ST. TERESA'S COLLEGE, ERNAKULAM

(AUTONOMOUS)

Affiliated to Mahatma Gandhi University, Kottayam

CURRICULUM FOR

BACHELOR'S PROGRAMME

IN BOTANY

Under Choice Based Credit & Semester System
& Outcome Based Education

(2018 Admissions)

Bachelor's Programme in Botany

PROGRAMME SPECIFIC OUTCOMES

PSO1: Categorize the plant and animal kingdom from the Microbes to the most advanced life forms based on morphology, ecology and phylogeny.

PSO2: Recognize the concepts, processes and the applied aspects of chemistry and zoology.

PSO3: Evaluate the structural features and reproductory processes in plant groups and integrate the concepts and processes involved in the various cellular mechanisms.

PSO4: Explain environment consciousness, resource management, sustainable development and human rights.

PSO5: Illustrate expertise in the application of Botany for research and entrepreneurship and develop communicating skills to share the knowledge with the society effectively.

SEMESTER I

Course Code	Course Title	Credits	Course Type
EN1A01B18	Fine-tune Your English	4	Common Course I
EN1A02B18	Pearls from the Deep	3	
FR1A01B18	French Language and Communicative Skills-I	4	Common Course II
HN1A01B18	Kahaani Aur Upanyas		
MA1A01B18	Kathasahithyam		
CH1C01B18	Basic Theoretical and Analytical Chemistry	2	Complementary Course I
ZY1C01B18	Non Chordate Diversity	2	Complementary Course II
BO1B01B18	Methodology of Science and an Introduction to Botany	2	Core Course

SEMESTER I

COMMON COURSE I

EN1A01B18– FINE-TUNE YOUR ENGLISH

Credits: 4

Total Lecture Hours: 90

Course Outcomes:

CO1. Recognize the basics of English grammar

CO2. Choose the appropriate word classes

CO3. Identify common errors in the use of English language in various contexts

CO4. Apply the rules of grammar to comprehend, speak, and write grammatically correct English

CO5. Compose materials for business communication

Mapping of Course Outcomes with Programme Specific Outcomes

Mapping	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	1	1	1	1	2
CO2	1	1	1	1	3
CO3	1	1	1	1	2
CO4	1	1	1	1	3
CO5	1	1	1	1	2

Syllabus Content

Module 1 **(18 Hours)**

The Sentence and its Structure

How to Write Effective Sentences – Phrases:What are They? – The Noun Clauses – The Adverb Clause – "If All the Trees Were Bread and Cheese" – The Relative Clause – How Clauses are Conjoined

Module 2 **(18 Hours)**

Word-Classes and Related Topics

Understanding the Verb – Understanding Auxiliary Verbs – Understanding Adverbs – Understanding Pronouns – The Reflexive Pronoun – The Articles I – The Articles II – The Adjective – Phrasal Verbs – Mind your Prepositions

Module 3 **(18 Hours)**

To Err is Human

Concord – Errors – Common and Uncommon

Spelling and Pronounciation

Pronunciation: Some Tips – More Tips on Pronunciation – An awesome Mess? – Spelling Part II

Module 4 **(18 Hours)**

Tense and Related Topics

'Presentness' and Present Tenses – The 'Presentness' of a Past Action – Futurity in English – Passivisation

Interrogatives and Negatives

Negatives – How to Frame Questions – What's What? – The Question Tag

Module 5 **(18 Hours)**

Conversational English

Some time expressions – Is John There Please?

Miscellaneous and General Topics

Reading

Letter Writing

In addition there will be an essay question on a general topic.

SEMESTER I

COMMON COURSE I

EN1A02B18– PEARLS FROM THE DEEP

Credits: 3

Total Lecture Hours: 72

Course Outcomes:

CO1: Name prominent literary figures and recognize various literary devices.

CO2: Analyze inherent themes and motives.

CO3: Identify the nuances of the age in which the literary work was written.

CO4: Examine the different aspects of theatre.

Mapping of Course Outcomes with Programme Specific Outcomes

Mapping	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	1	1	1	2	2
CO2	1	1	1	1	1
CO3	1	1	1	3	1
CO4	1	1	1	2	3

Syllabus Content:

Module 1 (Fiction) **(18hours)**
Ernest Hemingway: The Old Man and the Sea

Module 2 (One Act Plays) **(18hours)**

Susan Glaspell: Trifles

Asif Currimbhoy: The Refugee

A.A Milne: The Boy Comes Home

Module 3 (Short Stories) **(18hours)**

Guy De Maupassant: Two Friends

O. Henry: The Gift of Magi

K.A Abbas: Sparrows

Flora Annie Steel: Valiant Vicky, the Brave Weaver

Module 4 (Poems) **(18hours)**

Rumi: The Chance of Humming

Walter Scott: Lochinvar

John Keats: La Belle Dame Sans Mercy

Robert Frost: After Apple Picking

Chinua Achebe: Refugee Mother and Child

Kamala Das: My Grandmother's House

Ted Hughes: Jaguar

Pablo Neruda: Tonight I can Write the Saddest Lines

P.P Ramachandran: How Simple It Is!

SEMESTER I

COMMON COURSE II

FR1A01B18 – FRENCH LANGUAGE AND COMMUNICATIVE SKILLS – I

Credits: 4

Total Lecture Hours: 72

Course Outcomes:

CO1: Describe topics such as family, professions, time, place, likes and dislikes, daily life situations.

CO2: Develop language, vocabulary and grammar skills.

CO3: Articulate various speech sounds and their determined combinations.

CO4: Prepare conversations based on scenarios which helps while traveling

CO5: Articulate the concepts to express one's opinion in a specific situation.

Mapping of Course Outcomes with Program Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	1	1	3	2
CO2	1	1	1	1	3
CO3	1	1	1	1	2
CO4	1	1	1	1	3
CO5	1	1	1	2	3

Syllabus Content:

Module I **(25 hours)**

La population L'alphabet – Les chiffres – Identité – Se présenter – Poser des questions – Les professions – Les nationalités

Module II **(23 hours)**

La banlieue Demander une information, un prix – l'heure – la ville

Module III **(24 hours)**

Quartier de Paris Décrire un lieu – Indiquer un prix, un itinéraire.

SEMESTER I

COMMON COURSE II

HN1A01B18– KAHAANI AUR UPANYAS

Credits: 4

Total Lecture Hours: 72

Course Outcomes:

CO1: Discuss story content and structure in depth.

CO2: Analyze characterisation and comment on the development of the characters as the story/ novel unfolds.

CO3: Analyze short stories and novels on the basis of literary elements like plot, theme, metaphor, and image.

CO4: Compare treatments of theme, character and subject matter of different short stories.

CO5: Illustrate greater reading fluency and improved vocabulary in Hindi.

Mapping of Course Outcomes with Programme Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	1	1	2	2
CO2	1	1	1	1	1
CO3	1	1	1	1	1
CO4	1	1	1	1	1
CO5	1	2	1	2	3

Syllabus Content:

MODULE- I (16 hrs)

Syllabus- Anthim Saakshya –Chandrakaanta Chapters 1 ,2

Eidgaah- Premchand

MODULE- II (20 hrs)

Syllabus-Anthim Saakshya –Chandrakaanta Chapters 3, 4, 5 Jangal Ka Daah- Swayam Prakash Chchutti Ka Din- Usha Priyamvada

MODULE- III (20 hrs)

Syllabus- Anthim Saakshya –Chandrakaanta Chapters 6,7,8 Maa Rasoi Mei Rehti Hai – Kumar Ambuj Kheer – Madhavi Kutty

MODULE- IV (16 hrs)

Syllabus- Anthim Saakshya –Chandrakaanta Chapters 9, 10 Heelibon Ki Baththakhe- Agyey

SEMESTER I

COMMON COURSE II

MA1A01B18– KATHASAHITHYAM

Credits: 4

Total Lecture Hours: 72

Course Outcomes:

CO1: ചെറുകഥ, നോവൽ പഠനത്തിലൂടെ വായനാശേഷിയും ആസ്വാദനപ്രാപ്തിയും കൈവരിക്കൽ.

CO2: ചെറുകഥയുടെയും നോവലിന്റെയുംകാലാനുസൃതമായ ഭാവുകത്വപരിണാമം തിരിച്ചറിയൽ.

CO3: നിലവിലുള്ളസാമൂഹ്യജീവിത യാഥാർഥ്യങ്ങളെ അഭിമുഖീകരിക്കാൻ പ്രാപ്തരാക്കൽ.

CO4: ആശയവിനിമയം, ഭാഷാവിഷ്കരണം എന്നീ ശേഷികൾ കൈവരിക്കുന്നു

CO5: കഥ,നോവൽ എന്നിവയുടെ വ്യതിരിക്ത സവിശേഷതകൾ തിരിച്ചറിയുന്നു.

CO6: പുതുകാലജീവിതാനുഭവങ്ങൾ വിലയിരുത്താൻ പര്യാപ്തരാകുന്നു

Mapping of Course Outcomes with Programme Specific Outcomes

Mapping	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	1	1	1	1	2
CO2	1	1	1	1	1
CO3	1	1	2	1	3
CO4	2	2	1	2	3
CO5	1	1	1	1	1
CO6	1	1	1	1	2

Syllabus Content:

ഖണ്ഡംഒന്ന് 10മണിക്കൂർ

1.പൂവമ്പഴം -കാരൂർ

2.ഭൂമിയുടെഅവകാശികൾ - വൈക്കംമുഹമ്മദ്ബഷീർ

ഖണ്ഡംരണ്ട് - 15മണിക്കൂർ

1.കടൽ -ടി .പദ്മനാഭൻ

2.പെരുമഴയുടെപിറ്റേന്ന് -എം. ടി. വാസുദേവൻനായർ

3.മാനാഞ്ചിറടെസ്റ്റ് -വി .കെ.എൻ

4.തരിശുനിലം -മാധവിക്കുട്ടി

ഖണ്ഡംമൂന്ന് - 15മണിക്കൂർ

1.ആർക്കറിയാം -സക്കറിയ

2.ഓരോഎഴുത്തുകാരിയുടെഉള്ളിലും -സാറാജോസഫ്

3.തിരുത്ത് -എൻ .എസ് .മാധവൻ

4.മോഹമഞ്ഞ -കെ .ആർ .മീര

ഖണ്ഡംനാല്-10 മണിക്കൂർ

1.അഗ്നി -സിതാര.എസ്

2.ബിരിയാണി -സന്തോഷ്എച്ചിക്കാനം

3.മോദസ്ഥിരനായി അങ്ങ് വസിപ്പൂമലപോലെ -എസ്. ഹരീഷ്

4.സ്നേഹബഹുമാനപെട്ടഅന്നാമ്മയ്ക്ക്ഗീതാലക്ഷ്മിഎഴുതുന്നകത്ത് -

പ്രിയഎ .എസ്

5.ചിലസ്വപ്നങ്ങളിൽ .....സീതാലക്ഷ്മിയുടെകറുത്തമുടിയിഴ -

ഇന്ദുമേനോൻ

ഖണ്ഡംഅഞ്ച് - 22മണിക്കൂർ

ആടുജീവിതം -ബന്യാമിൻ

SEMESTER I

COMPLEMENTARY COURSE I

CH1C01B18: BASIC THEORETICAL AND ANALYTICAL CHEMISTRY

Credits: 2

Total Lecture Hours: 36

Course Outcomes:

CO1: Describe the Bohr atom model, types of bonds, Valence bond and VSEPR theories and Hybridization.

CO2: Explain the periodic properties of elements and concepts of chemical equilibrium.

CO3: Identify methods for separating a given organic compound from a reaction mixture and quantification of inorganic metal ions using titrimetric and gravimetric analysis

CO4: Differentiate between column chromatography, PC, TLC, GC, IEC and HPLC techniques

Mapping of Course Outcomes with Programme Specific Outcomes

Mapping	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	1	2	2	1	1
CO2	1	2	2	1	1
CO3	1	1	1	3	1
CO4	1	1	3	1	3

Syllabus Content:

Module 1 : Atomic Structure and Chemical Bonding (12 Hrs)

Atomic Structure: Bohr atom model and its limitations, Dual nature of matter and radiation.Photoelectric effect, de Broglie equation, Heisenberg's uncertainty principle, Concept of orbital, Quantum numbers, shapes of orbitals (*s*, *p*, *d*), Electronic configuration of atoms - Aufbau principle, Hund's rule of maximum multiplicity, Pauli's exclusion principle.

Chemical Bonding: Introduction – Type of bonds. Ionic bond: Factors favouring theformation of ionic bonds. Covalent bond: Valence bond theory – Coordinate bond. VSEPR theory and examples. Hybridisation: - sp^3, sp^2 and *sp* (ethane, ethene, ethyne). Intermolecular forces - Hydrogen bonding in H_2O - Dipole-dipole interactions.

Module II : Fundamental Concepts in Chemistry (9 hrs)

Periodic Properties: Modern periodic law – Long form of periodic table. Periodicity inproperties: Atomic radii, ionic radii, ionization enthalpy, electron affinity (electron gain enthalpy) and electronegativity (Pauling scale). Atomic mass - Molecular mass - Mole concept – Molar volume - Oxidation and reduction – Oxidation number and valency - Equivalent mass.

Concept of Equilibrium: Acids and Bases - Arrhenius, Lowry-Bronsted and Lewis theories.Ionic product of water - pH and pOH, Strengths of acids and bases - K_a and K_b, pK_a and pK_b. Buffer solution. Solubility, solubility product, common ion effect and their applications.

Module III : Basic Principles of Analytical Chemistry (9 Hrs)

Methods of Analysis: Volumetric method of analysis - General principles. Primary andsecondary standards, criteria for primary standards, preparation of standard solutions, standardization of solutions, end point. Acid base, redox and complexometric titrations and corresponding indicators. Double burette method of titration: Principle and advantages. Microanalysis and its advantages. Gravimetric method of analysis: General principles.

Reporting of Analytical Data: Precision and accuracy – Types of errors – Ways of expressing precision – Methods to reduce systematic errors.

Separation and Purification Techniques: Recrystallisation, use of drying agents, sublimation. General principles of distillation, fractional distillation, distillation under reduced pressure. Solvent extraction.

Module 1V: Chromatographic Techniques (6 Hrs)

Chromatography - Principle of differential migration. Classification of chromatographic methods. Basic principle and uses of Thin layer chromatography (TLC), Paper chromatography (PC), R_f value, Column chromatography, Gas chromatography(GC), High performance Liquid chromatography (HPLC), Ion Exchange chromatography (IEC).

SEMESTER I

COMPLEMENTARY COURSE II

ZY1C01B18: NON CHORDATE DIVERSITY

Credits: 2

Total Lecture Hours: 36

Course Outcomes:

CO1: Classify Non chordates up to the level of class

CO2: Differentiate beneficial and harmful non chordates.

CO3: Describe the ecological importance of Corals and Coral reefs.

CO4: Describe the physiological and morphological distinctiveness of Non chordates. (

Mapping of Course Outcomes with Programme Specific Outcomes

Mapping	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	1	1	1
CO2	3	1	1	1	1
CO3	1	1	1	3	1
CO4	2	1	1	1	1

Syllabus Content:

Module I **10 Hrs**

Introduction: Five kingdom classification

Kingdom Protista: Salient features (any five important salient features) of each phylum with one example each (detailed account of example is not necessary).

Phylum Rhizopoda (eg: Amoeba)

Phylum Actinopoda (eg: Actinophrys)

Phylum Dinoflagellata (eg: Noctiluca)

Phylum Parabasalia (eg: Trichonympha)

Phylum Metamonda (eg: Giardia)

Phylum Kinetoplasta	(eg: Trypanosoma)
Phylum Euglenophyta	(eg: Euglena)
Phylum Cryptophyta	(eg: Cryptomonas)
Phylum Opalinata	(eg: Opalina)
Phylum Bacillariophyta	(eg: Diatoms)
Phylum Chlorophyta	(eg: Volvox)
Phylum Choanoflagellata	(eg: Proterospongia)
Phylum Ciliophora	(eg: Paramecium)
Phylum Sporozoa	(eg: Plasmodium)
Phylum Microsporidia	(eg: Nosema)
Phylum Rhodophyta	(eg: Red algae)

General Topic: Pathogenic Protists – Plasmodium, Entamoeba

Module II **3 Hrs**

Phylum Porifera: Salient features (eg: Leucosolenia)

Phylum Coelenterata: Salient features and classification upto class.

