Frog, Salamanders, Viper, Cobra, Duck, Pigeon, Rabbit, Loris.</p> <p><u>Embryology</u> Examination of prepared slides to study the following: Frog: Egg – cleavage – blastula – yolk plug stage</p> <p><u>Evolution</u> Fossil: Nautiloid, Ammonoid</p> <p><u>Endocrinology</u> Pituitary, Thyroid, Islets of Langerhans - models</p> <p>RECORD A record of lab work shall be maintained and submitted at the time of Practical examination for valuation.</p>	45

Text Book(s):
<ol style="list-style-type: none"> Jayasurya., Arumugam, N., Nair, N.C., Leelavathy,S., Soundara Pandian,N., Murugan,T. Practical Zoology Volume - 1. Invertebrata. Saras publication, Nagercoil. 2013. Jayasurya., Arumugam, N., Thangamani., Prasannakumar., Narayanan.L.M. Practical Zoology Volume -2. Saras publication, Nagercoil. 2013. Jayasurya., Arumugam, N., Dulsy Fatima., Narayanan,L.M., Meyyan, R.P., Nallasingam,K., Kumaresan,V., Mani,A., Selvaraj,A.M., Mariakuttikan,A. Practical Zoology Volume -3. Cell Biology – Embryology – Animal Physiology – Immunology – Ecology – Genetics – Evolution – Microbiology – Biochemistry – Biophysics. Saras Publication. 2013

Reference Book(s):	
1. Nair,N.C., Leelavathy,S., Soundara Pandian, N., Murugan,T., Thangamani, A., Prasannakumar,S., Narayanan,L.M., and Arumugam,N., Animal Diversity Invertebrata and Chordata. Saras Publication, Nagercoil. Fifth Ed., 2013 2. Arumugam, N. and Mariakuttikan,A., Animal Physiology. Saras Publication, Nagercoil. 2011. 3. Arumugam, N, A Text Book of Embryology, Saras Publication, Nagercoil. Fourteenth Ed., 2013. 4. Arumugam, N, Organic Evolution, Saras publication, Nagercoil. 2010	
Web Resource(s):	
1. http://www.itis.usda.gov/itis/status.html 2. http://www.bishop.hawaii.org/bishop/HBS/hbs1.html 3. http://www.itis.usda.gov/itis/status.html 4. http://www.bishop.hawaii.org/bishop/HBS/hbs1.html	

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Understand the anatomy and physiology of selected animal systems.	K1 & K2
CO2	Apply the techniques in blood grouping and the components of blood and nitrogenous wastes testing.	K3
CO3	Classify chordates and determine the characteristics of chordates.	K2
CO4	Analyze the biological processes involved in embryonic development and describe the fundamental processes leading to evolutionary changes.	K4
CO5	Evaluate the integrated functions of endocrine glands.	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	3	3	2	2	3	2	2.7
CO2	3	3	3	3	3	3	2	2	3	2	2.7
CO3	3	3	3	3	3	3	2	2	3	2	2.7
CO4	3	3	3	3	3	3	2	2	3	2	2.7
CO5	3	3	3	3	3	3	2	2	3	2	2.7
Mean Overall Score											2.7
Correlation											High

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. H. E. Syed Mohamed

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
IV	23UZO4AC7	Allied - VII	5	4	25	75	100
Course Title		ECONOMIC ZOOLOGY					

