

DEPARTMENT OF BOTANY

COURSE STRUCTURE & SYLLABI

(For the students admitted from year 2023-2024 onwards)

Programme : B.Sc. Botany



Since 1951

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. BOTANY

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
	23UBO1CC1	III	Core - I	Plant Diversity (Algae, Fungi and Archegoniate)	5	5	25	75	100
	23UBO1CC2P		Core - II	Laboratory course for core - I - Practical	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
	23UBO2CC3	III	Core - III	Plant Anatomy and Embryology	6	6	25	75	100
	23UBO2CC4P		Core - IV	Laboratory course for core - III - Practical	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#	-
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
	23UBO3CC5	III	Core - V	Cytology, Genetics and Evolution	4	4	25	75	100
	23UBO3CC6P		Core - VI	Laboratory course for core - V - Practical	3	3	20	80	100
	23UZO3AC5		Allied - V	General Zoology	4	4	25	75	100
	23UZO3AC6P		Allied - VI	General Zoology - Practical - I	3	2	20	80	100
	23UBO3GE1	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
	23UBO4CC7	III	Core - VII	Microbiology and Plant Pathology	5	5	25	75	100
	23UBO4CC8P		Core - VIII	Laboratory course for core - VII - Practical	3	3	20	80	100
	23UZO4AC7		Allied - VII	Economic Zoology	5	4	25	75	100
	23UZO4AC8P		Allied - VIII	Economic Zoology - Practical - II	3	2	20	80	100
	23UBO4GE2	IV	Generic Elective - II		2	2	-	100	100
	23UCN4EL		Experiential Learning	Internship	-	2	-	100	100
	23UCN4EA	V	Extension Activities	NSS, NCC, etc.	-	1	-	-	-
23U4BT2/ 23U4AT2		Basic Tamil - II/ Advanced Tamil - II	எழுத்தும் இலக்கியமும் அறிமுகம் - II/ தமிழ் இலக்கியமும் வரலாறும் - II	-	-	-	100#	-	
Total					30	25			800
V	23UBO5CC9	III	Core - IX	Plant Systematics and Economic Botany	6	6	25	75	100
	23UBO5CC10		Core - X	Plant Physiology	6	6	25	75	100
	23UBO5CC11		Core - XI	Biochemistry, Biophysics and Biological Techniques	6	6	25	75	100
	23UBO5CC12P		Core - XII	Laboratory course for core - IX, X and XI - Practical	3	3	20	80	100
	23UBO5DE1A/B		Discipline Specific Elective - I		5	5	25	75	100
	23UBO5SE1	IV	Skill Enhancement Course - I	Algal Cultivation Techniques for Entrepreneurship	2	1	-	100	100
	23UBO5SE2		Skill Enhancement Course - II	Greenhouse Technology	2	1	-	100	100
	23UBO5EC1		Extra Credit Course - I*	Online Course	-	*	-	-	-
Total					30	28			700
VI	23UBO6CC13	III	Core - XIII	Plant Ecology and Phytogeography	6	6	25	75	100
	23UBO6CC14		Core - XIV	Plant Molecular Biology and Biotechnology	6	6	25	75	100
	23UBO6CC15P		Core - XV	Laboratory course for core - XIII and XIV - Practical	5	5	20	80	100
	23UBO6PW		Project Work	Project Work	3	2	-	100	100
	23UBO6DE2A/B		Discipline Specific Elective - II		5	4	25	75	100
	23UBO6DE3A/B		Discipline Specific Elective - III		4	3	25	75	100
	23UCN6AE3	IV	AECC - III	Gender Studies	1	1	-	100	100
	23UBO6EC2		Extra Credit Course - II*	Online Course	-	*	-	-	-
	23UBO6ECA		Extra Credit Course for all**	Online Course	-	**	-	-	-
Total					30	27			700
Grand Total						148			4400

* Programme Specific Online Course for Advanced Learners

** Any Online Course for Enhancing Additional Skills

GENERIC ELECTIVE COURSES

Semester	Course Code	Course Title
III	23UBO3GE1	Edible Mushroom Cultivation and Commercialization
IV	23UBO4GE2	Nursery, Gardening for Entrepreneurship

**# 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	23UBO5DE1A	Biostatistics and Bioinformatics
	23UBO5DE1B	Enzyme Technology
VI	23UBO6DE2A	Industrial Botany
	23UBO6DE2B	Seed Technology
	23UBO6DE3A	Horticulture and Plant Breeding
	23UBO6DE3B	Silviculture

ALLIED COURSES FOR B.Sc. CHEMISTRY & B.Sc. ZOOLOGY

Semester	Course Code	Part	Course Category	Course Title
III	23UBO3AC5	III	Allied - V	Applied Botany – I
	23UBO3AC6P		Allied - VI	Laboratory Course for Applied Botany I – Practical
IV	23UBO4AC7		Allied - VII	Applied Botany – II
	23UBO4AC8P		Allied - VIII	Laboratory Course for Applied Botany II – Practical

Semester	Course Code	Course Category	Hours/Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
I	23UBO1CC1	Core – I	5	5	25	75	100
Course Title		PLANT DIVERSITY (ALGAE, FUNGI AND ARCHEGONIATE)					
SYLLABUS							
Unit	Contents						Hours
I	Algae: General characteristics and outline classification of algae (F. E. Fritsch, 1985). Habit and habitats of freshwater, marine and soil algae. Thallus organization and food reserve in algae. A detailed study of structure, reproduction and life cycle of the following genera – <i>Oscillatoria</i> , <i>Volvox</i> , <i>Oedogonium</i> , <i>Caulerpa</i> , <i>Dictyota</i> and <i>Polysiphonia</i> . Economic importance of algae with reference to industry, *agriculture and medicine*.						15
II	Fungi: General characteristics and outline classification of fungi (Alexopoulos and Mims, 1979). Detailed study of occurrence, morphology, reproduction and life cycle of the following genera – <i>Albugo</i> , <i>Aspergillus</i> , <i>Puccinia</i> and <i>Polyporus</i> . Economic importance of fungi with reference to medicine, agriculture and industry. Lichens – General characters, types and *economic importance of fungi*.						15
III	Bryophytes: General characteristics and classification of bryophytes (Rothmaler, 1951). A detailed study of the structure, anatomy, reproduction and life cycle of the following genera – <i>Marchantia</i> , <i>Porella</i> , <i>Anthoceros</i> and <i>Polytrichum</i> . Economic importance of bryophytes.						15
IV	Pteridophytes: General characteristics and classification of Pteridophytes (Sporne, 1975). Morphology, anatomy, reproduction and life cycle of the following genera – <i>Lycopodium</i> , <i>Equisetum</i> and <i>Adiantum</i> (Excluding developmental stages). Stelar evolution and economic importance of Pteridophytes. Paleobotany: Fossil types, methods of fossilization, Geological time scale, brief study of <i>Rhynia</i> , <i>Lepidodendron</i> and * <i>Calamities</i> *.						15
V	Gymnosperms: General characters and classification of gymnosperms (Sporne, 1967). Morphology, anatomy, reproduction and life cycle of the following genera – <i>Cycas</i> and <i>Pinus</i> . Economic importance of gymnosperms with reference to wood, essential oils, resins and drugs. A brief study of the fossil gymnosperms – * <i>Williamsonia</i> *.						15
VI	Current Trends (For CIA only) – Contemporary developments related to the course during the semester concerned.						