Class 1: Hydrozoa	(eg: Physalia)
Class 2: Schyphozoa	(eg: Aurelia)
Class 3: Anthozoa	(eg: Adamsia)

General Topic: Corals and Coral reefs.

Module III **6 Hrs**

Phylum Platyhelminthes: Salient features and classification up to class.

Class 1: Turbelleria	(eg: Planaria)
Class 2: Trematoda	(eg: Fasciola)
Class 3: Cestoda	(eg: Taenia solium)

Phylum Nematoda: Salient features and classification up to class.

Class 1: Phasmida	(eg: Wuchereria)

Class 2: Aphasmida (eg: Trichinella)

Phylum Annelida: Salient features and classification up to class.

Class 1: Archiannelida (eg: Polygordius)

Class 2: Polychaeta (eg: Nereis)

Class 3: Oligochaeta (eg: Pheretima)

Class 4: Hirudinomorpha (eg: Hirudinaria)

Module IV **11 Hrs**

Phylum Arthropoda: Salient features. Type study – Fennero penaeus (Penaeus) - habitat, morphology, appendages, sexual dimorphism, digestive system, respiratory system, circulatory system, excretory system, nervous system, sense organs, reproductive system and larval stages. Classification up to class with one example each

Subphylum Trilobitomorpha

Class 1: Trilobita (Extinct) (eg: Dalmanites)

Subphylum: Chelicerata

Class 1: Merostoma (eg: Limulus)

Class 2: Arachnida (eg: Spider)

Class 3: Pycnogonida (eg: Nymphon)

Subphylum Mandibulata

Class 1: Crustacea (eg: Daphnia)

Class 2: Chilopoda (eg: Centipede)

Class 3: Symphyla (eg: Scutigerella)

Class 4: Diplopoda (eg: Millipede)

Class 5: Pauropoda (eg: Pauropus)

Class 6: Insecta (eg: Butterfly)

Module V **6 Hrs**

Phylum Mollusca: Salient features and classification up to class

Class 1: Aplacophora (eg: Neomenia)

Class 2: Monoplacophora (eg: Neopilina)

Class 3: Polyplacophora (eg: Chiton)

Class 4: Bivalvia (eg: Perna)

Class 5: Gastropoda (eg: Xancus)

Class 6: Cephalopoda (eg: Sepia)

Class 7: Scaphopoda (eg: Dentalium)

Phylum Echinodermata: Salient features and classification up to class.

Class 1: Asteroidea (eg: Astropecten)

Class 2: Ophiuroidea (eg: Ophiothrix)

Class 3: Echinoidea (eg: Echinus)

Class 4: Holothuroidea (eg: Holothuria)

Class 5: Crinoidea (eg: Antedon)

Phylum Hemichordata: Salient features (eg: Balanoglossus.)

SEMESTER I

CORE COURSE

BO1B01B18: METHODOLOGY OF SCIENCE AND AN INTRODUCTION TO BOTANY

Credits: 2

Total Lecture Hours:

Course Outcomes:

CO1: Interpret the methodology of scientific enquiry and experimentation considering ethical principles.

CO2: Analyze the different classificatory systems of organisms and identify the richness and importance of biodiversity.

CO3: Explain the origin of life and the course of organic evolution.

CO4: Execute the basic botanical skills and techniques

Mapping of Course Outcomes with Programme Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	1	2	1	2
CO2	3	2	2	1	1
CO3	2	1	1	1	1
CO4	2	1	2	1	3

Syllabus Content:

Module 1: Introduction to Science and the methodology of science (4 hrs)

Scientific method: steps involved - observation and thoughts, formulation of hypothesis; inductive reasoning - testing of hypothesis; deductive reasoning - experimentation - formulation of theories and laws.

Module 2: Experimentation in Science (4 hrs)

Selection of a problem - searching the literature – designing of experiments - selection of variables, study area, and a suitable design. Need of control, treatments and replication. Mendel's experiments as an example of moving from observations to questions, then to hypothesis and finally to experimentation. Ethics in science.

Module 3: Origin and Evolution of Life (10 hrs)

Origin of life on earth from molecules to life – Oparin's hypothesis, Haldane's hypothesis, Miller- Urey experiment, Panspermia, origin of cells and the first organisms. Evidences of evolution; theories of evolution - Lamarck, Wallace, Charles Darwin, Hugo De Vries. Neo-Darwinism – major postulates - isolation, mutation, genetic drift, and speciation.

Module 4: Diversity of life and its classification (12 hrs)

Diversity of life: two kingdom classification (Carolus Linnaeus, 1735); phylogenetic classification (August W Eichler, 1878); five kingdom classification (R H Whittaker, 1969). Three domains, six kingdom classification, (Carl Woese, 1990) – criteria for classification, general characters of each kingdom. The three domains of life: Archaea, Bacteria, Eucarya – general characters of each. Diversity of plants: study the salient morphological features of vegetative and reproductive parts of algae, fungi, bryophytes, pteridophytes, gymnosperms and angiosperms.

Module 5: Basic Botanical Skills (6 hrs)

Light microscope: dissection and compound microscope – parts and uses. Preparation of specimens for light microscopy - collection and preservation of plant specimens; killing and fixing; killing agents- formalin, ethyl alcohol; fixing agents - Carnoy's fluid, Farmer's fluid, FAA. Preparation of Normal, Molal and Molar solutions.

SEMESTER II

Course Code	Course Title	Credits	Course Type
EN2A03B18	Issues That Matter	4	Common Course I
EN2A04B18	Savouring The Classics	3	
FR2A03B18	French Language And Communicative Skills – II	4	Common Course II
HN2AO3B18	Kavita , Vyakaran Aur Anuvad		
MA2A03B18	Kavitha		
CH2C01B18	Basic Organic Chemistry	2	Complementary Course I
CH2CP01B18	Volumetric Analysis	2	Complementary Course I Practicals
ZY2C01B18	Chordate Diversity	2	Complementary Course II
ZY2CP01B18	Non-Chordate And Chordate Diversity	2	Complementary Course II Practicals
BO2B02B18	Microbiology, Mycology And Plant Pathology	2	Core Course
BO2BP01B18	Methodology Of Science, Introduction To Botany, Microbiology, Mycology And Plant Pathology	2	Core Course Practicals

SEMESTER II

COMMON COURSE I

EN2A03B18 - ISSUES THAT MATTER

Credits: 4

Total Lecture Hours: 90

Course Outcomes:

CO1. Identify the major issues of contemporary significance

CO2. Discuss the consequences of war and refugee crisis with respect to the psychological dimension

CO3. Employ theoretical learning in classrooms to current developments in the world

CO4. Critique the diverse experiences both historical and contemporary to create a more informed vision of the future

CO5. Develop oneself as a conscious, concerned, conscientious human being

Mapping of Course Outcomes with Programme Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	1	1	1	2
CO2	1	1	1	3	2
CO3	2	2	1	2	3
CO4	1	1	1	2	2
CO5	2	2	2	3	3

Syllabus Content

Module 1 **(18 hours)**

"The Unsurrendered People" – Kenzaburo Oe

"The Old Prison" – Judith Wright

"War" – Luigi Pirandello

Module 2 **(18 hours)**

Persuasions on the Power of the Word:

"On Censorship" – Salman Rushdie

"Peril" – Toni Morrison

"The Burning of the Books" – Bertolt Brecht

"The Censors" – Luisa Valenzuela

Module 3 **(18 hours)**

"The Poisoned Bread" – Bandhu Madhav

"A Trip Westward" – Zitkala-Sa

"The Pot Maker" – Temsula Ao

Module 4 **(18 hours)**

"Does it Matter?" – Richard Leakey

"On Killing a Tree" – Gieve Patel

"Hagar: A Story of a Woman and Water" (Gift in Green (chapter 2)) – Sarah Joseph

Module 5 **(18 hours)**

"Understanding Refugeeism: An Introduction to Tibetan Refugees in India" – Mallica Mishra

"Refugee Blues" – W.H Auden

"The Child Goes to the Camp" (from Palestine's Children) – Ghassan Kanafani

SEMESTER II

COMMON COURSE I

EN2A04B18 – SAVOURING THE CLASSICS

Credits: 3

Total Lecture Hours: 72

Course Outcomes:

CO1: Recognise the time-tested literary masterpieces from diverse cultures

CO2: Identify the representative authors from various genres (poetry, drama, novel, short fiction)

CO3: Recite celebrated lines from Classic works

CO4: Discuss the 'universals' of human condition

Mapping of Course Outcomes with Programme Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	1	1	1	1
CO2	1	1	1	1	1
CO3	1	1	1	2	2
CO4	1	1	1	3	2

Syllabus Content

Module 1 (Poems) **(18hours)**

Homer: "Father and Son" (Odyssey Book 16: 113-189) (Translated by Robert Fagles)

Kalidasa: "Lovely is Youth" (Translated by J.G Jennings)

Omar Khayyam: Rubaiyat (quatrains: 25-28) (Translated by Edward Fitzgerald)

Dante: Dante meets Virgil (Inferno Canto 1: 49-102) (Translated by J.G Nichols)

John Milton: "On his Blindness"

Module 2 (Shakespeare Excerpts) **(18hours)**

Romeo and Juliet: Act II, Scene ii

The Merchant of Venice: Act IV, Scene i

Module 3 (Novel Excerpts) (18hours)

Miguel de Cervantes: Don Quixote (Chapter 8) (Translated by Edith Grossman)

Jane Austen: Pride and Prejudice (Chapters 1-6)

Victor Hugo: Les Miserables (Part 1- Fantine, Book II, Chapters 9-13) (Translated by Christine Donougher)

Module 4 (Short Fiction) (18hours)

Charles Dickens: The Black Veil

Leo Tolstoy: How Much Land Does a Man Need? (Translated by Louise & Aulmer Maude)

Rabindranath Tagore: Kabuliwala (Translated by Mohammad A Quayum)

Jorge Louis Borges: The Shape of the Sword (Translated by Andrew Hurley)

SEMESTER II

COMMON COURSE II

FR2A03B18- FRENCH LANGUAGE AND COMMUNICATIVE SKILLS – II

Credit -4

Total Lecture Hours- 72

Course Outcomes:

CO1: Identify familiar everyday expressions and basic phrases.

CO2: Ask questions to get meaningful responses in effective communication.

CO3: Develop language, vocabulary and grammar skills.

CO4: Prepare conversations based on various situations

CO5: Articulate the concepts to express one's opinion in a specific situation.

Mapping of Course Outcomes with Programme Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	1	1	1	1
CO2	1	1	1	2	3
CO3	1	1	1	2	3
CO4	1	1	1	1	3
CO5	1	1	1	2	3

Syllabus Content:

Module I **(25 hours)**

Chambre pour étudiants Localiser des objets – l'habitat – les meubles – l'appréciation

Module II **(23 hours)**

Petits boulots Téléphoner – Raconter – l'emploi

Module III **(24 hours)**

Le resto U Exprimer une opinion – Poser des questions – la nourriture

SEMESTER II

COMMON COURSE II

HN2AO3B18 - KAVITA , VYAKARAN AUR ANUVAD

Credits – 4

Total Lecture Hours- 72

Course Outcomes:

CO1: Contextualize and Summarise the poems of different genres in Hindi.

CO2: Evaluate the Poets contribution to Hindi literature.

CO3: Demonstrate linguistic ability for translation of texts between Hindi & English

CO4: Classify Parts of Speech

CO5: Illustrate greater fluency in Hindi by applying theoretical knowledge of Grammar

Mapping of Course Outcomes with Programme Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	1	1	1	1
CO2	1	1	1	1	1
CO3	1	1	1	2	3
CO4	1	1	1	1	2
CO5	1	1	1	2	3

Syllabus Content

Module I **(18 Hours)**

Vyaakaran

Module II **(20 Hours)**

Tulasidas

Kabir

Ve Muskathe Phool Nahi- Mahadevi Verma

Cheenane Aaye Hain Ve – Sarweshvar Dayal Saxena

Dilli Darwaaza – Kumar Vimal

Jungle Ke Ujaad Mei – Vinod Kumar Shukla

Aazadi Urf Gulaami – Gyanendrapathi

Module III **(20 Hours)**

Meera

Bazaar- Mangalesh Dabraal

Beesvi Sadi Ke Antim Dino Ka Aashcharya- Rajesh Joshi

Do Haathiyon Ki Ladaai- Uda Pakash

Thande Paani Ki Machine – Ekant Srivastav

Saboot – Arun Kamal

Tumhe Kuch Karna Chahiye – Chanrakanth Devthale

Module IV **(14 Hours)**

Anuvaad

SEMESTER II

COMMON COURSE II

MA2A03B18-കവിത

ക്രെഡിറ്റ് : 4

പഠനസമയം : 72 മണിക്കൂർ

കോഴ്സ് ഔട്ട്കം (Course Outcome)

CO1.പത്തൊൻപത് കവിതകളുടെ പഠനത്തിലൂടെ വായനാശേഷിയും ആസ്വാദന പ്രാപ്തിയും കൈവരിക്കൽ.

CO2.മലയാളകവിതകളിലെ കാലാനുസൃതമായ ഭാവുകത്വപരിണാമം തിരിച്ചറിയ.

CO3.നിലവിലുള്ള സാമൂഹ്യജീവിതയാഥാർഥ്യങ്ങളെ അഭിമുഖീകരിക്കാൻ പ്രാപ്തരാക്കൽ.

CO4.പരിസ്ഥിതികസൗന്ദര്യശാസ്ത്രത്തെയും ചില സാമൂഹ്യചരിത്ര പശ്ചാത്തലങ്ങളെയും കുറിച്ച് ഗ്രഹിക്കൽ.

CO5.വിദ്യാർത്ഥികളുടെ സർഗ്ഗാത്മകശേഷി വികസിക്കൽ

Mapping of Course Outcomes with Programme Specific Outcomes

Mapping	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	1	1	1	2	2
CO2	1	1	1	1	1
CO3	1	1	1	2	3
CO4	2	2	1	3	2
CO5	1	1	1	1	3

ഖണ്ഡം ഒന്ന്- 20 മണിക്കൂർ

1. മാംസനിബദ്ധമല്ല രാഗം -കുമാരനാശാൻ (ലീലയിലെ 47 മുതൽ 74 വരെയുള്ള 28 ശ്ലോകങ്ങൾ)

2.സ്നേഹസുന്ദരപാതയിലൂടെ -വൈലോപ്പിള്ളി ('കുടിയൊഴിക്കലി'ലെ അവസാന ഖണ്ഡം)

ഖണ്ഡം രണ്ട് 15 മണിക്കൂർ

1 .ഒറ്റയ്ക്കിരിക്കാൻ പഠിച്ചുകഴിഞ്ഞു ഞാൻ -സുഗതകുമാരി

2 .കോഴി -കടമ്മനിട്ടരാമകൃഷ്ണപിള്ള

3 .പഴഞ്ചൊല്ലുകൾ -സച്ചിദാനന്ദൻ

4 .മുള്ളൻപന്നി -കെ.ജി.ശങ്കരപ്പിള്ള

ഖണ്ഡം മൂന്ന് **15 മണിക്കൂർ**

1.തിരുത്ത്-പി .പി.രാമചന്ദ്രൻ

2.പിറക്കാത്ത മകന് -ബാലചന്ദ്രൻ ചുള്ളിക്കാട്

3.മൃഗശിക്ഷകൻ -വിജയലക്ഷ്മി

4.കുന്നിമണികൾ-കുഞ്ഞുണ്ണി

ഖണ്ഡം നാല് **22 മണിക്കൂർ**

1 .ആടിയാടില അലഞ്ഞ മരങ്ങളേ -അൻവർ അലി

2 .കൽവീട് -വി.എം.ഗിരിജ

3 . ആഴങ്ങൾ അടച്ചിട്ട പുഴ -എസ് .ജോസഫ്

4 .സ്മാരകം -വീരാൻകുട്ടി

5 .കുട്ടമ്മാൻ -എം.ർ.രേണുകുമാർ

6 .നാഷണൽ ജ്യോഗ്രഫി -എസ് .കണ്ണൻ

7 .വാഴക്കുല -കെ .ആർ.ടോണി

8 .പഴയ ചിലത് -പി.രാമൻ

9 .ഗോതമ്പുശില്പം -കവിത ബാലകൃഷ്ണൻ

SEMESTER II

COMPLEMENTARY COURSE I

CH2C01B18: BASIC ORGANIC CHEMISTRY

Credits – 2

Total Lecture Hours: 36

Course Outcomes

CO1: Apply the IUPAC nomenclature to name and write the structure of organic compounds including stereoisomers.