SYLLABUS		
Unit	Contents	Hours
I	Poultry farming and Vermiculture: Poultry farming: Types of fowls – Rearing methods of Broilers and Layers – Poultry nutrition – Poultry diseases (NCD, IBV). Issues and limitations of poultry farming. Vermiculture: Classification, Species of Earthworms – Life cycle of <i>Lampito mauritii</i> – Preparation of vermin bed; vermiwash; Vermicompost – Economic importance; Physicochemical parameters. *Organic farming*.	15
II	Apiculture and Sericulture: Apiculture: Classification- Species - colonial structure– Biology of Honey bee –Bee hives (Newton hive, Langstroth hive) – Honey : Extraction – Nutritive and medicinal values. Sericulture: Classification; Species; Life cycle(<i>Bombyx mori</i>). Rearing of silk worm: Paraffin paper rearing – Box rearing. Diseases of silk worm: Protozoan (Pebrine) – Bacterial (Septicemia) - Reeling of silk – *Economic importance of silk*.	15
III	Aquaculture: Aquaculture: Freshwater fishes (Indian major carps) – Site selection and construction of pond – Fish feed (Live feed and formulated) – Induced breeding – rearing methods. Fish diseases –: Furunculosis, Epizootic Ulcerative Syndrome (EUS) and *Vibriosis* – Fresh water Prawn culture. *Ornamental fish culture.*	15
IV	Insect Vectors and Pests: Insects pests of crops: Classification, biology nature of damage and control measures of Pests: Paddy (<i>Scirpophaga incertulas</i>), Cotton (<i>Helicoverpa armigera</i>), sugarcane (<i>Scirpophaga excerptalis</i>), Coconut (<i>Oryctes rhinoceros</i>). Insects as Vectors of Human Diseases: Classification and Biology, disease spread and control measures of Mosquito *Housefly *	15
V	General Principles of Insect Control: Physical, Mechanical, Chemical and Biological Control and their Advantages limitations. Pesticide uses in India – Precaution in handling pesticides. Integrated Pest Management. Non-conventional Methods of Pest Control. *Organics pesticides and their advantages*	15

..... Self Study

Text Book(s):
<ol style="list-style-type: none"> 1. Shukla.G.S. and Upadhyay.V.B. Economic Zoology (Rastogi publications). 2. Ganga.G and Sulochana Chetty. J., An introduction to Sericulture(2nd edition)Oxford & IBH Publishing company.

Reference Book(s):
1. Ahsan, J and Sinha, S.P. A handbook on economic zoology, S.Chand& Co. 2. Sardarsingh – Bee keeping in India. 3. Santhanam – Aquaculture. 4. Ullal.S.R. and Narasimhanna, M.N – Central Silk Board, Govt. of India, Bombay. 5. Singh – Livestock and poultry production. 6. Jhingran – Fish and fisheries. 7. T.V.R. Pillai – Coastal Aquaculture. 8. Maine product export development authority – Freshwater fishes, Ornamental fishes, Shrimph culture – MPEDA Publication series.
Web Resource(s):
https://www.agropustaka.id/wp-content/uploads/2020/04/agropustaka.id_buku_Modern-Livestock-and-Poultry-Production-8th-Edition-by-James-R.-Gillespie-Frank-B.-Flanders.pdf 2. https://www.pdfdrive.com/poultry-fisheries-apiculture-and-sericulture-d52750733.html

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Understand the concepts of poultry farming and vermiculture	K2
CO2	Learn the benefits and economic value of animal products from apiculture and sericulture.	K3
CO3	Record the significance of Aquaculture and fish farming	K3
CO4	Classify insects vectors and pests; create awareness of spread of diseases and control methods.	K4
CO5	Apply entrepreneurial skill and illustrate pest management types.	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	3	3	2	2	3	2	2.7
CO2	3	3	3	3	3	3	2	2	3	2	2.7
CO3	3	3	3	3	3	3	2	2	3	2	2.7
CO4	3	3	3	3	3	3	2	2	3	2	2.7
CO5	3	3	3	3	3	3	2	2	3	2	2.7
Mean Overall Score											2.7
Correlation											High

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. M. Meeramaideen

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
IV	23UZO4AC8P	Allied - VIII	3	2	20	80	100
Course Title ECONOMIC ZOOLOGY - PRACTICAL - II							