..... Self Study

Text Book(s):
1. Sharma OP. A Text Book of Algae, 1 st Edition, Tata McGraw Hill Education Pvt Ltd, New Delhi, India, 2011. 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. Mehrotra, RS & Aneja, KR. An introduction to Mycology, 2nd Ed., New Age International Publishers, New Delhi, 1999. 4. Sporne, KR. The Morphology of Pteridophytes Hutchinson & Co., London, 2015. 5. Arnold. C. A. An Introduction to Paleobotany McGraw Hill Book Company, London, 2013.

Reference Book(s):

1. Vasishta PC, Sinha AK and Kumar A, Botany for Degree Students, 2nd Edition, Chand & Company Pvt Ltd, New Delhi, India, 2010.
2. Alexopoulos CJ, Mims CW and Blackwell M, Introductory Mycology, 4th Edition, Wiley Publishers, New Delhi, India, 2007.
3. Pandey BP, Botany for Degree Students, 2nd Edition, Chand & Company Pvt Ltd, New Delhi, India, 2010.
4. Sporne, K. R. The Morphology of Gymnosperm. Scientific Publishers, Jodhpur, (2015).
5. Steward. N. Wilson & Rothwell, W. Gar. Paleobotany and evolution of Plants, Cambridge University Press, 2005.

Web Resource(s):

1. <https://www.biologydiscussion.com/algae/thallus-organisation-in-algae-botany/53555>
2. <https://www.plantscience4u.com/2018/11/what-is-mode-of-nutrition-in-fungi.html>
3. <https://www.biologydiscussion.com/lichens-2/lichens-symbiotic-association-and-reproduction/49914>
4. <https://www.biologydiscussion.com/lichens-2/economic-importance-of-lichens-botany/53600>

Course Outcomes

CO Number	CO Statement	Cognitive Level (K-Level)
CO1	Summarize the salient features and general characters of Algae, Fungi, Lichens Bryophytes, Pteridophytes and Gymnosperms.	K1
CO2	Understand the various trends of classification and internal structures and life cycle patterns of lower group of plant and Pteridophytes and Gymnosperms.	K2
CO3	Application of economic importance of algae, fungi, lichens, Bryophytes, Pteridophytes and gymnosperms for the production of various industrial based products.	K3
CO4	Analyse the fossil, fossilization methods and geological time scale of evolutionary features in Pteridophytes and Gymnosperms.	K4
CO5	Evaluate the various modes of structure, reproduction and life history of Pteridophytes and Gymnosperms.	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	03	02	02	01	02	03	02	01	02	02	2.0
CO2	02	03	02	02	01	02	03	02	02	01	2.0
CO3	01	02	03	02	02	02	01	03	02	02	2.0
CO4	03	01	02	01	02	02	02	02	03	02	2.0
CO5	02	02	01	02	02	02	02	02	01	03	1.9
Mean Overall Score											2.0
Correlation											Medium

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

Course Coordinator: Dr. M. Kamaraj

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
I	23UBO1CC2P	Core – II	3	3	20	80	100
Course Title		LABORATORY COURSE FOR CORE - I – PRACTICAL					

SYLLABUS		
Unit	Contents	Hours
	<ol style="list-style-type: none"> 1. Micropreparation and observation of vegetative and reproductive parts of the following algal specimens – <i>Oscillatoria</i>, <i>Volvox</i>, <i>Oedogonium</i>, <i>Caulerpa</i>, <i>Dictyota</i> and <i>Polysiphonia</i>. 2. Micropreparation and observation of the following fungal specimens – <i>Albugo</i>, <i>Aspergillus</i>, <i>Puccinia</i> and <i>Polyporus</i>. 3. Micropreparation and observation of the following bryophyte specimens – <i>Marchantia</i>, <i>Porella</i>, <i>Anthoceros</i> and <i>Polytrichum</i>. 4. Micropreparation and observation of the following pteridophyte specimens – <i>Lycopodium</i>, <i>Equisetum</i> and <i>Adiantum</i>. 5. Micropreparation and observation of the following gymnosperm specimens – <i>Cycas</i> and <i>Pinus</i>. 6. Observation of following permanent fossil slides – <i>Rhynia</i>, <i>Lepidodendron</i>, <i>Calamities</i> and <i>Williamsonia</i>. 7. Botanical tour to witness the specimens in their natural habitats (not exceeding three days). 	45

Text Book(s):
<ol style="list-style-type: none"> 1. Santra SC, Chatterjee TP and Das AP, College Botany Practical (Volume II), 1st Edition (Reprinted), New Central Book Agency Pvt Ltd, Kolkata, India, 2001. 2. Pandey BP, Modern Practical Botany, 1st Edition (Reprinted), Chand & Company Pvt Ltd, New Delhi, India, 2011. 3. Sharma OP, Practical Botany, 7th Edition, PragatiPrakashan Educational Publishers Pvt Ltd, Meerut, India, 2014.
Reference Book(s):
Web Resource(s):

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Explain the internal structures of algae and fungi through microscopic observation.	K1
CO2	Examine the morphology, anatomy and reproductive parts of bryophytes.	K2
CO3	Observe the morphology, anatomy and reproductive parts of pteridophytes and gymnosperms.	K3
CO4	Categorize fossil plants based on geological time period.	K4
CO5	Realize the natural plant diversity through field visit.	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	03	01	02	02	02	03	02	01	02	02	2.0
CO2	01	03	02	02	01	01	03	02	01	02	1.8
CO3	02	01	03	02	02	02	01	03	02	02	2.0
CO4	02	02	02	03	01	02	03	02	01	02	2.0
CO5	03	02	02	01	01	02	02	02	02	03	2.0
Mean Overall Score											1.9
Correlation											Medium