CO2: Explain the types of reagents, reactive intermediates, reaction mechanisms and the corresponding influencing factors in organic chemistry.

CO3: Explain stereoisomerism in organic chemistry.

CO4: Explain the classification, structure, properties, methods of preparation, uses and environmental toxicity of polymers.

Mapping of Course Outcomes with Programme Specific Outcomes

Mapping	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	1	2	1	1	3
CO2	1	2	2	2	3
CO3	1	3	2	2	2
CO4	1	3	2	3	2

Syllabus Content

Module 1: Fundamental Concepts of Organic Chemistry (9 hrs)

Introduction: Origin of organic chemistry – Uniqueness of carbon – Homologous series. IUPAC nomenclature of alkyl halides, alcohols, aldehydes, ketones, carboxylic acids and amines. Structural isomerism: Chain isomerism, position isomerism, functional isomerism, metamerism and tautomerism. Bond fission - homolytic and heterolytic fission. Types of reagents - Electrophiles and nucleophiles. Polarity of bonds. Reaction Intermediates: Carbocations,

carbanions and free radicals (Structure and stability). Types of organic reactions: Addition, Elimination, Substitution and Rearrangement (definition and one example each).

Module II: Mechanisms of Organic Reactions (9 hrs)

Meaning of reaction mechanism. Polarity of bonds. Electron Displacement Effects: Inductive effect - Definition - Examples - +I and -I groups. Applications: Explanation of substituent effect on the acidity of aliphatic carboxylic acids. Mesomeric effect: Definition – Characteristics - +M and -M groups, Applications. Hyperconjugation: Definition – Characteristics. Applications: Baker-Nathan effect, Comparison of stability of 2-methyl-1-butene & 2-methyl-2-butene. Steric effect (causes and simple examples).

Substitution reactions: nucleophilic substitution of alkyl halides- S_N1 and S_N2 mechanisms. Electrophilic substitutions in benzene.

Addition reactions: Electrophilic addition to alkene - Markwonikoff's rule, Peroxide effect. *Elimination reactions:* E1 and E2 mechanisms. (General mechanism is only needed)

Module III: Stereochemistry of Organic Compounds (9 hrs)

Stereosiomerism – definition, classification.

Geometrical Isomerism: Definition – Condition – Geometrical isomerism in but-2-ene and but-2-ene-1,4-dioic acid. cis and trans, *E* and *Z* configurations. Methods of distinguishing and interconversion of geometrical isomers.

Conformations: Newman projection, Saw-horse projection. Conformations of ethane.

Optical Isomerism: Optical activity – Chirality – Enantiomers - Meso compounds - Diastereoisomers – Optical isomerism in lactic acid and tartaric acid - Racemisation and resolution (elementary idea only).

Module IV: Natural and Synthetic Polymers (9 hrs)

Introduction. Classification of polymers: Natural, synthetic; linear, cross-linked and network; plastics, elastomers, fibres; homopolymers and copolymers. Polymerization reactions. Typical examples: Polyethylene, polypropylene, PVC, phenol-formaldehyde and melamine-formaldehyde

resins, polyamides (nylons) and polyesters. Natural rubber: structure, latex processing methods, vulcanization and uses. Synthetic rubbers: SBR, nitrile rubber and neoprene. Biodegradability of polymers, environmental hazards.

SEMESTER II

COMPLEMENTARY COURSE I

CH2CP01B18: VOLUMETRIC ANALYSIS (PRACTICAL)

Credits – 2

Total Hours: 72 (36 + 36)

Course Outcomes:

CO1: Prepare standard solutions for microscale volumetric analysis.

CO2: Record the molarity of the given intermediate solution by standardizing it.

CO3: Calculate the mass of the analyte in a given solution by microscale volumetric analysis.

CO4: Administer microscale analysis of solutions by different types of volumetry like acidimetry, alkalimetry, permanganometry, dichrometry, iodometry and iodimetry.

Mapping of Course Outcomes with Programme Specific Outcomes

Mapping	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	1	3	2	2	3
CO2	1	3	2	2	3
CO3	1	3	2	2	3
CO4	1	3	2	2	3

Syllabus Content

Standard solution must be prepared by the student.

1. Acidimetry and Alkalimetry

1. Standardization of HCl with standard Na_2CO_3 solution
2. Standardization of NaOH with standard oxalic acid solution
3. Estimation of any acid using standard NaOH
4. Estimation of any alkali using standard HCl.

2. Permanganometry

1. Standardization of $KMnO_4$ using (i) oxalic acid (ii) Mohr's salt
2. Estimation of Fe^{2+} in Mohr's salt and crystalline Ferrous Sulphate using standard $KMnO_4$.

3. Dichrometry

1. Estimation of Ferrous ions (external indicator)
2. Estimation of Ferrous ions (internal indicator)
3. Estimation of $FeSO_4$. 7 H_2O (external indicator)

4. Iodimetry and Iodometry

1. Standardization of Iodine solution
2. Standardization of Sodium thiosulphate
3. Estimation of $KMnO_4$
4. Estimation of Copper

SEMESTER II

COMPLEMENTARY COURSE II

ZY2C01B18: CHORDATE DIVERSITY

Credits : 2

Total Lecture Hours: 36

Course Outcome

CO1: Explain the classification of the higher groups of animal kingdom

CO2: Differentiate the characteristics, systems and identify the chordate phyla.

CO3: Distinguish the economically important vertebrates.

CO4: Summarize the adaptations in various classes of chordates.

Mapping of Course Outcomes with Program Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	3	1	2	2
CO2	2	3	1	2	2
CO3	3	2	1	2	2
CO4	2	3	2	2	2

Syllabus Content

Module I **(4 Hrs)**

Phylum Chordata: Fundamental characters and outline classification upto class.

Sub phylum Urochordata:

General characters, Classification:

Class 1: Larvacea (eg: Oikopleura)

Class 2: Ascidiacea (eg: Ascidia), Retrogressive metamorphosis.

Class 3: Thaliacea (eg: Salpa)

Sub phylum Cephalochordata: Salient features (eg: Branchiostoma)

Module II **(6 Hrs)**

Sub phylum Vertebrata: Salient features

Division Agnatha: salient features and classification

Class 1: Cyclostoma (eg: Petromyzon)

Class 2: Class Ostracodermi (eg: Cephalapsis)

Division Gnathostomata: Salient features Super class Pisces

Super class Tetrapoda.

Super class Pisces: Salient features and classification

Class 1: Chondrichthyes (eg: Narcine)

Class 2: Osteichthyes (eg: Latimeria)

General Topic: Accessory respiratory organs in fishes.

Module III **(14 Hrs)**

Super class Tetrapoda: Salient features

Class 1: Amphibia: Salient features. Type study: Euphlyctis hexadactyla - Habitat, morphology, sexual dimorphism, coelom and viscera, skeletal system, digestive system, respiratory system, circulatory system, excretory system, nervous system, sense organs, reproductive system, development.

Classification up to order:

Order 1: Urodela (eg: Amblystoma)

Order 2: Anura (eg: Bufo)

Order 3: Apoda (eg: Icthyophis)

Module IV **(6 Hrs)**

Class Reptilia: Salient features and classification up to subclass

Sub class 1: Anapsida (eg: Chelone)

Sub class 2: Diapsida (eg: Chamaeleon)

Sub class 3: Parapsida (eg: Icthyosaurus)

Sub class 4: Synapsida (eg: Cynognathus)

General Topics: Poisonous and non poisonous snakes of Kerala.

Class Aves: Salient features and classification up to subclass

Sub class Archeornithes (eg: Archaeopteryx)

Sub class Neornithes (eg: Struthio)

General Topics: Flight adaptation of birds

Module V **(6 Hrs)**

Class Mammalia: Salient features and classification up to subclass

Sub class 1: Protheria (eg: Echidna)

Sub class 2: Metatheria (eg: Macropus)

Sub class 3: Eutheria (eg: Elephas)

General Topic: General adaptation of aquatic mammals with example.

SEMESTER II

COMPLEMENTARY COURSE II

ZY2CP01B18: NON CHORDATE AND CHORDATE DIVERSITY(PRACTICAL)

Credits : 2

No. of Hours: 72 (36 + 36)

Course Outcome

CO1: Dissect the prawn and cockroach nervous system and distinguish the body parts of non-chordates and chordates

CO2: Distinguish the characteristics and identify the non-chordates and chordates.

CO3: Classify the various non-chordate and chordate phyla

CO4: Illustrate the non-chordates

Mapping of Course Outcomes with Programme Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	3	1	1	2
CO2	3	3	1	1	2
CO3	3	3	1	1	2
CO4	3	3	1	1	2

SEMESTER I

COMPLEMENTARY COURSE– PRACTICAL 1

NON-CHORDATE DIVERSITY

Syllabus Content

1. Scientific drawing - 5 specimens
2. Simple identification - 10 invertebrates, out of which 5 by their scientific names
3. T.S - Earthworm, T.S Fasciola
4. Dissection - Nervous system of Prawn
5. Dissection - Nervous system of Cockroach
6. Mounting - Prawn Appendages

SEMESTER II

COMPLEMENTARY COURSE – PRACTICAL 2

CHORDATE DIVERSITY

Syllabus Content

1. Simple identification of 10 chordates, out of which 5 by their scientific names
2. Osteology - Vertebrae and girdles of Frog
3. Snake identification - 3 poisonous and 3 non poisonous snakes with key
4. Mounting of placoid scales of shark
5. Dissections: Frog: Photographs/Diagrams/ models may be used for the study.

1. Frog - Viscera
2. Frog - Digestive System
3. Frog - Arterial System
4. Frog – Brain

SEMESTER II

CORE COURSE

BO2B02B18: MICROBIOLOGY, MYCOLOGY AND PLANT PATHOLOGY

Credits : 2

Total Lecture Hours: 36

Course Outcomes:

CO1: Analyse the morphological and ultrastructural features of bacteria, viruses fungi and lichens.

CO2: Recognise the process of isolation and culturing of bacteria based on their morphology.

CO3: Analyse the various adaptive strategies of the bacteria, viruses, fungi and lichens through phylogenetic line of evolution.

CO4: Explain the ecological, economic and pathologic importance of microorganisms.

Mapping of Course Outcomes with Programme Specific Outcomes

Mapping	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	2	2	1	2
CO2	3	2	2	1	2
CO3	3	1	2	1	1
CO4	3	1	2	3	2

Syllabus Content

MICROBIOLOGY (Theory 9 hrs; Practical 9 hrs)

Module 1: Introduction, Bacteria and Viruses (7 hrs)

Introduction to microbiology, scope of microbiology.

Bacteria: general characters and classification based on staining, morphology and flagellation. Ultra-structure of bacteria. Reproduction - binary fission. Genetic recombination in bacteria - conjugation, transformation and transduction. Economic importance of bacteria.

Viruses: General characters of viruses, viriods and prions. Structure of TMV and Bacteriophage (λ). Multiplication of λ phage – lytic and lysogenic cycle.

Module 2: Applied Microbiology (2 hrs)

Isolation and culture of bacteria; media used – general purpose and selective media, applications of bacterial culture (brief study only). Role of microbes: in producing antibiotics, vine, vinegar, curd – role in N_2 fixation, as biofertilizers – role in food spoilage (Brief study only).

MYCOLOGY (Theory 16 hrs; Practical 18 hrs)

Module 3: Introduction, classification and type study. (13 hrs)

General characters of fungi. Classification of fungi - Ainsworth (1973). Distinguishing characters of the different classes of fungi with special reference to reproductive structures and life history of the genera mentioned in each group:

Myxomycotina – *Physarum*; Mastigomycotina – *Albugo*; Zygomycotina - *Rhizopus*; Ascomycotina – Hemiascomycetes - *Saccharomyces*; Plectomycetes - *Penicillium*; Pyrenomycetes – *Xylaria*; Discomycetes - *Peziza*; Basidiomycotina – Teliomycetes – *Puccinia*; Hymenomycetes – *Agaricus*; Deuteromycotina – *Fusarium.*

Economic importance of Fungi (3 hrs)

Useful and harmful effects of fungi - medicinal, industrial, agricultural, food, genetic studies, spoilage, fungal toxins and diseases. Mycorrhiza: ecto- and endomycorrhiza. Significance.

Module 4: Lichens (2 hrs)

General characters, types, general internal structure. Economic and ecological significance of lichens. Structure, reproduction and life cycle of *Parmelia.*

PLANT PATHOLOGY (Theory 9 hrs; Practical 9 hrs)

Module 5: Plant disease development, Common plant diseases and Control of diseases

History of plant pathology. Classification of plant diseases on the basis of causative organism and symptoms. Host parasite interaction - defense mechanisms in host, mechanism of infection, transmission and dissemination of diseases.

Common plant diseases: Study of following diseases with emphasis on symptoms, cause, disease cycle and control: Bunchy top of Banana, Bacterial blight of Paddy, Root wilt of Coconut, Abnormal leaf fall of Rubber, Root knot disease of Pepper, Leaf mosaic disease of Tapioca, Citrus canker.

Control of diseases: Prophylaxis - quarantine measures, seed certification; Therapeutic - physical therapy, chemotherapy; Biological control and its significance. Preparation and application of fungicides - Bordeaux mixture; Biopesticides - Tobacco and Neem decoction

SEMESTER II

CORE COURSE

BO2BP01B18 - METHODOLOGY OF SCIENCE, INTRODUCTION TO BOTANY, MICROBIOLOGY, MYCOLOGY AND PLANT PATHOLOGY (PRACTICAL)

Credits : 2

Total Lecture Hours: 72 (36+36)

Course Outcomes:

CO1: Determine the distinctive features of plant groups and separate them to groups in the plant kingdom using morphological and reproductive features.

CO2: Develop an experiment and verify the validity of any given hypothesis to infer the different elements of scientific enquiry

CO3: Develop skills in basic microbiological techniques and prepare micro preparations of fungal specimens for identification

CO4: Identify plant diseases that affect crops based on symptoms and provide environment friendly preventive and remedial measures.

Mapping of Course Outcomes with Programme Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	3	2	3
CO2	3	1	2	2	3
CO3	3	1	2	2	1
CO4	3	2	2	3	3

SEMESTER I

CORE COURSE– PRACTICAL 1

METHODOLOGY OF SCIENCE AND AN INTRODUCTION TO BOTANY

PRACTICAL (36 hrs)

1. Design an experiment to verify a given hypothesis.
2. To identify and collect plant specimens to appreciate the diversity of plant kingdom.
3. Submit five preserved specimens (in bottles and/or herbarium) belonging to diverse groups.
4. Conduct a survey-based inquiry on a given topic (To test the validity of a given hypothesis. E.g., all angiosperm parasites are Dicot plants).
5. Select an important classical experiment and find out the different elements of the methodology of science (e.g., Robert Koch experiment).
6. Conduct field surveys plants with vascular elements, plants which produce flowers, fruits, seeds, cone, sporophyll, embryos and study their salient features.
7. Prepare temporary, stained hand sections (TS) of plant specimens appropriate for light microscopic studies.

SEMESTER II

CORE COURSE 2 - Practical

MICROBIOLOGY, MYCOLOGY AND PLANT PATHOLOGY

Practicals: 36 hrs

Microbiology - (9 hrs)

1. Gram staining - curd, root nodules.
2. Isolation of microbes from soil through serial dilution and streak plate method.
3. Demonstrate the culture of bacteria.

Microbes and type of fermentation - vine, vinegar, curd.

Mycology (18 hrs)

1. Micropreparation and detailed microscopic study of *Rhizopus, Albugo, Saccharomyces, Penicillium, Xylaria, Peziza, Puccinia, Fusarium* and *Parmelia.*
2. Staining and microscopic observation of endomycorrhizal fungus.
3. Investigation of fungal succession on cow dung.