SYLLABUS		
Unit	Contents	Hours
	<p>Dissections:</p> <ol style="list-style-type: none"> 1. Dissect and display the Earth worm/ Cockroach nervous system 2. Dissect and display the Prawn appendages 3. Dissect and display the Prawn nervous system 4. Dissect and display the silk gland of silk moth larva (Demo) <p>Mountings</p> <ol style="list-style-type: none"> 1. Mounting of Earth worm: Body setae, Pineal setae. 2. Mounting of honey bee sting apparatus 3. Mounting of scales: Cycloid, Cteinoid, Placoid 4. Mounting the Mouth parts: Mosquito, Honey bee, <p>Spotters</p> <p>Vermiculture- <i>Lampito mauritii</i>, <i>Perionyx excavates</i>.</p> <p>Apiculture – <i>Apis indica</i> ;</p> <p>Sericulture – <i>Bombyx mori</i> ;</p> <p>Aquaculture – Major carps : Catla, Rohu and Mrigal: Prawn – Macrobrachium.</p> <p>Poultry : Layers & Broilers.</p> <p>Animal products: Honey, Bee wax, Lac, Silk, and Hen's egg.</p> <p>Record Work</p> <p>A record of lab work shall be maintained and submitted at the time of Practical Examination for valuation.</p>	45
	<p>Current Trends (For CIA only) – Nutrient composition of vermicompost – Advantages of sea food – Health benefits of egg.</p>	

Text Book(s):
<ol style="list-style-type: none"> 1. Jayasurya., Arumugam, N., Nair, N.C., Leelavathy, S., Soundara Pandian, N., Murugan, T. Practical Zoology Volume - 1. Invertebrata. Saras publication, Nagercoil. 2013. 2. Jayasurya., Arumugam, N., Thangamani., Prasannakumar., Narayanan. L.M. Practical Zoology Volume -2. Saras publication, Nagercoil. 2013. 3. Jayasurya., Arumugam, N., Dulisy Fatima., Narayanan, L.M., Meyyan, R.P., Nallasingam, K., 4. Kumaresan, V., Mani, A., Selvaraj, A.M., Mariakuttikan, A. Practical Zoology Volume -3. Cell 5. Biology – Embryology – Animal Physiology – Immunology – Ecology – Genetics – Evolution – 6. Microbiology – Biochemistry – Biophysics. Saras Publication. 2013

Reference Book(s):	
1. Nair,N.C., Leelavathy,S., Soundara Pandian, N., Murugan,T., Thangamani, A., Prasannakumar,S., Narayanan,L.M., and Arumugam,N., Animal Diversity Invertebrata and Chordata. Saras Publication, Nagercoil. Fifth Ed., 2013 2. Arumugam, N. and Mariakuttikan,A., Animal Physiology. Saras Publication, Nagercoil. 2011. 3. Arumugam, N, A Text Book of Embryology, Saras Publication, Nagercoil. Fourteenth Ed., 2013. 4. Arumugam, N, Organic Evolution, Saras publication, Nagercoil. 2010	
Web Resource(s):	
1. http://www.itis.usda.gov/itis/status.html 2. http://www.bishop.hawaii.org/bishop/HBS/hbs1.html 3. http://www.itis.usda.gov/itis/status.html 4. http://www.bishop.hawaii.org/bishop/HBS/hbs1.html	

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Understand the different functional systems of earthworm and honey bee through dissection.	K3
CO2	Identify and prepare slides of fish scales and compare the appendages of prawn.	K2
CO3	Classify giving reasons, draw labelled sketch and bring out their biological significance	K3
CO4	Relate the nature of damage and the life cycle of pests	K3
CO5	Report the economic importance of animal products and their significance.	K4

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	3	3	2	2	3	2	2.7
CO2	3	3	3	3	3	3	2	2	3	2	2.7
CO3	3	3	3	3	3	3	2	2	3	2	2.7
CO4	3	3	3	3	3	3	2	2	3	2	2.7
CO5	3	3	3	3	3	3	2	2	3	2	2.7
Mean Overall Score											2.7
Correlation											High

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. M. Meeramaideen