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

Prepared by:

1. Dr. M. Kamaraj

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	<p>PERIODIC PROPERTIES, INDUSTRIAL GASES AND INSECTICIDES</p> <p>1.1 Periodic properties: Ionization potential, *electron affinity* and electro negativity - Definition, factors affecting and variation in the periodic table.</p> <p>1.2 Industrial Gases: Fuel gases composition and Preparation of Water gas, Producer gas, LPG, Gobar gas and Natural gas.</p> <p>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.</p>	15
II	<p>BIOMOLECULES</p> <p>2.1. Carbohydrates: Classification. Glucose and fructose – Preparation, properties and uses. Sucrose – Manufacture and properties. Starch and cellulose – uses.</p> <p>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.</p> <p>2.3. Nucleic acids: DNA and RNA – Differences between DNA and RNA, functions - *Structure of DNA*.</p>	15
III	<p>BLOOD AND POLYMERS</p> <p>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.</p> <p>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.</p>	15
IV	<p>SEPARATION AND PURIFICATION TECHNIQUES</p> <p>4.1 Separation Techniques: Distillation-steam, *fractional* and azeotropic distillation, crystallization – principles, working techniques and applications.</p> <p>4.2 Chromatography – Paper, thin layer chromatography, HPLC and GC-MS - principle, experimental techniques and applications.</p>	15
V	<p>ACIDS - BASES AND CATALYSIS</p> <p>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.</p> <p>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.</p>	15

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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
<p>Volumetric Estimation Practicals</p> <ol style="list-style-type: none"> 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) <p style="text-align: center;"><u>Scheme of valuation</u></p> <p>Record – 10 Marks Procedure writing – 10 Marks For Estimation – 60 Marks</p> <p><u>For Estimation Results:</u></p> <p style="padding-left: 40px;">1-2% - 60 marks 2-3% - 50 marks 3-4% - 40 marks >4% - 30 marks</p>	45

Text Books:
<ol style="list-style-type: none"> 1. Peter McPherson, Volumetric Analysis, Royal Society of Chemistry, 1st Edition 2014. 2. K.B. Baliga et al., College Analytical Chemistry, Himalaya Publishing House, 19th Edition, 2011 3. Venkateswaran V. Veerasamy R. Kulandaivelu A.R, Basic Principles of Practical Chemistry, S. Chand & Co Pvt. Ltd, New Delhi, 2nd Edition 1997.
Reference Books:
<ol style="list-style-type: none"> 1. Handbook Of Inorganic Qualitative Analysis by Maharudra Chakraborty, Scifinity Publication; 1st Edition 2019. 2. Vogel, Text Book of Quantitative Chemical Analysis,, Pearson Education, 6th edition ,2009. 3. Day R A., Underwood A I., Quantitative Analysis, New York: Pearson Emory University. Print. 6th edition, 1991
Web Resources:
<ol style="list-style-type: none"> 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
II	23UBO2CC3	Core – III	6	6	25	75	100
Course Title		PLANT ANATOMY AND EMBRYOLOGY					

SYLLABUS		
Unit	Contents	Hours
I	<p>Meristematic and permanent tissues: Introduction to tissues, General classification of tissues. Meristematic tissues: Definition, classification Based on origin, function and position). Theory of shoot organization – Tunica-cortex, Theory of root organization – Histogen theory. Permanent tissues: Simple permanent tissues – Structure, types and functions of Parenchyma, Collenchyma and Sclerenchyma. Complex permanent tissues - Structure, types and functions of Xylem and Phloem.</p>	18
II	<p>Tissue system: Origin, structure and function of epidermal tissue system, special epidermal structures and hydathodes. Secretory tissue – glandular, resin ducts and laticiferous tissue. Ground tissue – extrastelar (cortex), intrastelar (pericycle, pith and medullary rays) and mesophyll. *Types of vascular bundles*.</p>	18
III	<p>Anatomical features of plant organs Primary structures of leaf stem and root of monocot and dicot. Normal secondary thickening in dicot stem and root. Development of periderm, phellem, phellogen, lenticels and tyloses. Types of wood – sap, heart, ring porous and diffused wood. Brief account on dendrochronology. Anomalous secondary thickening in <i>Boerhavia</i>, <i>Nyctanthes</i> and <i>*Dracaena*</i>.</p>	18
IV	<p>Structural organization and fertilization Anther structure, microsporogenesis and development of malaegametophyte. Ovule structure, and types, megasporogenesis, development of Monosporic, Bisporic and Tetrasporic types of embryo sacs. Pollination – Factors favour for pollination, types, advantages and disadvantages. Fertilization – *Double fertilization and triple fusion*.</p>	18
V	<p>Endosperm, embryo, apomixis and polyembryony Endosperm development and its types. Functions of endosperm. Development of dicot and monocot embryos. Brief note on apomixis, parthenocarpy, polyembryony and its types. Seed structure, development, function and *dispersal of seeds*.</p>	18
VI	Current Trends (For CIA only) – Brief account on dendrochronology.	

..... Self Study

Text Book(s):

1. Bhojwani SS and Bhatnagar SP, The embryology of Angiosperms, 5th Edition, Vikas Publishing House Pvt Ltd, New Delhi, India, 2009.
2. Pandey SN and Chandha A, Plant anatomy and Embryology. 1st Edition, Vikas Publishing House Pvt Ltd, New Delhi, India, 2009.
3. Pandey BP, Plant Anatomy, 2nd Edition, Chand & Company Pvt Ltd, New Delhi, India, 2012.

Reference Book(s):

1. Lersten Nels R, Flowering Plant Embryology. 1st Edition. Iowa State University Press, Iowa, 2004.
2. Evert RF, Esau's Plant Anatomy, 3rd Edition, Wiley Publishers India, 2005.