Plant Pathology (9 hrs)

1. Identify the diseases mentioned in the syllabus with respect to causative organisms and symptoms
2. Submit herbarium preparations of any three of the diseases mentioned.

Learn the technique of preparing Bordeaux mixture, Tobacco and Neem decoction

SEMESTER III

Course Code	Course Title	Credits	Course Type
EN3A05B18	Literature and/as Identity	4	Common Course I
FR3A05B18	An Advanced Course in French -I	4	Common Course II
HN3A05B18	Naatak Aur Lambi Kavita		
MA3A05B18	Drisyakalasahithyam		
CH3C01B18	Inorganic and Organic Chemistry	3	Complementary Course I
ZY3C01B18	Physiology and Immunology	3	Complementary Course II
BO3B03B18	Phycology and Bryology	3	Core Course II

SEMESTER III

COMMON COURSE I

EN3A05B18 – LITERATURE AND/AS IDENTITY

Credits: 4

Total Lecture Hours: 90

Course Outcomes:

CO1. Explain how literature problematizes identity. (Understand)

CO2. Analyze the quest for identity in the Indian diaspora. (Analyze)

CO3. Illustrate the effects of partition and communal violence in South Asian Literature. (Analyze)

CO4. Critique the social construction of identity. (Evaluate)

Mapping of Course Outcomes with Program Specific Outcomes

Mapping	**PSO1AN**	**PSO2R**	**PSO3E**	**PSO4U**	**PSO5A**
CO1U	2	2	1	3	1
CO2AN	2	2	1	1	3
CO3AN	2	2	2	1	3
CO4E	2	1	2	1	3

Syllabus Content

Module 1 (Diasporic Identities) **(18 hours)**

Agha Shahid Ali: Postcard from Kashmir

Amy Tan: Mother Tongue

Imtiaz Dharker: At the Lahore Karhai

Chitra Banerjee Divakaruni: Indian Movie, New Jersey

Module 2 (South Asian Identities) (18 hours)

Sadat Hassan Manto: The Dog of Tetwal

Intizar Hussain: A Chronicle of Peacocks

Selina Hossain: Fugitive Colours

Punakante Wijenaike: That Deep Silence

Module 3 (Life Writings) (18 hours)

Malcolm X: ―Nightmare, excerpt from *The Autobiography of Malcolm X*.

Sashi Deshpande: Learning to be a Mother in *Janani– Mothers, Daughters, Motherhood,* (Ed.) Rinki Bhattacharya.

Module 4 (Indigenous Identities (18 hours)

Leslie Marmon Silko: Lullaby

Garhwali Songs in *Painted Words- An Anthology of Tribal Literature* – Edited by G.N. Devy

Mamang Dai: Pinyar the Widow (Excerpt from Legends of Pensam)

Module 5 (Alter Identities) (18 hours)

Nathaniel Hawthorne: The Birth Mark

Girish Karnad: Hayavadana (Excerpt)

Ruskin Bond: The Girl on the Train

SEMESTER III

COMMON COURSE II

FR3A05B18- AN ADVANCED COURSE IN FRENCH - I

Credits: 4

Total Lecture Hours: 90

Course Outcomes:

CO1: Describe topics such as physical appearance of a person, sports and entertainments. (Understand)

CO2: Articulate the concepts to express ones opinion in a specific situation. (Apply)

CO3: Compose conversations based on scenarios which help while shopping. (Create)

CO4: Articulate the concepts to give advice and instructions and to invite a person in a specific situation. (Apply)

CO5: Construct conversations based on scenarios which help during medical and health consultations. (Create)

Mapping of Course Outcomes with Programme Specific Outcomes

Mapping	**PSO1AN**	**PSO2R**	**PSO3E**	**PSO4U**	**PSO5A**
CO1 U	2	2	2	3	2
CO2 A	2	2	2	2	3
CO3 C	1	1	1	1	1
CO4 A	2	2	2	2	3
CO5 C	1	1	1	1	1

Syllabus Content:

Module I **(30 hours)**

Jeunes artistes: Décrire une personne - Exprimer une opinion - La description physique - Les spectacles

Module II **(30 hours)**

Tenue de soirée : Inviter - Les vêtements - Les chaussures - Les couleurs - Les matières

Module III **(30 hours)**

Faites du sport ! : Donner des conseils - Les parties du corps - Les mouvements - Les sports

SEMESTER III

COMMON COURSE II

HN3AO5B18 - NAATAK AUR LAMBI KAVITHA

Credits – 4

Total Lecturer Hours - 90

Course Outcomes:

CO1: Summarise the poems and illustrate the socio-political and cultural concerns of the Author (Apply)

CO2: Discuss the Authors contribution to Hindi Literature (Understand)

CO3: Analyse the characterisation of the Drama Konark (Analyse)

CO4: Critique excerpts of the poems and Drama (Analyse)

CO5: Communicate in oral and written form of Hindi with competence. (Apply)

Mapping of Course Outcomes with Programme Specific Outcomes

Mapping	PSO1AN	PSO2R	PSO3E	PSO4U	PSO5A
CO1 A	2	1	2	2	3
CO2 U	1	2	2	2	2
CO3 AN	2	1	2	2	3
CO4 AN	2	2	2	1	3
CO5 A	2	2	1	1	3

Syllabus Content

Module- I **22 Hours**

Syllabus- Konark Introduction & Act 1 (Jagdishchandra Mathur)

Module- II **24 Hours**

Syllabus- - Konark Act 2 & 3(Jagdishchandra Mathur)

Module- III **22 Hours**

Syllabus-

Nagayi Mahura (Thrilochan)

Shahenshah Ki Neend (Umashankar Chaudhary)

Dhaaba- Nilesh Raghuvanshi

Module- IV **22 Hours**

Syllabus-

Ithni Door Mat Bhyahna Baba- Nirmala Putul

Jawahar Tunnel – Agnishekhar

സെമസ്റ്റർ : മൂന്ന്

കോമൺ കോഴ്സ് മലയാളം

ബി.എ/ബി.എസ്.സി (റഗുലർ), ബി.എസ്.സി സൈക്കോളജി (സ്വാശ്രയം)

MA3A05B18- ദൃശ്യകലാസാഹിത്യം

Credits: 4

Total Lecture hours: 90

പഠനനേട്ടങ്ങൾ (Course Outcomes)

CO1:കേരളീയരംഗകലാപാരമ്പര്യവും സംസ്കാരപരിണാമവും ചർച്ചചെയ്യുക (Understand)

CO2:ദൃശ്യകലാപഠനത്തിലൂടെ കേരളീയസംസ്കാരപരിണാമം, ചരിത്രം എന്നിവ അപഗ്രഥിക്കുക (Analyze)

CO3:കഥാപാത്രപഠനത്തിലൂടെ സമകാലികവിഷയങ്ങളെ വിലയിരുത്തുക (Evaluate)

CO4: ഇതിവൃത്ത പഠനത്തിലൂടെ കഥാപാത്രങ്ങളെ വിമർശനാത്മകമായി നിരൂപണം ചെയ്യുക (Apply)

CO5:സമകാലികസംഭവങ്ങളെ അടിസ്ഥാനമാക്കി നാടകം, ഹ്യസ്വചിത്രം എന്നിവ തയാറാക്കുക. (Create)

Mapping of Course Outcomes with Programme Specific Outcomes

Mapping	PSO1AN	PSO2R	PSO3E	PSO4U	PSO5A
CO1 U	1	2	1	3	1
CO2 AN	2	1	2	2	3
CO3 E	1	2	2	2	3
CO4 A	2	1	1	2	3
CO5 C	2	1	2	2	2

പാഠഭാഗങ്ങൾ

ഖണ്ഡം ഒന്ന് - സംസ്കൃത നാടകം 20 മണിക്കൂർ.

മലയാളശാകുന്തളം നാലാമങ്കം - എ. ആർ രാജ രാജ വർമ

ഖണ്ഡം രണ്ട് - ആട്ടക്കഥ 15 മണിക്കൂർ

നളചരിതം (ഒന്നാം ദിവസം) - ഉണ്ണായി വാര്യർ (തുടക്കം മുതൽ ഹംസം നളനിലുള്ള പ്രണയം ഉറപ്പിക്കുന്നത് വരെ)

ഖണ്ഡം മൂന്ന് - തുള്ളൽ 15 മണിക്കൂർ

കല്യാണസൗഗന്ധികം (ശീതങ്കൻ തുള്ളൽ) - കുഞ്ചൻ നമ്പ്യാർ - (ഭീമൻറെ കദളീവന പ്രവേശം മുതൽ ശ്രീരാമ ദാസൻറെ വംശേ ജനിക്കയാൽ പാരം നിനക്കു മഹംഭാവമിങ്ങനെ' വരെ ഭാഗങ്ങൾ

ഖണ്ഡം നാല് - മലയാള നാടകം 20 മണിക്കൂർ

1128 ൽ ക്രൈം 27 - സി. ജെ. തോമസ്

ഖണ്ഡം അഞ്ച്- സിനിമ 20 മണിക്കൂർ

നിർമാല്യം തിരക്കഥ - എം. ടി . വാസുദേവൻ നായർ

SEMESTER III

COMPLEMENTARY COURSE

CH3C01B18: INORGANIC AND ORGANIC CHEMISTRY

Credits: 3

Total lecture hours - 54 hrs

Course Outcomes:

CO1: Explain the nuclear stability, fission and fusion processes and applications of radioactive isotopes. (Apply)

CO2: Summarize the biochemical reactions taking place during photosynthesis and respiration and the role of metal ions in biological processes. (Understand)

CO3: Explain the classification, uses and toxic effects of drugs, cosmetics, food additives, fertilizers and pesticides. (Understand)

CO4: Illustrate the preparation, properties, structure and aromaticity of furan, pyrrole and pyridine. (Apply)

Mapping of Course Outcomes with Programme Specific Outcomes

Mapping	PSO1AN	PSO2R	PSO3E	PSO4U	PSO5A
CO1 A	2	3	1	2	2
CO2 U	2	3	2	3	2
CO3 U	2	3	2	3	2
CO4 A	1	3	2	2	2

Syllabus Content:

Module I : Nuclear Chemistry (12 Hrs)

Nuclear Stability - Mass defect, Binding energy, Nuclear forces, Magic number, Packing fraction, n/p ratio. Natural and induced radioactivity, radioactivity – detection, Units of radioactivity. Modes of decay – Group displacement law. Isotopes, isobars and isotones with examples. Nuclear

fission - Atom bomb – Nuclear fusion – Hydrogen bomb - Nuclear reactors - Nuclear reactors in India. Application of radioactive isotopes – ^{14}C dating – Rock dating – Isotopes as tracers – Radio diagnosis and radiotherapy.

Module II: Bioinorganic Chemistry and Agricultural Chemistry (18 Hrs)

Bioinorganic Chemistry: Thermodynamics of Living cell- Exergonic and endergonic reactions. Metal ions in biological systems - Biochemistry of iron – Metalloporphyrins - Haemoglobin and myoglobin, pH of blood, cytochromes, Ferredoxine - Mechanism of O_2 and CO_2 transportation - Chlorophyll and photosynthesis (mechanism not expected) elementary idea of photophosphorylation. Photosynthesis and respiration – comparison. – Elementary idea of structure and mechanism of action of sodium potassium pump. Biochemistry of zinc and cobalt.

Chemistry and Agriculture: Fertilizers - NPK, superphosphates, triple super phosphate, uses of mixed fertilizers, micronutrients and their role, bio-fertilizers, plant growth hormones.

Pesticides - Classifications with simple examples, Biopesticides. Insecticides – stomach poisons, contact insecticides, fumigants. Method of preparation and use of DDT. Herbicides - function of 2, 4,-D and 2,4,5 –T, Fungicides - inorganic and organic- Bordeaux mixture. Excessive use of pesticides – environmental hazards.

Module III : Heterocyclic Compounds (8 Hrs)

Aromaticity – Huckel's rule, preparation (any one method), properties, structure and aromaticity of furan, pyrrole and pyridine.

Module IV: Drugs (8 Hrs)

Classification of drugs. Structure, therapeutic uses and mode of action (synthesis not required) of Antibiotics: Ampicillin, Sulpha drugs: Sulphanilamide, Antipyretics: Paracetamol, Analgesics: Aspirin, Antacids: Ranitidine, Antimalarials: Chloroquine and Anti-cancer drugs: Chlorambucil. Psychotropic drugs: Tranquilizers, antidepressants and stimulants with examples. Drug addiction and abuse. Prevention and treatment.

Module V: Food Additives and Cosmetics (8 Hrs)

Food Additives: Food preservatives, artificial sweeteners, flavours, emulsifying agents, antioxidants, leavening agents and flavour enhancers (definition and examples, structures not required) – Structure of BHT, BHA and MSG - Commonly used permitted and non-permitted food colours (structures not required) - Fast foods and junk foods & their health effects – Soft drinks and their health effects.

Cosmetics: Introduction. Dental cosmetics, Shampoos, Hair dyes, Skin products, Shaving cream, Talcum powder, Perfumes and Deodorants (health effects).

SEMESTER III

COMPLEMENTARY COURSE

ZY3C01B18: PHYSIOLOGY AND IMMUNOLOGY

Credits – 3

Total Lecture Hours: 54

Course Outcomes:

CO1: Illustrate the basic concepts and disorders of nutrition, circulation, respiration. (Analyze)

CO2: Compare the physiology and disorders of excretory, muscular and nervous system. (Analyze)

CO3: Summarize the role of endocrine system in maintaining homeostasis. (Evaluate)

CO4: Distinguish immunological concepts, Immune disorders and application of antigen antibody reactions (Evaluate)

Mapping of Course Outcomes with Programme Specific Outcomes

Mapping	PSO1AN	PSO2R	PSO3E	PSO4U	PSO5A
CO1AN	2	3	2	2	2
CO2AN	2	3	2	2	2
CO3E	2	3	2	2	2
CO4E	2	3	2	2	2

Syllabus Content

Module I (14 Hrs)

Nutrition: Types of nutrition – autotrophy, heterotrophy. Nutritional requirements – carbohydrates, proteins, lipids, minerals (Ca, Fe, I), vitamins (sources and deficiency disorders), nutritional disorders

Respiration: Transport of respiratory gases in blood - transport of oxygen, transport of carbon dioxide, chloride shift. Respiratory disturbances – Hypoxia, Hypercapnia, Asphyxia, physiological effect of smoking, carbon monoxide poisoning.

Circulation: Composition and functions of blood. Plasma and formed elements - WBC, RBC and platelets, Mechanism of blood coagulation – clotting factors, intrinsic and extrinsic pathways, anticoagulants. ECG, Blood pressure, Arteriosclerosis, Heamophilia, cerebral and pulmonary thrombosis.

Module II (14 hrs)

Excretion: Structure of a nephron. Urine formation – glomerular filteration, tubular reabsorption, tubular secretion. Urine concentration – counter current mechanism. Composition of urine –normal and abnormal constituents. Hormonal regulation of kidney function. Kidney stone, dialysis.

Neuro physiology: Structure of a neuron. Myelinated and non myelinated nerve fibre, nerve impulse production (resting membrane potential, action potential), Impulse propagation, All or none law, saltatory conduction, synaptic transmission. Neurotransmitters (acetyl choline, adrenalin, dopamine), brain waves, EEG. Neural disorders - Parkinson's disease, Alzheimer's disease.

Muscle physiology: Types of muscles: striated, non striated and cardiac. Ultra structure of striated muscle, Mechanism of muscle contraction, Cori cycle and muscle relaxation. Muscle fatigue, oxygen debt, Rigor mortis.

Module III (8 hrs)

Endocrinology: Introduction to Endocrine system. Mechanism of hormone action, Endocrine glands - hypothalamus, pituitary gland, pineal gland, thyroid gland, parathyroid gland, endocrine pancreas, adrenal gland, thymus gland, testis and ovary. Physiological role of hormones, Hormonal disorders.