Course Outcomes

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

CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Understanding the basic concepts in Plant Anatomy and Embryology.	K1
CO2	Identify different type of tissue system and their organization.	K2
CO3	Analyze the secondary thickening and anomalous secondary thickening in dicot and monocot leaf, stem and root.	K3
CO4	Evaluate the structural organization of flower and the process of pollination and fertilization.	K4
CO5	Categorize the plant relationships based on internal anatomy and reproductive system.	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	03	02	02	01	02	03	02	01	02	02	2.0
CO2	02	03	02	02	01	02	03	02	02	01	2.0
CO3	01	02	03	02	02	02	01	03	02	02	2.0
CO4	03	01	02	01	02	02	02	02	03	02	2.0
CO5	02	02	01	02	02	02	02	02	01	03	1.9
Mean Overall Score											2.0
Correlation											Medium

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

Course Coordinator: Dr. R. Ravi kumar

Semester	Course Code	Course Category	Hours/Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
II	23UBO2CC4P	Core – IV	3	3	20	80	100
Course Title		LABORATORY COURSE FOR CORE - III – PRACTICAL					

SYLLABUS	
Contents	Hours
<p>List of Practicls:</p> <ol style="list-style-type: none"> 1. Study of primary anatomy of monocot and dicot leaf, stem and root with help of hand cut stained sections (monocot – Grass/<i>Canna</i> and dicot – <i>Tridax</i>). 2. Study of normal secondary thickening in dicot stem (<i>Azadiractaindica</i>). 3. Study of anomalous secondary thickening (<i>Boerhavia</i>, <i>Nyctanthes</i> and <i>Dracaena</i>). 4. T.S of young and mature anther (<i>Datura metal</i>) 5. Isolation and mounting of embryo (<i>Cucumis</i> and <i>Tridax</i>). 6. Observation of simple and complex tissues (Charts / permanent slides / photographs). 7. Observation of vascular bundle orientation (Charts / permanent slides / photographs). 8. Study of L.S. of ovule and types of ovule (Charts / permanent slides / photographs). 	45

Text Book(s):
<ol style="list-style-type: none"> 1. SundaraRajan S, Practical manual of plant anatomy and embryology, 1st Edition, Anmol Publications Pvt Ltd, Bangalore, Karnataka, India, 2003. 2. Pandey SN and Chandha A, Plant anatomy and Embryology. 1st Edition, Vikas Publishing House Pvt Ltd, New Delhi, India, 2009. 3. Pandey BP, Modern Practical Botany, 1st Edition (Reprinted), Chand & Company Pvt Ltd, New Delhi, India, 2011.
Reference Book(s):
Web Resource(s):

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Categorize the structure and functions of primary and complex tissues.	K4
CO2	Distinguish and compare the anatomical features of dicot and monocot plants.	K5
CO3	Illustrate the primary, secondary and anomalous thickening of plants.	K3
CO4	Discuss the development of the endosperm and embryo.	K2
CO5	Justify the identification of anatomical and embryological specimens.	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	03	02	02	01	02	03	02	01	01	02	1.9
CO2	02	03	01	02	02	02	03	02	02	01	2.0
CO3	01	01	03	02	01	02	01	03	02	02	1.8
CO4	03	02	01	01	02	01	03	02	01	02	1.8
CO5	01	02	02	02	03	03	01	02	02	01	1.9
Mean Overall Score											2.0
Correlation											Medium

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

Course Coordinator: Dr. R. Ravi kumar

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	<p>INDIAN MEDICINAL PLANTS AND BIOLOGICALLY IMPORTANT COMPOUNDS</p> <p>1.1 Indian Medicinal Plants: Hibiscus Rosa Sinesis - Adathoda Vasica - Azadirachta Indica – Solanum Trolobatum – Active Constituents and Medicinal uses.</p> <p>1.2 Biologically important compounds: Haemoglobin and Chlorophyll- structure and biological role.</p>	12
II	<p>NUCLEAR CHEMISTRY</p> <p>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*</p> <p>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</p>	12
III	<p>VITAMINS AND DRUGS</p> <p>3.1 Vitamins – Definition, classification. Sources and deficiency diseases of vitamins A, D, E, K, B₆, B₁₂ and C.</p> <p>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.</p>	12
IV	<p>ENZYMES AND HORMONES</p> <p>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.</p> <p>4.2. Hormones- introduction, structure and physiological functions - Adrenaline, thyroxine, oxytocin and insulin.</p>	12
V	<p>COLLOIDS</p> <p>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.</p> <p>5.2 Emulsion: definition, types, preparation, properties and applications.</p> <p>5.3. Gels: definition, types, preparation, properties and applications.</p>	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, 2nd reprint, 1987
2. A .K. Srivastava, Organic Chemistry, New Age International Publishers, New Delhi, 1st Edition, 2002
3. R. L. Madan, G.D. Tuli, Simplified Course in Physical Chemistry, S. Chand & Co., New Delhi 5th 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
<p>Qualitative analysis of the following organic compounds:</p> <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:
<ol style="list-style-type: none"> Ganaprasad N S and Ramamurthy G, Organic Chemistry Lab Manual, S. Vishwanathan Printers and Publishers (P) Ltd., Chennai, 2nd Edition, 2007. Venkateswaran V. Veerasamy R. Kulandaivelu A.R, Basic Principles of Practical Chemistry, S. Chand & Co Pvt. Ltd, New Delhi, 2nd Edition, 1997. Furniss B S, et al., Vogel's Textbook of Practical Organic Chemistry, ELBS Longman, London, 7th Edition, 1984.
Reference Books:
<ol style="list-style-type: none"> A. I. Vogel's, Text Book of Practical Organic Chemistry, Prentice Hall, 5th Edition, 1989.
Web Resources:
<ol style="list-style-type: none"> https://jru.edu.in/studentcorner/lab-manual/bpharm/Lab%20Manual%20-%20Pharmaceutical%20Organic%20Chemistry.pdf https://ncert.nic.in/pdf/publication/sciencelaboratorymanuals/classXII/chemistry/lelm108.pdf 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):
<ol style="list-style-type: none"> 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:
<ol style="list-style-type: none"> 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	23UBO3CC5	Core – V	4	4	25	75	100
Course Title		Cytology, Genetics and Evolution					

SYLLABUS		
Unit	Contents	Hours
I	Organization of prokaryotic and eukaryotic cells. Structure, composition and properties of middle lamella, cell wall (primary and secondary), pits (simple and bordered), plasmodesmata, plasma membranes (fluid mosaic model) and cytoplasm. Membrane transport – Passive, active and facilitated transport, endocytosis and exocytosis. Structure and functions of cellular organelles (nucleus, mitochondria, chloroplasts, endoplasmic reticulum, golgi complex, ribosomes), cytoskeleton and ergastic substances. *Lysosomes*.	12
II	Cell Cycle, mechanisms and significance of mitotic and meiotic cell divisions *amitosis*. Structure and chemical composition of chromosomes. Euchromatin and heterochromatin. Special types of chromosomes - giant chromosome, supernumerary chromosomes, chimaera, SAT - chromosome, Polytene and Lampbrush chromosomes.	12
III	History, branches and applications of genetics, principles of genetics, Mendel's laws, monohybrid, dihybrid crosses. Reciprocal cross - Back cross and Test cross, deviation from Mendelian ratio, lethality, multiple factor hypothesis, incomplete dominance - <i>Mirabilis jalapa</i> , Epistasis, non-epistasis, inheritance of quantitative traits, multiple alleles - ABO Blood grouping in Human. complementary factor, chromosomal theory of inheritance. *pleiotropism*.	12
IV	Linkage and crossing over, Sex linked inheritance – Haemophilia and colour blindness, cytoplasmic inheritance, sex determination in plants. Chromosomal aberrations - deletions, duplications, inversions and translocations, Aneuploidy - (monosomy, nullisomy and trisomy). Euploidy, Polyploidy – (autopolyploids – allopolyploids). *Sex linked inheritance in plants*. Extra nuclear inheritance and its significance- Male sterility in corn, Maternal inheritance – Plastid Inheritance in <i>Mirabilis jalapa</i> . Genetics of <i>Neurospora</i> . Population genetics: Hardy - Weinberg principle.	12
V	Evolution - origin of life, chemosynthetic theory - evidences (any five). Theories of evolution - Darwin, Lamark and De veries, modern synthetic theory. Variation - analysis and sources, adaptive radiation, Concept of speciation - *Allopatric and sympatric*.	12

* * Self Study

Text Book(s):
<ol style="list-style-type: none"> 1. Sinnott, EW., Dunn, L.L and Dobzhansky, T. Principles of Genetics, Tata McGraw Hill Publishing Co. New Delhi, 1997. 2. Singh, R. J. 2016. Plant Cytogenetics, 3rd Edition. CRC Press, Boca Raton, Florida, USA. 3. Verma, P.S and V.K. Agarwal. Cytology. S. Chand & Co. Ltd., New Delhi. 2002.
Reference Book(s):
<ol style="list-style-type: none"> 1. Klug, W.S., Cummings, M.R., Spencer, C.A. Concepts of Genetics. 9th edition. Benjamin Cummings, U.S.A. 2009. 2. Cooper, G.M and Hausman, R.E. The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C. Sinauer Associates, MA. 2009. 3. Gardner, E.J., Simmons, M.J and Snustad, D. Principles of Genetics, John Wiley Sons Inc., 8th Edn., New York. 1991.

Web Resource(s)	
1.	http://www.freebookcentre.net/Biology/Cell-Biology-Books.html
2.	https://www.us.elsevierhealth.com/medicine/cell-biology
3.	https://www.amazon.in/Cell-Biology-Thomas-D-Pollard-ebook/dp/B01M7YAL2A
4.	http://www.freebookcentre.net/medical_text_books_journals/genetics_ebooks_online_texts_download.html
5.	https://www.us.elsevierhealth.com/medicine/genetics
6.	https://libguides.uthsc.edu/genetics/ebooks

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	Enumerate the structure and functions of cells, cellular structures and organelles.	K1
CO2	Explain about cell cycle, cell division and laws of inheritance with suitable examples.	K2
CO3	Elucidate concepts of sex determination and sex linked inheritance.	K3
CO4	Analyze the importance of genes interactions at population and evolutionary levels.	K4
CO5	Determine the various fossilization methods and their significance in evolution.	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	03	03	01	03	02	01	02	02	03	01	2.1
CO 2	03	03	02	02	03	03	02	03	03	02	2.6
CO 3	03	03	02	03	01	02	01	03	03	02	2.3
CO 4	03	03	03	03	03	02	03	03	03	03	2.9
CO 5	03	03	02	03	02	02	01	03	01	03	2.3
Mean Overall Score											2.4
Correlation											Medium

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

Course Coordinator: Dr. R. Radhakrishnan

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
III	23UBO3CC6P	Core – VI	3	3	20	80	100
Course Title		Laboratory Course for Core - V – Practical					

SYLLABUS	
Contents	Hours
<p>Cytology:</p> <ol style="list-style-type: none"> 1. Observation of the structure of cell organelles through photomicrographs. 2. Observation of structure of plant cell through temporary mounts. 3. Observation of cell inclusions (non-living) 4. Histochemical identification of starch, sugars, proteins and alkaloids in plant cells 5. Observation of polyploidy in onion root tips after treatment with Colchicine (<i>DBT Star College Scheme</i>) 6. Identification of different stages of mitosis by using squash and smear techniques – Onion root tip. 7. Observation of meiosis in Rheo flower buds - Demo. <p>Genetics:</p> <ol style="list-style-type: none"> 1. Problems relevant to monohybrid ratio 2. Problems relevant to dihybrid ratio 3. Problems relevant to non-Mendelian ratio 4. Construction of chromosomal map 	45

Text Book(s):
<ol style="list-style-type: none"> 1. Jackson, S.A., Kianian, S.F., Hossain, K.G and Walling, J.G. Practical laboratory exercises for plant molecular cytogenetics. In Plant Cytogenetics Springer, New York, 2012. 2. Gupta P.K. Cell and Molecular Biology (5th ed.), Rastogi Publications, Meerut, 2017. 3. Krebs J.E., Goldstein E.S and Kilpatrick S.T. Lewin's GENES XII (12th ed.). Jones & Bartlett Learning. 2017.
Reference Book(s):
<ol style="list-style-type: none"> 1. Gardener, J, Simmons, H.J and Snustad, D.P. Principle of Genetics, John Wiley & Sons, New York, 2006. 2. De Robertis E.D.P. and De Robertis E.M.P. Cell and Molecular Biology (8th ed.) (South Asian Edition), Lea and Febiger, Philadelphia, USA, 2017.
Web Resource(s)
<ol style="list-style-type: none"> 1. https://books.google.co.in/books/about/Practical_Manual_Of_Plant_Anatomy_And_Em.html?id=Cq1KPwAACAAJ&redir_esc=y 2. https://www.amazon.in/Cell-Biology-Dr-Renu-Gupta/dp/8193651219 3. https://www.amazon.in/Practical-Handbook-Genetics-Vikas-Pali/dp/932727248X