Module IV (12 Hrs)

Immunology: Introduction to immunology, types of immunity – innate, acquired, passive, active, mechanism of innate immunity (barriers, inflammation, phagocytosis). Types of antigens. Basic

structure of immunoglobulins, Classes of immunoglobulins and functions. Antigen antibody reactions, Precipitation test, agglutination test, WIDAL, VDRL, HIV test (ELISA)

Module V (6 Hrs)

Immune response system: (Brief accounts of the followings)Primary and secondary lymphoid organs, Cells of Immune system - T&B lymphocytes, natural killer cells, macrophages, plasma cells , memory cells, Monoclonal antibodies, Hybridoma technology.

Immune disorders: Hypersensitivity, Auto immunity (rheumatoid arthritis) & Immunodeficiency (AIDS), Vaccines - BCG, DPT, Polio vaccine.

SEMESTER III

CORE COURSE

BO3B03B18: PHYCOLOGY AND BRYOLOGY

Credits – 3

Total Lecture Hours: 54

Course Outcomes:

CO1: Identify the different types of algae and bryophytes based on the characteristics and general features (Remember).

CO2: Explain the salient features of algae and bryophytes based on their basic characters such as habitat, range of thallus, life cycle etc. (Understand)

CO3: Analyze the significance of algae and bryophytes. (Analyze)

Mapping of Course Outcomes with Programme Specific Outcomes

Mapping	**PSO1AN**	**PSO2R**	**PSO3E**	**PSO4U**	**PSO5A**
CO1R	3	1	2	1	1
CO2U	3	1	2	2	1
CO3AN	2	1	2	3	3

Syllabus Content:-

PHYCOLOGY

Module 1: Introduction to Phycology and Classification of Algae (9 hrs)

Introduction: general characters, habitat diversity, range of thallus structure and pigments in algae; structure of algal flagella. Different types of life cycle and alternation of generations in algae. Classification: by Fritsch (1945); brief introduction to the modern classification by Lee (2009) [up to divisions].

Module 2: Type Study (18 hrs)

Salient features, thallus structure and reproduction of algae in the following groups with special reference to the type(s) mentioned: Cyanophyceae - *Nostoc*; Chlorophyceae - *Volvox,*

Oedogonium, Cladophora, Chara; Xanthophyceae – *Vaucheria;* Bacillariophyceae - *Pinnularia*; Phaeophyceae – *Ectocarpus, Sargassum*; Rhodophyceae - *Polysiphonia*.

Module 3: Artificial Culture and Economic Importance of Algae (9 hrs)

Algal culture: isolation, cultivation and preservation of micro- and macro-algae. Economic importance of algae: algae as food, SCP, fodder, green manure, role in N2 fixation, medicine and biofuels. Commercial products from Algae - carrageenin, agar-agar, alginates and diatomaceous earth. Role of algae in pollution studies: as indicators of pollution and as bioremediation agents. Eutrophication – algal bloom; harmful and toxic algal blooms – neurotoxins and parasitic algae.

BRYOLOGY

Module 4: General Introduction and Classification of Bryophytes (6 hrs)

Introduction, general characters and classification of bryophytes by Rothmaler (1951); a very brief account of systems and classifications by Goffinet *et al* (2008).

Economic importance of Bryophytes – biological, ecological, medicinal and as potting material.

Module 5: Type Study (12 hrs)

Distribution, morphology, anatomy, reproduction and life cycle of the following types (developmental details are not required): Hepaticopsida - *Riccia, Marchantia*; Anthocerotopsida *Anthoceros*; Bryopsida - *Funaria*. Evolution of gametophyte and sporophyte among Bryophytes

SEMESTER IV

Course Code	Course Title	Credits	Course Type
EN4A06B18	Illuminations	4	Common Course I
FR4A06B18	An Advanced Course in French -II	4	Common Course II
HN4A06B18	Gadya Aur Ekanki		
MA4A06B18	Malayala Gadhyarachanakal		
CH4C01B18	Advanced Bio-Organic Chemistry	3	Complementary Course I
CH4CP01B18	Organic Chemistry Practical	2	Complementary Course I
ZY4C01B18	Applied Zoology	3	Complementary Course II
ZY4CP01B18	Physiology, Immunology and Applied Zoology (Practical)	2	Complementary Course II
BO4B04B18	Pteridology, Gymnosperms and Paleobotany	3	Core Course
BO4BP02B18	Phycology, Bryology, Pteridology, Gymnosperms and Paleobotany	2	Core Course

SEMESTER IV

COMMON COURSE VI

EN4A06B18 – ILLUMINATIONS

Credits: 4

Total Lecture Hours: 90

Course Outcomes:

CO1. Discover life lessons through the study of life sketches. (Understand)

CO2. Explain multiple perspectives of life from the viewpoint of great minds. (Understand)

CO3. Apply the language skills acquired in academic and non-academic contexts. (Apply)

CO4. Analyze creative texts with a special focus on human emotions and the spirit of survival. (Analyze)

CO5. Critique the conventional notions of happiness, courage and failure. (Evaluate)

Mapping of Course Outcomes with Programme Specific Outcomes

Mapping	PSO1AN	PSO2R	PSO3E	PSO4U	PSO5A
CO1 U	1	1	1	1	1
CO2 U	1	1	1	1	1
CO3 A	1	1	1	1	2
CO4 AN	1	1	1	1	1
CO5 E	1	1	1	1	3

Syllabus Content

Module 1- Life Sketches (18 hours)

Helen Keller: Three Days to See

Jesse Owens: My Greatest Olympic Prize

Thus Spoke Sudarshan: An Interview with God's Own Physicist Compiled from E C G Sudarshan's interviews

Module 2- Essays (18 hours)

Stephen Leacock: Are the Rich Happy?

A.G. Gardiner: On Courage

Module 3- Speeches (18 hours)

Lafcadio Hearn: On Reading

J.K. Rowling: The fringe benefits of failure and the importance of imagination

Chimamanda Ngozi Adichie: An Ode to Makeup

Module 4- Short Stories (18 hours)

Oscar Wilde: The Nightingale and the Rose

George Orwell: Roucolle, the Miser

John Galsworthy: Quality

Alice Walker: Everyday Use

Module 5- Poems (18 hours)

William Ernest Henley: Invictus

Robert Frost: The Road Not Taken

Kahlil Gibran: Of Good and Evil

Maya Angelou: Still I Rise

SEMESTER IV

COMMON COURSE II

FR4A06B18 - AN ADVANCED COURSE IN FRENCH II

Credits: 4

Total Lecture Hours: 90 hours

Course Outcomes:

CO1: Develop language, vocabulary and grammar skills. (Apply)

CO2: Prepare conversations based on various situations and speak about them. (Apply)

CO3: Articulate the concepts to express one's opinion in a specific situation. (Apply)

CO4: Ask questions to get meaningful responses in effective communication. (Understand)

CO5: Describe events or topics based on various daily life situations such as persons, family, time schedules, visiting countries (Understand)

Mapping of Course Outcomes with Programme Specific Outcomes

Mapping	PSO1AN	PSO2R	PSO3E	PSO4U	PSO5A
CO1 A	1	1	1	1	3
CO2 A	1	1	1	1	1
CO3 A	1	1	1	1	2
CO4 U	1	1	1	1	1
CO5 U	1	1	1	1	2

Syllabus Content:

Module I : En voiture Proposer – Accepter – Refuser – Faire des projets- Les routes – La voiture **(30 Hours)**

Module II : Sur la route Exprimer l'obligation/ L'interdiction – La météo– Le temps **(30 Hours)**

Module III : Raconter un emploi du temps Se justifier – Le tourisme - Les pays et les continents **(30 Hours)**

SEMESTER IV

COMMON COURSE II

HN4AO6B18 - GADYA AUR EKAANKI

Credits: 4

Total Lecture Hours: 90

Course Outcomes:

CO1: Discuss the authors contribution to Hindi Literature (Understand)

CO2: Summarise the central theme and other relevant details of all literary works. (Understand)

CO3: Illustrate the socio-political and cultural concerns of the Author (Apply)

CO4: Critique excerpts of the Prose and One Act Plays (Analyse)

CO5: Communicate in oral and written form of Hindi with competence. (Apply)

Mapping of Course Outcomes with Programme Specific Outcomes

Mapping	PSO1AN	PSO2R	PSO3E	PSO4U	PSO5A
CO1U	1	1	1	1	1
CO2U	1	1	1	1	1
CO3A	1	1	1	1	1
CO4AN	1	1	1	1	1
CO5A	1	1	1	1	3

Syllabus Content:

Module- I **(22hrs)**

1. Aaiye hum vriksh devta ki aaradhana karen- Dr. Kishorilal vyas
2. Raajniti ka batvaara- Harishankar parsai
3. Deep daan – Ramkumar verma

Module- II **(24hrs)**

4. Himachadit uttung shikhar aur dhuli hariyali – Vijay kumar sandesh
5. Kaphan chor ka beta – Ushabaala
6. Bahu ki vida- Vinod rastogi

Module- III **(22hr)**

7. Jab mai fail hua- Ramkumar Verma
8. Jaan se pyare – Mamta Kaaliya
9. Sati – G.K. Harjeeth

Module- IV **(22hrs)**

10. Jab intizar hussain apni janmabhoomi laute – Azhar vajahat
11. Hari ghaas par ghante bhar – Surendra Verma

SEMESTER IV

COMMON COURSE II

MA4A06B18 - മലയാള ഗദ്യരചനകൾ

Credits: 4

Total Lecture Hours: 90

Course Outcomes:

CO1: മലയാള ഗദ്യസാഹിത്യത്തിലെ സമകാലിക വിഷയങ്ങൾ ചർച്ച ചെയ്യുക (Understand)

CO2: കേരളീയസംസ്കാര - കലാപരിണാമം , ചരിത്രം, ആത്മകഥ എന്നിവ അപഗ്രഥിക്കുക (Analyze)

CO3: ഗദ്യപാഠങ്ങളിലൂടെ സമകാലികവിഷയങ്ങളെ വിലയിരുത്തുക (Evaluate)

CO4: സമകാലിക സാമൂഹിക വിഷയങ്ങളെ വിമർശനാത്മകമായി നിരൂപണംചെയ്യുക (Apply)

CO5: വിവിധ വിഷയങ്ങളെ ആസ്പദമാക്കി ലേഖനങ്ങൾ തയാറാക്കുക. സ്വാനുഭവങ്ങൾ വിവിധ ആഖ്യാന രൂപങ്ങളിലൂടെ ആവിഷ്കരിക്കുക. (Create)

Mapping of Course Outcomes with Program Specific Outcomes

Mapping	PSO1AN	PSO2R	PSO3E	PSO4U	PSO5A
CO1U	1	1	1	1	1
CO2AN	1	1	1	1	1
CO3E	1	1	1	1	1
CO4A	1	1	1	1	1
CO5C	1	1	1	2	3

പാഠഭാഗങ്ങൾ

പുസ്തകങ്ങൾ : ഗദ്യാരാമം , ഓർമ്മകൾ ചന്ദനഗന്ധം പോലെ

ഖണ്ഡം ഒന്ന് **15 മണിക്കൂർ**

1. കാളിദാസനും കാലത്തിൻറെ ദാസൻ - ജോസഫ് മുണ്ടശ്ശേരി
2. മേഘസന്ദേശവിവർത്തനങ്ങൾ - ഡോ. എൻ .അജയകുമാർ
3. മാതൃഭാഷയിലേക്കു വീണ്ടും - എൻ .വി . കൃഷ്ണവാര്യർ

ഖണ്ഡം രണ്ട് **20 മണിക്കൂർ**

1. വാക്കുകളുടെ വിസ്മയം - എം .ടി.വാസുദേവൻനായർ
2. മാറുന്ന മലയാള സംസാരഭാഷ - ടി .ബി .വേണുഗോപാലപ്പണിക്കർ
3. നമ്മുടെ അടുക്കള തിരിച്ചുപിടിക്കുക - സാറാ ജോസഫ്
4. കലയും കലാദർശനവും - ഡോ. ജെ . ഉണ്ണികൃഷ്ണപിള്ള

ഖണ്ഡം മൂന്ന് **15 മണിക്കൂർ**

1. ചെമ്പൈ വൈദ്യനാഥ ഭാഗവതർ സംഗീതത്തിലെ സിംഹനാദം - ഇന്ദിരാമേനോൻ
2. ഈശ്വരപിള്ളയെ ആരോർക്കുന്നു - പി. കെ . രാജശേഖരൻ
3. രവിവർമ്മ - വിജയകുമാർ മേനോൻ

ഖണ്ഡം നാല് **15 മണിക്കൂർ**

1. പ്രകാശത്തിൻറെ ആയിരം തടവറകൾ - ജീവൻ ജോബ് തോമസ്
2. ജനാധിപത്യ വിദ്യാഭാസം ചില ചിന്തകൾ - ഡോ. കെ .എൻ. പണിക്കർ
3. ഞങ്ങൾ നിങ്ങൾക്ക് ഭൂമി വിറ്റാൽ - സിയാറ്റിൽ മൂപ്പൻ

ഖണ്ഡം അഞ്ച് **25 മണിക്കൂർ**

1. ഓർമ്മകൾ ചന്ദനഗന്ധം പോലെ - ബി. സരസ്വതിയമ്മ

SEMESTER IV

COMPLEMENTARY COURSE I

CH4C01B18: ADVANCED BIO-ORGANIC CHEMISTRY

Credits: 3

Total lecture hours - 54 hrs

Course Outcomes:

CO1: Summarize the classification, isolation and properties of essential oils, alkaloids and lipids. (Understand)

CO2: Explain the structure, classification and biological functions of Amino acids, proteins, enzymes, nucleic acids, vitamins, steroids and hormones. (Apply)

CO3: Summarize the preparation, properties and configuration of glucose, fructose, sucrose, starch and cellulose. (Understand)

CO4: Explain the classification, cleaning action and environmental effects of soaps and detergents. (Understand)

Mapping of Course Outcomes with Programme Specific Outcomes

Mapping	PSO1AN	PSO2R	PSO3E	PSO4U	PSO5A
CO1U	1	3	1	1	1
CO2A	1	3	1	1	2
CO3U	1	3	1	1	1
CO4U	1	3	1	1	1

Syllabus Content:

Module I : Natural Products (12 Hrs)

Terpenoids: Classification with examples – Isoprene rule – Isolation of essential oils by steam distillation – Uses of lemongrass oil, eucalyptus oil and sandalwood oil - Source, structure and uses of citral and geraniol.

Alkaloids: Classification – Isolation, general properties. Source, structure and physiological activity of nicotine, coniine and piperine.

Lipids: Classification – Oils, fats and waxes (definition, structure, biological functions and examples). Hydrogenation and Rancidity - Acid value, Saponification value and Iodine value –. Biological functions of phospholipids and glycolipids

Soaps and Detergents: Soaps – Types of soaps. Cleansing action of soaps. Synthetic detergents - Classification. Comparison between soaps and detergents. Environmental aspects.

Module II: Amino Acids and Proteins (12 Hrs)

Amino acids: Classification – Zwitter ion formation and isoelectric point- Synthesis of glycine, alanine, and phenyl alanine (any one method). Peptides: Peptide bond. Synthesis of peptides (upto dipeptides). Proteins: Classification of proteins – Primary, secondary and tertiary structure of proteins -– Denaturation of proteins – Tests for proteins.

Module III : Enzymes and Nucleic Acids (9 Hrs)

Enzymes: Nomenclature, classification and characteristics. Mechanism of enzyme action. Theory of enzyme catalysis – Michaelis-Menten theory. Cofactors and coenzymes. Enzyme inhibitors. Uses of enzymes.

Nucleic acids: Structure of pentose sugar, nitrogenous base, nucleoside and nucleotide – Double-helical structure of DNA – Differences between DNA and RNA. Biological Functions – Replication and protein biosynthesis. Transcription and Translation. Genetic code.

Energy rich molecules: Elementary structure of ATP, ADP and AMP.

Module IV : Carbohydrates (12 Hrs)

Classification with examples. Preparation and properties of glucose, fructose and sucrose. Cyclic structures and Haworth projections of glucose, fructose, maltose and sucrose (ring size determination not expected). – Mutarotation. Conversion of glucose to fructose and vice versa. – Structure of starch and cellulose (structure elucidation not expected). Industrial applications of cellulose.

Module V: Vitamins, Steroids and Hormones (9 Hrs)

Vitamins: Classification. Structure, biological functions and deficiency diseases of vitamins A, B_1, B_2, B_3, B_5, B_6, B_{12} (structure not required), C and D.

Steroids: Introduction. Structure and functions of cholesterol. Elementary idea of HDL and LDL. Bile acids.

Hormones: (only examples and biological functions needed. Structures are not needed.) Introduction. Steroid hormones, peptide hormones and amine hormones (examples, endocrine gland and biological functions, structure not required). Artificial hormones (elementary study only).

SEMESTER IV

COMPLEMENTARY COURSE I

CH4CP01B18: ORGANIC CHEMISTRY PRACTICALS

Credit – 2

Total Hours: 72 Hrs

Course Outcomes:

CO1: Determine the heteroatoms present in an organic compound. (Apply)

CO2: Identify the functional groups present in an organic compound. (Apply)

CO3: Summarise the method of preparation of solid derivative of the analysed organic compound. (Understand)

Mapping of Course Outcomes with Programme Specific Outcomes

Mapping	PSO1AN	PSO2R	PSO3E	PSO4U	PSO5A
CO1A	1	3	1	1	1
CO2A	1	3	1	1	1
CO3U	1	3	1	1	1

Syllabus Content:

1. Tests for elements: Nitrogen, Halogen and Sulphur
2. Determination of physical constants
3. Study of reactions of common functional groups.
4. Qualitative analysis with a view to characterization of functional groups and identification of the following compounds: Naphthalene, anthracene, chlorobenzene, benzyl chloride, p-dichlorobenzene, benzyl alcohol, phenol, o-, m- and p- cresols, α-naphthol, β-naphthol, resorcinol, benzaldehyde, acetophenone, benzophenone: benzoic acid, phthalic acid, cinnamic acid, salicylic acid, ethyl benzoate, methyl salicylate, benzamide, urea, aniline,

o-, m- and p- toluidines, dimethyl aniline, nitrobenzene, o-nitrotoluene, m-dinitrobenzene and glucose. (minimum of ten compounds to be analysed).

5. Organic preparation involving halogenation, nitration, oxidation, reduction, acetylation, benozylation, hydrolysis, diazotization. (non- evaluative)
6. Isolation of an organic compound from a natural source. (non- evaluative)

SEMESTER IV

COMPLEMENTARY COURSE II

ZY4C01B18: APPLIED ZOOLOGY

Credits: 3

Total Lecture Hours: 54

Course Outcomes:

CO1: Develop skills in fish breeding techniques and various aquaculture practices. (Create)

CO2: Analyse the life history and rearing techniques of silkworm (Analyse)

CO3: Practice earthworm rearing techniques and methods of vermicomposting (Apply)

CO4: Illustrate social life in honey bees and management of an apiary in relation with entrepreneurship development. (Apply)

Mapping of Course Outcomes with Programme Specific Outcomes

Mapping	PSO1AN	PSO2R	PSO3E	PSO4U	PSO5A
CO1C	1	3	1	1	1
CO2AN	1	3	1	1	1
CO3A	1	3	1	1	1
CO4A	1	3	1	1	1

Syllabus Content:-

Module I: Aquaculture **24 Hrs**

Advantages of aquaculture, Traditional methods of aquaculture, Biotic and abiotic factors in water, Pond culture – construction and maintenance. Types of aquaculture, composite fish culture, integrated fish culture, induced breeding of carp & prawn, Importance of algae in aquaculture. Aquarium management - Setting up of an aquarium, biological filter and aeration. Common cultivable fishes of Kerala. Fish diseases, Prawn culture, mussel culture, pearl culture, Fish processing and preservation.

Module II: Sericulture **12 Hrs**

Four species of silkworms, life history of silkworm, silk worm rearing techniques, Mounting of silkworm - Chandrika, defective cocoons, harvesting and stifling of coccons. Silkworm diseases and pest, preventive and control measures.

Module III: Vermiculture **6 Hrs**

Species of earthworms, ecological classification of earthworms, life cycle and reproduction of earthworm. Physical & chemical effects of earthworms on soil, Vermicomposting – site selection, preparation of pit, maintenance, monitoring and harvesting of vermicompost.

Module IV: Apiculture **12 Hrs**

Species of honey bees, organization of honey bee colony. Bee keeping methods and equipments. Apiary management and maintenance. Bee pasturage, byproducts of honey bees and their uses. Diseases, pests of honey bees and control measures.

SEMESTER IV

COMPLEMENTARY COURSE II

ZY4CP01B18: PHYSIOLOGY, IMMUNOLOGY AND APPLIED ZOOLOGY

Credits – 2

Total Hours: 72

Course Outcomes:

CO1: Analyse the presence of reducing sugar, protein and lipid (Analyse)

CO2: Identify human blood groups and leucocytes and estimate haemoglobin (Apply)

CO3: Explain the action of salivary amylase, principle and use of sphygmomanometer and stethoscope. (Understand)

CO4: Compare economic importance and morphology of culturable fishes, earthworms, honey bees and silkworm. (Analyse)

Mapping of Course Outcomes with Programme Specific Outcomes

Mapping	PSO1AN	PSO2R	PSO3E	PSO4U	PSO5A
CO1AN	1	3	1	1	1
CO2A	1	3	1	1	1
CO3U	1	3	1	1	1
CO4AN	1	3	1	1	1

PHYSIOLOGY AND IMMUNOLOGY

1. Preparation of Human Blood smear & Identification of leucocytes.

2. Qualitative analysis of Reducing Sugar, Protein and Lipid.

3. Action of Salivary amylase on Starch (Demonstration Only).

4. Estimation of Haemoglobin (Demonstration only).

5. Identification of human blood groups, A, AB, B and O, Rh factor.

6. Instruments (Principle & uses) -Sphygmomanometer, Stethoscope.

APPLIED ZOOLOGY

General identification, economic importance, morphology, scientific names and common names of the following

1. Economic importance and morphology of culturable fishes (Catla, Rohu, Grass carp,

Common carp, Silver carp, Etroplus, Tilapia)

2. Two species of earthworms used in Vermiculture

3. Two species of honey bees

4. Silkworm. Cocoon/Adult

5. Castes of honey bees

6. Bee keeping equipments - Bee hive, Smoker, honey extractor

7. Identification and uses - Bee wax, Honey, Silk, Vermicompost

8. Chandrika / Natrika used in sericulture

SEMESTER IV

CORE COURSE

BO4B04B18: PTERIDOLOGY, GYMNOSPERMS AND PALEOBOTANY

Credits: 3

Total Lecture hours: 54

Course Outcomes:

CO1: Identify the different types of pteridophytes and gymnosperms based on the characteristics and general features (Remember).

CO2: Explain the salient features of pteridophytes and gymnosperms based on their basic characters such as habitat, reproduction, life cycle etc. (Understand).

CO3: Analyze the significance of Pteridophytes and gymnosperms. (Analyze).

CO4: Compare the morphology, anatomy, reproduction and life cycle of different types of pteridophytes and gymnosperms (Evaluate).

Mapping of Course Outcomes with Programme Specific Outcomes

Mapping	PSO1AN	PSO2R	PSO3E	PSO4U	PSO5A
CO1R	2	1	2	1	1
CO2U	2	1	2	3	1
CO3AN	3	1	1	1	1
CO4E	2	1	1	1	1

Syllabus Content: -

PTERIDOLOGY

Module 1: General Introduction and Classification of Pteridophytes and Type Study (23 hrs)

Introduction, general characters and classification of Pteridophytes up to classes by Smith (1955) and a very brief account of the classification by Christenhusz *et a*l., 2011.

Type study- Study the distribution, morphology, anatomy, reproduction, life cycle and affinities of the following types (Developmental details are not required): Psilophyta - *Psilotum*; Lycophyta - *Lycopodium, Selaginella;* Sphenophyta - *Equisetum;* Pterophyta - *Pteris*, *Marsilea.* Stelar evolution in Pteridophytes; Heterospory and seed habit.

Module 2: Economic and Ecological Importance (4 hrs)

Importance of Pteridophytes: medicinal, ornamental, as biofertilizer.

GYMNOSPERMS

Module 3: General Introduction, Classification of Gymnosperms and Type Study (16 hrs)

Introduction, General characters, classification of Gymnosperms by Sporne (1965) and a very brief account of the classification by Christenhusz *et al* (2011). Affinities of Gymnosperms with Pteridophytes and Angiosperms.

Type study: Distribution, morphology, anatomy, reproduction, life cycle and affinities of the following types (Developmental details are not required): Cycadopsida – *Cycas*; Coniferopsida – *Pinus*; Gnetopsida– *Gnetum.*

Module 4: Economic and Ecological Importance of Gymnosperms (2 hrs)

Uses of Gymnosperms: as food, medicine, in industry and as ornamental plants.

SEMESTER IV

CORE COURSE

BO4BP02B18 - PHYCOLOGY AND BRYOLOGY, PTERIDOLOGY, GYMNOSPERMS AND PALEOBOTANY

Credits –2

Total Hours: 72 hrs

Course Outcomes:

CO1: Identify the different algal specimens and their vegetative and reproductive structures of each type (Remember)

CO2: Analyze the anatomy of thallus and reproductive structures of Riccia, Marchantia, Anthoceros and Funaria. (Analyze)

CO3 : Analyze the habit, TS of stem, morphology of the strobilus of the following types:

Psilotum, Lycopodium, Selaginella, Equisetum, Pteris, Marsilea. (Analyze)

CO4: Analyze the habit, TS of leaf and stem, TLS and RLS of coniferous wood (Pinus), morphology of reproductive structures of Cycas, Pinus and Gnetum. (Analyze)

Mapping of Course Outcomes with Programme Specific Outcomes:

Mapping	PSO1AN	PSO2R	PSO3E	PSO4U	PSO5AN
CO1R	2	1	2	1	1
CO2AN	3	1	2	1	1
CO3AN	2	1	2	1	1
CO4AN	3	1	2	2	1

Syllabus Content: -

PHYCOLOGY

1. Make micropreparations of vegetative and reproductive structures of the types mentioned in the syllabus.
2. Algal Culture: isolation and cultivation of micro- and macro-algae in suitable growth media.

3. Familiarizing the technique of algal collection and preservation.

BRYOLOGY

1. Studying the habit, anatomy of thallus and reproductive structures of Riccia, Marchantia, Anthoceros and Funaria.

PTERIDOLOGY:

1. Study of the habit, TS of stem, morphology of the strobilus of the following types: Psilotum, Lycopodium, Selaginella, Equisetum, Pteris, Marsilea.

GYMNOSPERM:

1. Study of the habit, TS of leaf and stem, TLS and RLS of coniferous wood (Pinus), morphology of reproductive structures of Cycas, Pinus and Gnetum.

SEMESTER V

Course Code	Course Title	Credits	Course Type
BO5B05B18	Environmental Science and Human Rights	3	Core Course
BO5B06B18	Research Methodology, Biophysics and Biostatistics	3	Core Course
BO5B07B18	Plant Physiology and Biochemistry	3	Core Course
BO5B08B18	Anatomy, Reproductive Botany and Microtechnique	3	Core Course
BO5D01aB18	Horticulture and Nursery Management	3	Open Course
BO5D01bB18	Agri-based Microenterprises		
BO5D01cB18	Ecotourism		

SEMESTER V

CORE COURSE

BO5B05B18 - ENVIRONMENTAL SCIENCE AND HUMAN RIGHTS

Credits – 3

Total Hours: 54 hrs

Course Outcomes:

CO1: Explain the structure and function of the Ecosystem and the relevance of Environmental Science.

CO2: Evaluate biodiversity management strategies and conservation efforts carried out by environmental organizations and agencies.

CO3: Describe the extent of pollution and control measures.

CO4: Apply the knowledge of the various rights in real life situations as responsible citizens.

Mapping of Course Outcomes with Programme Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	1	2	2	2
CO2	2	2	1	3	2
CO3	1	2	1	3	2
CO4	1	1	1	2	3

Syllabus Content

Module 1: Introduction to Ecology, Ecosystems (18 hrs)

a) Ecology: introduction, definition, scope and relevance; sub-divisions of ecology - autecology, synecology and ecosystem ecology**.**
Population: population size, density, natality, mortality, age, rate of natural increase, growth form and carrying capacity, population interactions between species - competition, parasitism,

predation, commensalism, proto co-operation, mutualism, neutralism.
Community: community concept, biotic community, species diversity, species richness, dominance; growth forms and structure, trophic structure, ecotone, edge effect, habitat,

ecological niche, micro- climate, ecological indicators, keystone species**.**

b) Structure and function of ecosystems, ecosystem components: abiotic - atmosphere, climate, soil, water; biotic - producers, consumers, decomposers. Productivity - primary and secondary - gross and net productivity - homeostasis in the ecosystem. Concept of energy in ecosystems - energy flow, food chain, food web, trophic levels, trophic structure and ecological pyramids - pyramid of numbers, biomass, energy. Nutrient cycles - biogeochemical cycles of C and N2. Ecosystem development: ecological succession process, climax community, hydrosere, xerosere.

Adaptations of plants to environment - xerophytes, hydrophytes, epiphytes, halophytes, mangroves.

Module 2: Biodiversity and its Conservation (10 hrs)

Biodiversity: definition, types, examples – endemism - hot spots; hot spots in India - Western Ghats as hot spot. Wetlands and their importance. Biodiversity loss - IUCN threat categories, Red data book; causes and rate of biodiversity loss - extinction, causes of extinction. Conservation: methods - *in-situ, ex-situ*. Joint Forest management - peoples participation in biodiversity conservation: community reserve, eg. Kadalundi-Vallikkunnu. Remote sensing and GIS: introduction, principle, application of remote sensing and GIS in environmental studies and biodiversity conservation (brief account). Ecotourism: ecotourism centers in Kerala - Thenmala and Thattekkad WLS.

Module 3: Environmental Pollution (10 hrs)

Environmental studies - definition, relation to other sciences, relevance. Environmental pollution - introduction, definition; Air pollution - air pollutants, types, sources, effect of air pollution on plants and humans, control measures; Water pollution – common pollutants, sources, impact, control measures; water quality standards - DO and BOD; eutrophication. Soil Pollution - causes, sources, solid waste, biodegradable, non-biodegradable, management of solid waste, composting, e – waste. Environmental issues - global warming, greenhouse effect, climate change - causes and impact, ozone layer depletion. Carbon sequestration.

Module 4: Conservation of Nature (10 hrs)

Global conservation efforts - Rio Earth summit - Agenda 21, Kyoto protocol, COP15 (15^{th}Conference of the parties under the UN framework convention on climate change) and

Paris protocol -major contributions. Conservation strategies and efforts in India and Kerala.

Organizations, movements and contributors of environmental studies and conservation: organizations- WWF, Chipko, NEERI; contributors - Salim Ali, Sunder Lal Bahuguna, Madhav Gadgil, Anil Agarwal, Medha Patkar, Vandana Siva (brief account only).

Environmental Legislation and Laws: Environment (protection) Act 1986, Air (protection and control of pollution) act, 1981 Water (protection and control of pollution) Act, 1974, Wildlife (protection) Act, 1972, Forest (conservation) Act, 1980, Biological Diversity Act (2002) [brief account only].

Module 5: HUMAN RIGHTS **(6 hrs)**

Introduction, meaning, concept and development. Three generations of human rights - civil and political rights, economic, social and cultural rights. Human Rights and United Nations: contributions; main human rights related organizations - UNESCO, UNICEF, WHO, ILO; Declarations for women and children, Universal declaration of human rights. Human rights in India: fundamental rights and Indian constitution, rights for children and women, scheduled castes, scheduled tribes, other backward castes and minorities.

Environment and human rights: right to clean environment and public safety; issues of industrial pollution; prevention, rehabilitation and safety aspect of new technologies such as chemical and nuclear technologies, issues of waste disposal, protection of environment. Conservation of natural resources and human rights: reports, case studies and policy formulation. Conservation issues of Western Ghats – Madhav Gadgil committee report, Kasturi Rangan report. Over-exploitation of ground water resources, marine fisheries, sand mining *etc*.