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	Identify the structure of cell organelles and stages of cell division.	K1
CO2	Classify the types of cell divisions	K2
CO3	Compare the functions of various ergastic substances present in plant tissues.	K3
CO4	Perform free hand sectioning of plant materials and decipher the internal tissue organization.	K4
CO5	Interpret the given genetic data to develop genetic map based on the principles of Mendelian inheritance and gene interaction.	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	03	03	01	03	02	01	02	02	01	03	2.1
CO 2	03	02	02	02	03	03	02	03	02	02	2.4
CO 3	02	02	03	02	01	02	01	03	03	03	2.2
CO 4	03	03	02	03	03	02	03	02	03	03	2.7
CO 5	03	02	02	03	02	03	03	03	02	02	2.5
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. R. Radhakrishnan

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
III	23UZ03AC5	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. digestive system/Anatomy and Physiology">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, Ascaris male and female, Nereis, Earthworm, Prawn, Butterfly, Freshwater Mussel, Snail, Sea urchin, Starfish.</i></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 PhysioloHy – 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
III	23UBO3GE1	Generic Elective – I	2	2	-	100	100
Course Title		Edible Mushroom Cultivation and Commercialization					
Syllabus							
Unit	Contents						Hours
I	Introduction: History, importance and scope of edible mushrooms, morphology of mushroom, identification of edible and poisonous mushrooms. Skill development for mushroom cultivation *Mushroom cultivation in India*.						6
II	Biological importance, composting and storage: Nutritional and medicinal values of edible mushrooms. Composting: importance in waste recycling. Compost used for edible mushroom. Farm and the layout of culture room, harvesting room. *Storage - methods of short term and long-term storage*.						6
III	Spawning and Cultivation Methods: Strains, containers, quantity of spawn to be used, spawning types and techniques, compost preparation, casing. Cultivation of button, milky and *oyster mushrooms*.						6
IV	Crop management: Air temperature, humidity, ventilation, watering and watering methods, disposal of used compost and recycling, cropping period, insects and pests, *insecticides and their use*.						6
V	Economics of Cultivation and Post Harvest Technologies: Cost economics – Permanent medium scale mushroom farm. Post harvesting: Picking, grading, packing, Sanitation, supply and demand ratio, Marketing and e-marketing. Value added products of mushrooms, Export opportunities and *Mushroom recipes* (Soup, pulao, pickles, omelette).						6

* * Self Study

Text Book(s):
<ol style="list-style-type: none"> 1. Pandey RK, Ghosh SK and Chauhan KS, A hand book on mushroom cultivation, 1st Edition, Emkay Publications Pvt Ltd, New Delhi, India, 1996. 2. Parveen Garg, Mushroom cultivation, 1st Edition, B R Publishing Corporation Pvt Ltd, New Delhi India, 2015. 3. Rajan S. Mushroom technology, 2nd Edition, CBS Publishers and Distributors, Pvt Ltd, New Delhi India, 2020.
Reference Book(s):
<ol style="list-style-type: none"> 1. Nita Bahl, Hand book of Mushroom, Oxford and IBH Book House Pvt Ltd, New Delhi, India, 2005. 2. Eiri B, Hand Book of Mushroom Cultivation, Processing and Packaging, Engineers India Research Institute, New Delhi, India, 2007.

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	Provide an adequate knowledge about importance and habitation of mushroom.	K1
CO2	Get understating of nutritional value, cultivation unit and practice of storage methods.	K2
CO3	Acquire knowledge and practice about spawning techniques and learn mushroom cultivation techniques.	K3
CO4	Evaluating the factors influencing the mushroom cultivation, practice post harvesting methods and preparation of insecticides.	K4
CO5	Students get training about cost economics and preparation of value-added 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	02	02	02	02	2.1
CO2	02	03	03	02	03	03	03	02	03	03	2.7
CO3	02	03	03	03	03	03	03	03	03	03	2.9
CO4	02	02	03	03	03	03	02	02	02	03	2.5
CO5	02	03	03	03	03	03	03	02	03	03	2.8
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. K. Mohamed Rafi

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: Renewable and Non-renewable Resources: Land Resources and 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 patterns biodiversity hot spots. mega-biodiversity nation; 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:
<ol style="list-style-type: none"> 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:
<ol style="list-style-type: none"> 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	23UBO4CC7	Core - VII	5	5	25	75	100
Course Title		Microbiology and Plant Pathology					

SYLLABUS		
Unit	Contents	Hours
I	Fundamentals of Microbiology: History and scope of microbiology. Classification of microorganisms – Haeckel’s three kingdom and Whittaker’s five kingdom concept. Outline of Bergey’s manual of systematic bacteriology (9 th Edition). General features of archaeobacteria, eubacteria, cyanobacteria, mycoplasmas, rickettsia, chlamydia’s, *actinomycetes*. Microscopy – principles and applications of bright field, dark field, phase contrast and electron microscopy (TEM & SEM).	15
II	Bacteria: Morphology – cell size, shape and arrangement. Brief outline of capsule, flagella, axial filaments and pilli. Cell wall – composition and characteristics. Structures internal to the cell wall – cytoplasm, ribosomes, mesosomes and nucleoid. *Bacterial growth curve*. Human disease caused by bacteria – Air borne bacterial disease – <i>Mycobacterium tuberculosis</i> , Pneumonia and <i>Streptococcal pharyngitis</i> .	15
III	Viruses: History, classification of viruses, morphology – shape, size, structure – helical (naked and enveloped viruses), icosahedral (naked and enveloped) and complex viruses. General characteristics of plant and animal viruses. Viral multiplications (Lytic cycle, Lysogenic cycle). Human disease caused by virus – *Chicken pox*, Influenza, MERS and SARS (Covid-19).	15
IV	Plant Pathology: Definition, history, importance, epidemiology and forecasting of plant diseases. Common terminologies relevant to the plant pathology and Koch’s postulates. Classification of plant diseases, symptoms of fungal, bacterial and *viral diseases*.	15
V	Plant Diseases: Study of the following plant disease: Tikka disease of ground nut, Early blight of potato, Wilt disease of cotton, Loose smut of wheat, Bacterial blight of paddy, Citrus canker, *Bunchy top of banana*. Management of plant disease – cultural and chemical methods. Integrated Pest Management (IPM). Disease control by immunizing the host. Breeding for disease resistant and innovative methods of plant disease control.	15