SEMESTER V

CORE COURSE

BO5B06B18: RESEARCH METHODOLOGY, BIOPHYSICS AND BIOSTATISTICS

Credits – 3

Total Hours: 54 hrs

Course Outcomes:

CO1: Apply the different laboratory techniques and knowledge of biophysical instruments in carrying out experiments.

CO2: Execute information gathering from various resources to carry out research and data analysis

CO3: Interpret numerical data with different statistical methods and tools.

CO4: Develop expertise in information technology for general application and for solving research problems .

Mapping of Course Outcomes with Programme Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	1	2	2	3
CO2	2	2	1	1	3
CO3	1	1	1	2	3
CO4	1	1	1	2	3

Syllabus Content

Module 1: Introduction and Process of Research (11 hrs) -

Objectives of research. Types of research - pure and applied. Identification of research problem. Review of literature: purpose, literature sources – names of reputed National and International journals in life science (2 international & 3 national); reprint acquisition - INSDOC, INFLIBNET.

Process of research: Conducting research: define the problem, identify the objective, design the study, collection of data, analysis and interpretation. Preparation of research report: preparation

of dissertation - IMRAD system - preliminary pages, introduction and review of literature, materials and methods, results, discussion, conclusion and bibliography.

Module 2: Use of Computer in Research (7 hrs)

Introduction to MS - WINDOWS and LINUX, application of MS WORD - word Processing, editing tools (cut, copy, paste), formatting tools. MS EXCEL - creating worksheet, data entry, sorting data. Statistical tools (SUM, MEAN, MEDIAN and MODE). Preparation of graphs and diagrams (Bar diagram, pie chart, line chart, histogram). MS-POWERPOINT - presentation based on a biological topic; inserting tables, charts, pictures. Open source and free alternatives to MS Office: Libre Office, Open Office (brief study). Search engines: Google.com; meta search engine – dogpile.com; academic search - Google scholar. Educational sites related to biological science - Scitable, DNAi.

BIOPHYSICS (Theory 18 hrs; Practical 9 hrs)

Module 3: Introduction (2 hrs)

Introduction to biophysics; branches of biophysics - molecular, cellular, membrane and biomedical instrumentation (scope only).

Module 4: Biophysical Instrumentation (16 hrs)

Principle, working and applications of the following:
Microscopy: compound microscope, phase-contrast microscope and electron microscope – SEM. Colorimeter, Spectrophotometer. Centrifuge: ultracentrifuge. Chromatography: paper, thin layer and column. Electrophoresis, PAGE. pH meter. Haemocytometer.

BIOSTATISTICS (Theory 18 hrs; Practical 18 hrs)

Module 5: Statistical Tools and Techniques

Introduction, statistical terms and symbols (Brief study only). Sampling: concept of sample, sampling methods - random and non-random sampling. Collection and representation of data: diagrammatic and graphic representation - line diagram, bar diagram, pie diagram, histogram, frequency curve. Measures of central tendency: mean, median, mode, (discrete and continuous series). Measures of dispersion: standard deviation. Distribution patterns: normal distribution, binomial distribution. Tests of significance: Chi-squire test - uses, procedure.

SEMESTER V

CORE COURSE

BO5B07B18: PLANT PHYSIOLOGY AND BIOCHEMISTRY

Credits – 3

Total Hours: 54 hrs

Course Outcomes:

CO1: Recognize the various physiological and biochemical processes in plants.

CO2: Explain the structure and significance of the bio molecules and physiological mechanisms associated with plant life.

CO3: Apply the theoretical and practical aspects of physiological and biochemical processes in plant growth and development.

CO4: Evaluate the mechanism of action of biomolecules in relation to plant physiology and biochemistry

Mapping of Course Outcomes with Programme Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	2	2	1	2
CO2	1	2	2	1	2
CO3	2	2	2	1	3
CO4	1	1	2	1	3

Syllabus Content

PLANT PHYSIOLOGY (Theory 36 hrs; Practical 27 hrs)

Module 1: Water Relations and Mineral Nutrition (9 hrs)

Plant water relations - diffusion, imbibition, osmosis, OP, DPD, TP; water potential - concepts and components (pressure potential, gravity potential, osmotic potential and matric potential). Absorption of water - active and passive, pathway of water movement - apoplastic and symplastic

pathway. Ascent of sap - cohesion-tension theory. Transpiration - types, mechanism, theories (Starch-sugar, Proton-K+ ion exchange), significance; antitranspirants. Guttation.

Mineral nutrition: Role of major and minor elements in plant nutrition, deficiency symptoms of essential nutrients; mineral uptake - passive (ion exchange) and active (carrier concept).

Module 2: Plant Metabolism (20 hrs)

Photosynthesis: Photosynthetic pigments, photo excitation - fluorescence, phosphorescence; red drop and Emerson enhancement effect. Photosystems - components and organization; cyclic and non-cyclic photophosphorylation; carbon assimilation pathways - C3, C4 plants - kranz anatomy, CAM. Photorespiration. Factors affecting photosynthesis – Blackmann's law of limiting factors.

Translocation of solutes: Pathway of phloem transport, mechanism - pressure flow, mass flow hypothesis; phloem loading and unloading.

Respiration: Respiration: anaerobic and aerobic; glycolysis, Kreb's cycle, mitochondrial electron transport system- components, oxidative phosphorylation, ATPase, chemiosmotic hypothesis. RQ - significance. Factors affecting respiration.

Module 3: Plant Growth and Development and Stress Physiology (7 hrs)

Plant hormones: their physiological effect and practical applications - auxins, gibberellins, cytokinins, ABA, and ethylene. Plant movements: tropic movements - geotropism and phototropism; nastic movements - seismonastic and nyctinastic movements. Physiology of flowering - phytochrome, photoperiodism, vernalization.

Stress physiology: Concepts of plant responses to abiotic stresses (water, salt, temperature), biotic stress (pathogens). Allelopathy.

BIOCHEMISTRY (Theory 18 hrs; Practical 18 hrs)

Module 4: Water (3 hrs)

Physical and chemical properties of water, acids and bases; pH - definition, significance; measurement of pH – colorimetric, electrometric (brief study only). Buffers: buffer action, uses of buffers.

Module 5: Plant Biomolecules (15 hrs)

Carbohydrates: General structure and functions; classification - mono (glucose and fructose), di (maltose and sucrose) and polysaccharides (starch and cellulose).

Proteins: General structure and classification of amino acids - peptide bond; structural levels of

proteins - primary, secondary, tertiary and quaternary; functions of proteins.

Lipids: General features and roles of lipids, types of lipids; fatty acids - saturated and unsaturated; fatty acid derivatives - fats and oils; compound lipids (brief study only).

Enzymes: Classification and nomenclature, mechanism of action. Enzyme kinetics, Michaelis-Menten constant (brief study only). Regulation of enzyme action. Factors affecting enzyme action.

SEMESTER V

CORE COURSE

BO5B08B18: ANATOMY, REPRODUCTIVE BOTANY AND MICROTECHNIQUE

Credits – 3

Total Hours: 54 hrs

Course Outcomes:

CO1: Explain the anatomical organization of plants.

CO2: Determine plant/wood identity based on anatomical features.

CO3: Explain the structure of plant reproductive parts and events of plant reproduction.

CO4: Execute microtechniques for preservation and microscopic study of plants.

Mapping of Course Outcomes with Programme Specific Outcomes

Mapping	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	2	1	2	1	2
CO2	1	1	3	2	3
CO3	2	1	2	1	2
CO4	1	3	1	1	2

Syllabus Content

ANATOMY (Theory: 27 hrs. Practical: 18 hrs)

Module 1: Structure and Composition of Plant Cells and Organization of Tissues (17 hrs)

Cell wall: structure of cell wall; sub-microscopic structure - cellulose, micelle, micro fibril and macro fibril; structure and function of plasmodesmata, simple and bordered pits; different types of cell wall thickening in treachery elements; extra cell wall thickening materials. Growth of cell wall - apposition, intussusception. Non-living inclusions in plant cells: food products, secretory products, excretory (waste) products - nitrogenous and non-nitrogenous.

Tissues: meristematic tissue – characteristic features, functions and classification. Theories on apical organization - Apical cell theory, Histogen theory, Tunica-Corpus theory. Permanent tissues - structure and function of simple and complex tissues. Secretory tissues: external secretory tissue - glands and nectaries; internal secretory tissues - laticifers.

Tissue systems: epidermal tissue system - epidermis, cuticle, trichome; stomata – structure, types; bulliform cells. Ground tissue system - cortex, endodermis, pericycle, pith and pith rays. Vascular tissue system - structure of xylem and phloem, different types of vascular bundles and their arrangement in root and stem.

Module 2: Plant Body Structure and Wood Anatomy (10 hrs)

Primary structure of stem, root and leaf (dicot and monocot). Normal secondary growth in dicot stem and root. Periderm: structure and development - phellum, phellogen, phelloderm, bark, and lenticels. Anomalous secondary thickening: *Bignonia* stem, *Boerhaavia* stem and *Dracaena* stem **Wood Anatomy**: Basic structure of wood; heart wood, sap wood; hard wood and soft wood; dendrochronology; growth rings; porous and non- porous wood; ring porous wood and reaction wood; tension wood and compression wood

REPRODUCTIVE BOTANY (Theory 18 hrs; Practical 9 hrs)

Module 3: Introduction and Gametophyte Development (12 hrs)

Introduction to embryology, floral morphology - parts of flower.

Microsporangium and Male Gametophyte: Microsporangium: structure and development of anther, microsporogenesis, dehiscence of anther, structure of pollen. Male gametophyte development.

Megasporangium and Female Gametophyte: Megasporangium: types of ovules – anatropous, orthotropous, amphitropous, campylotropous, circinotropous. Megasporogenesis – female gametophyte – structure of a typical embryosac, types of embryosacs - monosporic (*Polygonum* type), bisporic (*Allium* type) and tetrasporic (*Peperomia* type).

Module 4: Fertilization, Endosperm and Embryo (6 hrs)

Mechanism of pollination, agents of pollination, germination of pollen grains; double fertilization.

Endosperm and Embryo: Endosperm: types – cellular, nuclear and helobial. Embryogeny, structure of dicot and monocot embryo, seed formation. Polyembryony.

MICROTECHNIQUE (Theory 9 hrs; Practical 9 hrs)

Module 5: Preservation of Plant Specimens, Sectioning and Mounting (9 hrs)

Introduction to microtechnique: killing and fixing - purpose. Dehydration - purpose, agents used - ethyl alcohol. Sectioning: hand sections, serial section; Microtome - rotary, sledge (application only). Staining technique: principle of staining; stains - hematoxylin, fast green, acetocarmine; vital stains - neutral red, Evans blue; mordants - purpose with examples. Types of staining - single staining, double staining. Mounting and mounting media – purpose, mounting media - glycerine, DPX, Canada balsam. Use of permanent whole mounts; permanent sections; maceration, smear and squash preparation.

SEMESTER V

OPEN COURSE 1

BO5D01aB18: HORTICULTURE AND NURSERY MANAGEMENT

Credits – 3

Total Hours: 54 hrs

Course Outcomes:

CO1: Identify the different garden tools and implements.

CO2: Explain soil characteristics and irrigation methods.

CO3: Establish commercial scale production units for processing and marketing of plant and plant products.

CO4: Design gardens to suit the requirements of stakeholders.

Syllabus Content

HORTICULTURE (48 hrs)

Module 1: Introduction (10 hrs)

Introduction to Horticulture: Definition, history; classification of horticultural plants, disciplines of horticulture. Soil: formation, composition, types, texture, pH and conductivity. Garden tools and implements. Preparation of nursery bed; manures and fertilizers - farm yard manure, compost, vermicompost, biofertilizers; chemical fertilizers - NPK; time and application of manures and fertilizers, foliar spray. Irrigation methods - surface, sub, drip and spray irrigations - advantages and disadvantages - periodicity of irrigation.

Module 2: Propagation of Plants (10 hrs)

Propagation of horticultural plants - by seeds; seed development and viability, seed dormancy, seed health, seed testing and certification. Growing seedlings in indoor containers and field nurseries, seed bed preparation, seedling transplanting; advantages and disadvantages of seed propagation.

Vegetative propagation - organs used in propagation - natural and artificial vegetative propagation; methods - cutting, layering, grafting and budding; advantages and disadvantages of vegetative propagation; micropropagation.

Module 3: Gardening (24 hrs)

Gardening - Ornamental gardens, indoor gardens, kitchen gardens - terrestrial and aquatic gardens - garden adornments; garden designing; garden components - lawns, shrubs and trees, borders, hedges, edges, drives, walks, topiary, trophy, rockery; Famous gardens of India. Landscape architecture - home landscape design, urban planning, parks, landscaping and public buildings, industrial and highway landscaping. Bonsai - physical control of plant growth - training and pruning - selection of plant, bonsai containers and method of bonsai formation.

Floriculture: Introduction, commercial floriculture - jasmine, orchid, anthurium, rose, gladiolus; production of cut flowers, quality maintenance, packing, marketing. Flower arrangements - basic styles - upright and slanting. Japanese ikebana, dry flower arrangement.

Olericulture: Olericulture - types of vegetable growing - home gardens and market gardens; cultivation practices of leafy vegetable (Amarathus), tuber (Potato), fruit (Tomato), flower (Cauliflower).

Pomology: Pomology - cultivation of fruit crops - mango, banana and pine apple - preparation of land, spacing, planting, irrigation, hormones, harvest and storage. Factors affecting duration of storage. Principles of preservation - temporary and permanent - agents for fruit preservation. Preparation of pickles, jams, jellies and squashes using locally available fruits.

Module 4: Gardening – Additional Features (4 hrs)

Garden friends - honey bees, ladybirds, frogs, spiders, earthworms, centipedes and millipedes. Garden foes - pests, pathogenic fungi, bacteria, virus. Control measures - pesticides and fungicides; neem tobacco decoction. Hazards of chemical pesticides; equipment used in controlling horticultural pests - sprayers, dusting equipment - sterilization, fumigation. Weeds - annual, perennial; weed control - prevention, eradication - hand weeding, tillage, burning, mowing, biological control, use of herbicides - selective and non-selective - mechanisms involved in herbicidal actions.

NURSERY MANAGEMENT (6 hrs)

Module 5: Nurseries (6 hrs)

Nursery: definition, types; management strategies - planning, layout, budgeting - production unit, sales unit. Plant growing structures - green houses, fernery, orchidarium, arbetorium.

ON HAND TRAINING (18 hrs)

1. Preparation of potting mixture of known combination and potting in earthern pots/polybags.
2. Preparation of nursery beds.
3. Preparation of compost/vermicompost using different substrates.
4. Working knowledge and identification of garden tools and implements.
5. Practical knowledge in different plant propagation techniques listed in syllabus.
6. Cultivation of a vegetable/ornamental plant/fruit crop listed in the syllabus.
7. Practice of different pruning operations (top dressing, shaping and topiary).
8. Visit a well-established nursery and submit report.

SEMESTER V

OPEN COURSE 2

BO5D01bB18 - AGRIBASED MICROENTERPRISES

Credits – 3
Total Hours: 54 hrs

Course Outcomes:

CO1: Identify the different organic farming and composting.

CO2: Explain the different horticultural and nursery management methods.

CO3: Practice the different propagation and culture practices of horticultural plants.

CO4: Practice the different tissue culture techniques.

Syllabus Content

Module 1: Organic Farming and Composting Techniques (9 hrs)

Advantages of organic manures and fertilizers. Composition of fertilizers – NPK content of various fertilizers. Common organic manures – bone meal, cow dung, poultry waste, oil cakes, organic mixtures and compost. Preparation of compost - aerobic and anaerobic - advantages of both; vermicompost - preparation, vermiwash. Biofertilizers: definition, types – *Trichoderma*, *Rhizobium*, PGPR. Biopesticides – Tobacco and Neem decoction. Biological control.

Module 2: Horticulture and Nursery Management (18 hrs)

Soil components. Preparation of potting mixture. Common Garden tools and implements. Methods of plant propagation - by seeds - advantages and disadvantages. Vegetative propagation - advantages and disadvantages. Natural methods of vegetative propagation. Artificial methods - cutting, grafting, budding and layering. Use of growth regulators for rooting. Gardening - types of garden - ornamental, indoor garden, kitchen garden, vegetable garden for marketing.