* * Self Study

Text Book(s):
<ol style="list-style-type: none"> Dubey RC and Maheshwari DK, A Text Book of Microbiology, 4th Edition, Chand and Company Pvt Ltd, New Delhi, India, 2013. Pandey BP, Plant pathology, 11th Edition, Chand and Company Pvt Ltd, New Delhi, India, 2014. Willey JM, Sherwood LM and Woolverton CJ, Prescott’s Microbiology, 10th Edition, McGraw Hill Education Pvt Ltd, New York, 2017.
Reference Book(s):
<ol style="list-style-type: none"> Ananthanarayan R and Jayaram Paniker CK, Text Book of Microbiology, 10th Edition, Universities Press (India) Pvt Ltd, New Delhi, India, 2017. Mehrotra RS and Aggarwal A, Plant Pathology, 3rd Edition, McGraw Hill Education (India) Company Pvt Ltd, New Delhi, India, 2017.
Web Resource(s):
<ol style="list-style-type: none"> https://www.biologydiscussion.com/microscope/microscope-types-of-microscope/56714 https://microbenotes.com/ribosomes-structure-and-functions/ https://www.vedantu.com/biology/difference-between-plant-virus-and-animal-virus https://ipm.cahn.uconn.edu/early-blight-and-late-blight-of-potato/ http://www.nou.ac.in/Online%20Resources/30-8/botany4.pdf

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	Describe the characters and classification of bacteria and study the principle and application of various types of microscopes.	K1
CO2	Analyse the internal & external structures, growth and air borne disease caused by bacteria.	K2
CO3	Study the characters and classification of plant and animal viruses and emphasis the most virulence human viral infections.	K3
CO4	Correlate the epidemiology and forecasting of plant disease.	K4
CO5	Acquire the knowledge of plant disease, integrated pest management and innovative methods for plant disease control.	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	3.0	2.0	1.0	2.0	3.0	2.0	3.0	2.0	3.0	3.0	2.5
CO2	3.0	2.0	3.0	2.0	3.0	2.0	3.0	2.0	3.0	3.0	2.6
CO3	3.0	3.0	2.0	2.0	3.0	2.0	3.0	2.0	2.0	3.0	2.5
CO4	2.0	3.0	3.0	2.0	3.0	2.0	3.0	3.0	3.0	3.0	2.7
CO5	3.0	3.0	2.0	2.0	2.0	2.0	3.0	3.0	3.0	3.0	2.6
Mean Overall Score											2.5
Correlation											High

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

Course Coordinator: Dr. N. Ahamed Sherif

Semester	Course Code	Course Category	Hours / Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
IV	23UBO4CC8P	Core - VIII	3	3	20	80	100
Course Title	Laboratory Course for Core -VII - Practical						

Contents	Hours
<p>A. Microbiology</p> <ol style="list-style-type: none"> 1. Good Laboratory Practices (GLP) 2. Principle and methods of sterilization (Physical and Chemical Methods) 3. Preparation of culture media <ol style="list-style-type: none"> a) Preparation of solid and liquid medium <ol style="list-style-type: none"> i) Nutrient agar medium ii) Potato Dextrose Agar medium 4. Calibration and standardization of microscope by using ocular micrometre and stage micrometre 5. Isolation of bacteria and fungi from soil by serial dilution techniques 6. Demonstration of techniques for pure culture of bacteria and fungi <ol style="list-style-type: none"> a) Streak plate method b) Pour plate method c) Spread plate method 7. Gram staining techniques 8. Methylene Blue dye reduction test <p>B. Plant Pathology</p> <p>Study of the morphological and internal part of the following infected plant parts.</p> <ol style="list-style-type: none"> 1. Tikka disease of ground nut 2. Early blight of potato 3. Wilt disease of cotton 4. Loose smut of wheat 5. Bacterial blight of paddy 6. Citrus canker 7. Bunchy top of banana 	45

Text Book(s):

1. Dubey RC and Maheshwari DK, Practical microbiology, 1st Edition, Chand & Company Pvt Ltd, New Delhi, India, 2010.
2. Santra SC, Practical Botany, 1st Edition, New Central Book Agency Pvt Ltd, Kolkata, India, 2015.
3. Huma N and Hussain Khan H, Practical lab manual for microbiology and plant pathology, 1st Edition, AkiNik Publications Pvt Ltd, New Delhi, India, 2018.

Web Resource(s):
1. https://youtu.be/_1KP9zOtxk?si=vN47MSRPSATPYSDr
2. https://youtu.be/alTgt0h5jOE?si=d7RA0QM6MxgNLk_U
3. https://youtu.be/AZS2wb7pMo4?si=H4F11QsHtoqUQPyw
4. https://youtu.be/9RuDd1sNVnU?si=J_326iwF139KL4y
5. https://www.vedantu.com/biology/rice-bacterial-blight

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	Calibrate the different type of microscope.	K1
CO2	Study the basic rules, sterilization methods and preparation of culture media for the enumeration of bacteria.	K2
CO3	Differentiate cell wall characters of bacteria through Gram's staining technique.	K3
CO4	Pure culture methodology is adopted for the characterization of bacteria.	K4
CO5	Correlate the morphological and internal tissue of the infected plants.	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	2.0	2.0	3.0	2.0	3.0	2.0	2.0	2.0	3.0	3.0	2.4
CO2	3.0	2.0	3.0	2.0	2.0	2.0	3.0	2.0	3.0	3.0	2.5
CO3	3.0	2.0	2.0	2.0	3.0	2.0	3.0	2.0	2.0	3.0	2.4
CO4	3.0	3.0	3.0	2.0	2.0	2.0	2.0	3.0	2.0	3.0	2.5
CO5	3.0	2.0	2.0	2.0	3.0	2.0	3.0	3.0	3.0	3.0	2.4
Mean Overall Score											2.4
Correlation											Medium

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

Course Coordinator: Dr. N. Ahamed Sherif

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 Upadhy.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. Sardersingh – 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
	Current Trends (For CIA only) – Nutrient composition of vermicompost – Advantages of sea food – Health benefits of egg.	

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., Dulsy 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 PhysioloHy – 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

Semester	Course Code	Course Category	Hours / Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
IV	23UBO4GE2	Generic Elective – II	2	2	-	100	100
Course Title		Nursery, Gardening for Entrepreneurship					

Syllabus		
Unit	Contents	Hours
I	Nursery: Definition, objectives, scope and building up of infrastructure for nursery and planning. Planting - direct seeding and transplants. Hardening of plants, green house, mist chamber, shed roof, shade house and glass house. *Business analysis of important plants*.	6
II	Gardening: Definition, objectives and scope, formal and informal gardening, garden components, landscape and home gardening. Plant materials and design, computer applications in landscaping. Gardening operations - soil laying, manuring, watering. Kitchen garden, terrestrial garden, soil less culture, vertical garden and bonsai. *Management of pests and diseases*.	6
III	Seeds: Structure and types - Seed dormancy, causes and methods of breaking dormancy, seed storage: Seed banks, factors affecting seed viability, genetic erosion, seed production technology, seed testing and certification.	6
IV	Vegetative Propagation: Methods - natural vegetative propagation, artificial vegetative propagation- cutting, layering, grafting and budding, stock and scion relationship. Cultivation of chrysanthemum, roses and jasmine. *Opportunities for floriculture export*.	6
V	Entrepreneurship: Marketing of ornamental and nursery plants– methods, publicity and marketing mix. Application procedure for subsidy of various governments agencies - APEDA, DIC, SIDA, SISI, NSIC, SIDO. Investment procurement – project formation, feasibility, legal formalities, shop act, estimation and costing, investment procedure, loan procurement, *banking*.	6

*..... * Self Study

Text Book(s):
<ol style="list-style-type: none"> 1. Eiri Staff, Hand Book of Mushroom Cultivation, Processing and Packaging, EiRi Publication, 2007. 2. Sadhu MK, Plant Propagation, 1st Edition, New Age International Pvt Ltd, New Delhi, India, 2007. 3. Kumar N, Introduction to Horticulture, 8th Edition, Medtech, Scientific International Pvt Ltd, New Delhi, India, 2017.
Reference Book(s):
<ol style="list-style-type: none"> 1. Pearson CE, Complete Gardening, 1st Edition, Treasure Press, London, England, 1982. 2. Whiteaker S, English Garden Embroidery, 1st Edition, Century Hutchinson Ltd, London, England, 1989.
Web Resource(s):
<ol style="list-style-type: none"> 1. https://aggie-horticulture.tamu.edu/ornamental/economic-fact-sheets/plan-for-improved-marketing/ 2. https://www.slideshare.net/AnubhaRastogi/role-of-agencies-assisting-entrepreneurship

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	Distinguish the concept of nursery and Gardening.	K1
CO2	Expand the skills for growing fresh and safe vegetables.	K2
CO3	Create awareness and practice cultivation methods about home gardening.	K3
CO4	Develop different skills regarding the gardening operations.	K4
CO5	Apply nursery and gardening for entrepreneurship.	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	2	3	3	2	3	3	2	3	2.6
CO2	2	3	2	2	3	2	2	2	2	3	2.3
CO3	2	2	3	2	2	3	2	2	3	3	2.4
CO4	3	3	2	3	2	3	2	3	3	2	2.6
CO5	3	3	2	3	2	2	3	2	2	3	2.5
Mean Overall Score											2.4
Correlation											Medium

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

Course Coordinator: Dr. K. Mohamed Rafi

Allied Botany for B.Sc. Chemistry

Allied Botany for B.Sc. Zoology

Allied Botany for B.Sc. Chemistry and B.Sc. Zoology

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	<p>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 – <i>Oscillatoria</i>*, <i>Chlorella</i>, <i>Sargassum</i> and <i>Gracilaria</i>. Cultivation methods of fresh water (<i>Spirulina</i>), and marine (<i>Kappaphycus</i>) algae.</p>						12
II	<p>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 – <i>Albugo</i>, Brief account on cultivation of edible mushroom (<i>Pleurotus</i>). Introduction to medicinal mushrooms (<i>Ganoderma</i>) and antibiotic producing fungi (<i>Penicillium</i>). Brief account on production of citric acid and acetic acid from fruit peel waste. *Lichens – General characters, types and economic importance of Lichens*.</p>						12
III	<p>Bryophytes: General characteristics and outline classification of Bryophytes (Watson, 1971). Structural description (excluding development stages) of the following genera – <i>Marchantia</i> and <i>Polytrichum</i>. 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*.</p>						12
IV	<p>Pteridophytes: General characteristics and outline classification of Pteridophytes (Sporne, 1975). Structural description (excluding developmental stages) of the following genera – <i>Lycopodium</i> and <i>Adiantum</i>. and *Economic importance of Pteridophytes*. Cultivation of Azolla.</p>						12
V	<p>Gymnosperms: General characters and outline classification of gymnosperms (Sporne, 1967). Morphology, anatomy, reproduction, life cycle (excluding developmental stages) and economic uses of <i>Cycas</i>. Importance of gymnosperms as wood and resins (<i>Pinus</i>), anti-cancer drug (<i>Taxus</i> and <i>Ephedra</i>). A brief study of types and application of fossil plants in paleoclimatology and *climate models*.</p>						12

..... Self-Study

Text Book(s):

1. Vasishta PC, Sinha AK and Kumar A, Botany for Degree Students (Volumes), 2nd Edition, Chand & Company Pvt Ltd, New Delhi, India, 2010.
2. Hait G, Bhattacharya K and Ghosh AK, A Text Book of Botany, 5th 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):

- Alexopoulos CJ, Mims CW and Blackwell M, Introductory Mycology, 4th Edition, Wiley Publishers, New Delhi, India, 2007.
- 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
	1. Generic level identification of algal specimens in a mixture. <ul style="list-style-type: none"> a. <i>Oscillatoria</i> b. <i>Chlorella</i> c. <i>Spirulina</i> d. <i>Sargassum</i> e. <i>Gracilaria</i> 2. Identification of following fungi in both host as well as permanent slides <ul style="list-style-type: none"> a. <i>Albugo</i> b. <i>Saccharomyces</i> 3. Observation of external and internal structure of <ul style="list-style-type: none"> a. <i>Marchantia</i> b. <i>Polytrichum</i> c. <i>Lycopodium</i> d. <i>Adiantum</i> e. <i>Cycas</i> f. <i>Pinus</i> 4. Identification of spotters related to economic uses of species mentioned in theory	45

Text Book(s):
1. Santra SC, Chatterjee TP and Das AP, College Botany Practical (Volume II), 1 st Edition (Reprinted), New Central Book Agency Pvt Ltd, Kolkata, India, 2001. 2. Pandey BP, Modern Practical Botany, 1 st Edition (Reprinted), Chand & Company Pvt Ltd, New Delhi, India, 2011. 3. Sharma OP, Practical Botany, 7 th 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.	CO Statement	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
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):

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, 1st Edition, Cambridge University Press, United Kingdom, 1982.
2. Pandey BP. Taxonomy of Angiosperms, 2nd 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, Caesalpinaceae, 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

Text Book(s)
<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