Module 3: Food Spoilage and Preservation Techniques (9 hrs)

Causes of spoilage. Preservation techniques - asepsis, removal of microorganisms, anaerobic conditions and special methods – by drying, by heat treatment, by low temperature storage and by chemicals (Food Additives). Preparation of wine, vinegar and dairy products.

Module 4: Mushroom Cultivation and Spawn Production (9 hrs)

Types of mushrooms - button mushroom, oyster mushroom and milky mushroom, poisonous mushroom – methods of identification. Spawn – isolation and preparation. Cultivation milky mushrooms – using paddy straw and saw dust by polybag. Value added products from

mushroom – pickles, candies, dried mushrooms.

Module 5: Plant Tissue Culture and Micropropagation (9 hrs)

Concept of totipotency. Micropropagation: different methods – shoot tip, axillary bud and meristem culture; organogenesis, somatic embryogenesis. Infra structure of a tissue culture laboratory. Solid and liquid media - composition and preparation. Sterilization techniques. Explant - inoculation and incubation techniques. Stages of micropropagation – hardening and transplantation. Packaging and transportation of tissue culture regenerated plantlets.

SEMESTER V

OPEN COURSE 3

BO5D01cB18 - ECOTOURISM

Credits – 3
Total Hours: 54 hrs

Course Outcomes:

CO1: Explain the principles, context and practice of ecotourism

CO2: Analyze the key issues related to sustainable use of ecotourism destinations

CO3: Apply planning and management frameworks for developing recreation opportunities on a site, community, and landscape level

CO4: Plan for sustainable recreation facilities and services that result in positive outcomes for visitors, local communities, economies, and the environment

Module 1: Principles and Components of Ecotourism (30 hrs)

Introduction: Definition, concept, introduction, history, relevance and scope.
Key principles and characteristics of ecotourism: Nature area focus, interpretation, environmental sustainability practice, contribution to conservation, benefiting local communities, cultural respect, customer satisfaction, responsible marketing.
Components of Ecotourism: Travel, tourism industry, biodiversity, local people, cultural diversity, resources, environmental awareness, interpretation, stake holders, capacity building in ecotourism.
Ecotourism terms: Adventure tourism, certification, commercialization chain, cultural tourism, canopy walkway, conservation enterprises, ecosystem, ecotourism activities, ecotourism product, ecotourism resources, ecotourism services, endemism, ecolabelling, ecotourism "lite", geotourism, green washing, stakeholders, sustainable development, sustainable tourism, leakages.

Module 2: Ecotourism Resources in India and Kerala (14 hrs)

Major ecosystems vegetation types and tourism areas in Kerala. Festivals and events, entertainment, overview, culture, famous destinations, sightseeing, historical monuments, museums, temples, national parks & wildlife sanctuaries, hill stations, waterfalls, rivers, wildlife watching and bird watching sites, agricultural sites, tribal areas, tribal museums, tribal arts, rural handicrafts, tribal medicines, archeological sites, adventure sports, sacred groves, mountains, etc.

Module 3: Forms of Ecotourism in India and Kerala (8 hrs)

Eco regions, eco places, waterfalls in Kerala and India, eco travel, dos and don'ts on eco travel, ecotrips. Potential of ecotourism in Kerala. Community based ecotourism, ecotourism and NGOs.

Module 4: Ecotourism Planning (16 hrs)

Background, objectives, strategy, design of activities, target groups, opportunities, capacity building, threats, expectations positive and negative impacts, strength and weakness, benefits and beneficiaries, stakeholders, linkages, economics, ecotourism auditing. Problems with ecotourism. Carrying capacity of ecotourism. ecotourism facilities – Green report card. Ecotourism management – issues.

Module 5: Ecotourism and Livelihood Security (4 hrs)

Community, biodiversity conservation and development – Eco-development committees.

SEMESTER VI

Course Code	Course Title	Credits	Course Type
BO6B09B18	Genetics, Plant Breeding and Horticulture	3	Core Course
BO6B10B18	Cell and Molecular Biology	3	Core Course
BO6B11B18	Angiosperm Morphology, Taxonomy and Economic Botany	3	Core Course
BO6B12B18	Biotechnology and Bioinformatics	3	Core Course
BO6B13aB18	Phytochemistry and Pharmacognosy	3	Choice based course
BO6B13bB18	Agribusiness		
BO6B13cB18	Plant Genetic Resources Management		
BO6BP03B18	Anatomy, Reproductive Botany, Microtechnique, Research Methodology, Biophysics and Biostatistics	2	Core Course
BO6BP04B18	Plant Physiology, Biochemistry, Environmental Sciences and Human Rights	2	Core Course
BO6BP05B18	Genetics, Plant Breeding, Horticulture Cell and Molecular Biology	2	Core Course
BO6BP06B18	Angiosperm Morphology, Taxonomy, Economic Botany, Biotechnology and Bioinformatics	2	Core Course
BO6BPRB18	Project	2	Core Course

SEMESTER VI

CORE COURSE

BO6B09B18: GENETICS, PLANT BREEDING AND HORTICULTURE

Credits – 3

Total Hours: 54

Course Outcomes:

CO1: Discuss the character inheritance with the aid of principles of Genetics

CO2: Describe the Mendelian principles which laid the foundation for Genetics as a science.

CO3: Interpret the various plant breeding techniques for varietal improvement of plants.

CO4: Explain the various techniques of plant propagation and gardening

Mapping of Course Outcomes with Programme Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	1	2	1	2
CO2	2	1	2	1	2
CO3	2	1	1	1	3
CO4	1	1	1	2	3

Syllabus Content

GENETICS

Module 1: Origin and Development of Genetics (13 hrs)

Genetics as a Science: Origin - Experiments of Mendel with *Pisum sativum*, general terminology used in genetics. Principles of inheritance, Mendelian laws - monohybrid and dihybrid cross, test cross and backcross.

Exceptions to Mendelism -Modification of Mendelian ratios: incomplete dominance - *Mirabilis*; Co-dominance - MN blood group in man; Lethal genes – pigmentation in Snapdragon..

Geneic Interaction: Epistasis, (a) Dominant - fruit colour in summer squashes (b) Recessive - coat colour in mice; Complementary genes - flower colour in sweet pea. Non-epistasis - comb pattern in Fowls. Multiple alleles – ABO blood groups in man; self-sterility in *Nicotiana*.

Module 2: Mechanisms of Inheritance (14 hrs)

Linkage of Genes- Linkage and crossing over: chromosome theory of linkage; crossing over - types of crossing over, mechanism of crossing over. Linkage map - 2-point cross, interference and coincidence.

Determination of Sex: sex chromosomes and autosomes; chromosomal basis of sex determination; XX- XY, XX-XO mechanism; sex determination in higher plants (*Melandrium album*). Sex linked inheritance: X-linked - Morgan's experment e.g. eye colour in *Dorsophila*, Haemophilia in man; Y- linked inheritance; sex limited and sex influenced inheritance. Pedigree analysis.

Quantitative Inheritance: Quantitative characters: polygenic inheritance, continuous variation - kernel color in wheat, ear size in maize**.**

Extra-Chromosomal Inheritance: chloroplast mutation - variegation in 4O'clock plant; mitochondrial mutations in yeast. Maternal effects - shell coiling in snail; infective heredity - kappa particles in *Paramecium*.

Population Genetics- Concept of population, gene pool, Hardy-Weinberg principle (brief).

PLANT BREEDING

Module 3: Plant Breeding and Techniques for Plant Improvement (13 hrs)

Introduction and objectives of plant breeding. Plant breeding centers in Kerala, their achievements – CPCRI, CTCRI, RRII.

Plant Introduction-Plant introduction: domestication - centers of origin - procedure of plant introduction - quarantine regulations, acclimatization, agencies of plant introduction in India, major achievements.

Selection- Plant Selection: mass, pure-line and clonal.

Hybridization- types, procedure, important achievements. Heterosis in plant breeding, inbreeding depression, genetics of heterosis and inbreeding depression. Handling segregating generation - pedigree method, bulk method, back cross method. Disease resistance breeding.

Mutation Breeding and Polyploidy Breeding-Mutation breeding: methods, applications and important achievements. Polyploidy breeding: methods and applications.

Tissue Culture as Method in Plant Breeding-Application of meristem culture, embryo culture and pollen culture in plant breeding. Role of tissue culture in the creation of transgenic plants.

HORTICULTURE

Module 4: Introduction to Horticulture and Plant Propagation Techniques (8 hrs)

Introduction to Horticulture - definition, history. Classification of horticultural plants. Disciplines of horticulture - pomiculture, olericulture, floriculture, arboriculture.

Garden implements - budding knife, secateurs, hedge shear, hand cultivator, sprayers, lawn mower, garden rake and spade.

Irrigation methods: surface, sub, drip and spray irrigations; mist chambers - advantages and disadvantages.

Plant Propagation: Seed propagation: seed testing and certification, seed bed preparation, seedling transplanting, hardening of seedling; advantages and disadvantages of seed propagation. Vegetative propagation: natural and artificial; artificial methods - cutting, layering, grafting and budding, micro-propagation; advantages and disadvantages of vegetative propagation.

Module 5: Gardening (6 hrs)

Types of garden: brief study on ornamental garden, indoor garden, kitchen garden, aquatic garden, vertical garden, medicinal garden, terrace garden, terrarium.

Garden designing: garden components - lawns, shrubs and trees, borders, topiary, hedges, edges, walks, drives.

Physical control of plant growth: training and pruning. Bonsai - selection of plant - bonsai containers and method of bonsai formation.

Plant growing structures: green house, orchidarium, conservatory; Potting mixture – components.

SEMESTER VI
CORE COURSE
BO6B10B18: CELL AND MOLECULAR BIOLOGY

Credits – 3

Total Hours: 54

Course Outcomes:

CO1: Discuss the morphological and ultrastructural features of the cell and cell organelles

CO2: Explain the cell growth and pattern of division in cell

CO3: Analyse the structure of genetic material, chromosome aberrations and mutations and replication of DNA

CO4: Analyse the gene expression, regulations and genetics of cancer

Mapping of Course Outcomes with Programme Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	1	2	1	2
CO2	1	1	1	1	3
CO3	1	1	2	1	3
CO4	1	1	2	1	3

Syllabus Content

CELL BIOLOGY

Module 1: Ultra Structure of Cell Components (14 hrs)

Cell biology through ages: A brief history of cell biology. Cytosol - chemical composition. Composition, structure and function of plasma membrane - fluid mosaic model.

The ultra-structure of a plant cell with structure and function of the following organelles and membrane structures: Endoplasmic reticulum, chloroplasts, Mitochondria, Ribosomes, Dictyosomes, Microbodies - peroxisomes and glyoxisomes, lysosomes and vacuole. Cytoskeleton - microtubules and microfilaments.

Ultrastructure of nucleus: nuclear envelope - detailed structure of pore complex, nucleoplasm - composition, nucleolus.

Chromosomes: Chromosomes: introduction, chromosome number, autosomes and allosomes, morphology - metacentric, submetacentric, acrocentric and telocentric. Structure - chromatid, chromonema, chromomere, centromere and kinetochore, telomere, secondary constriction and

nucleolar organizer. Chromatin fibres: heterochromatin and euchromatin. Karyotype and ideogram. Chemical composition of chromatin: histones and non-histones, arrangement of proteins and DNA in chromatin - the 10 nm fibre (nucleosome model), 30 nm fibre (solenoid model) and central axis with radial loops of 300 nm fibre.

Special type of chromosomes: giant chromosomes (salivary gland chromosomes, Lamp brush chromosomes), supernumerary chromosomes (B chromosome).

Module 2: Cell Division (6 hrs)

Cell cycle - definition, different stages – interphase (G1, S and G2) and division phase. Mitosis: karyokinesis and cytokinesis, significance of mitosis. Meiosis: stages - first meiotic division (reduction division) and second meiotic (equational division), structure and function of synaptonemal complex, significance of meiosis; comparison of mitosis and meiosis.

Module 3: Chromosomal Aberrations and Mutations (7 hrs)

Numerical: heteroploidy; euploidy – haploidy; polyploidy – autopolyploidy, allopolyploidy (*Raphanobrassica*); aneuploidy - monosomy, trisomy (Fruit morphology in Datura), nullisomy (*Triticum*). Numerical chromosomal abnormalities in man: Down's syndrome, Klinefelter's syndrome, Turner's syndrome.

Structural: deletion (Cri-du-chat syndrome), duplication (Bar eye in Drosophila), inversions (paracentric and pericentric) and Translocations (Robertsonian translocation).

Mutation: Mutation: definition, importance. Types of mutations: somaticand germinal; spontaneous and induced; chromosomal and gene or point mutations. Molecular basis of mutation: frame shift, transition, transversion and substitution. Mechanism of mutation induction: base replacement, base alteration, base damage, errors in DNA replication. Mutagens: physical - non-ionizing and ionizing radiations; chemical - base analogs, alkylating agents, deaminating agents.

MOLECULAR BIOLOGY

Module 4: The Genetic Material and Replication of DNA (12 hrs)

Molecular biology: A brief historical prelude. Identification of DNA as genetic material: direct evidences – transformation experiment by Avery *et al.*; Hershey and Chase Experiment. Evidences for RNA as genetic material in some viruses.

Nucleic acids: DNA and RNA, important features of Watson and Crick model of DNA; Chargaff's rule. Alternate forms of DNA - comparison of A, B and Z forms. Structure and function of different types of RNA - tRNA, mRNA, rRNA, snRNA, miRNA.

Replication of DNA: Semiconservative replication of DNA - Messelson and Stahl's experiment; process of semiconservative replication with reference to the enzymes involved in each step.

Module 5: Gene Expression and Regulation (15 hrs)

Gene expression: Concept of gene, split genes, one gene one enzyme hypothesis, one gene one polypeptide hypothesis, the central dogma, reverse transcription. Details of transcription in prokaryotes and eukaryotes; hnRNA, splicing, release of mRNA. Translation - initiation, elongation and termination. Genetic code and its features, wobble hypothesis.

Regulation of gene expression: Regulation of gene expression in prokaryotes: operon concept, inducible and repressible systems, negative control and positive control. Lac operon, catabolic repression. Tryptophan operon, attenuation. Regulation in eucaryotes (brief account only).

Genetics of cancer: Genetic basis of cancer – brief description of proto-oncogenes and oncogenes, tumour suppressor genes; characteristics of cancer cells.

SEMESTER VI

CORE COURSE

BO6B11B18: ANGIOSPERM MORPHOLOGY, TAXONOMY AND ECONOMIC BOTANY

Credits – 3

Total Hours: 72

Course Outcomes:

CO1: Deduce the morphological characters of plants vital in classification.
CO2: Explain the concepts underlying the principles of plant systematics in plant classification and nomenclature.
CO3: Analyze morphological characters of plants to correctly identify them according to the Bentham and Hooker system of classification.
CO4: Explain the botanical details and uses of plants of economic and ethnobotanical significance.

Mapping of Course Outcomes with Programme Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	2	2	3
CO2	2	2	2	3	2
CO3	3	1	2	2	3
CO4	2	1	2	2	2

Syllabus Content

ANGIOSPERM MORPHOLOGY

Module 1: Leaf, Inflorescence and Fruit Morphology (19 hrs)

Leaf Morphology: types, venation, phyllotaxy. Morphology of flower: flower as modified shoot; detailed structure of flowers - floral parts - their arrangement, relative position - symmetry, aestivation and placentation types - cohesion and adhesion. Floral diagram and floral formula. Inflorescence: racemose types - simple raceme, corymb, umbel, spike, spadix, head and catkin; cymose types - simple cyme; monochasial - scorpoid and helicoid, dichasial and polychasial; special type - cyathium, hypanthodium, verticillaster, thyrsus and panicle. Fruits: simple - fleshy, dry - dehiscent, schizocarpic, indehiscent, aggregate, multiple (sorosis and syconus).

TAXONOMY

Module 2: Principles of Plant Systematics (12 hrs)

Aim, scope, significance and components of taxonomy. Types of classification - artificial (brief account), natural – Bentham and Hooker (Detailed account) and Phylogenetic (Brief account). Angiosperm phylogeny group system (introduction only). Plant nomenclature - binomial, ICBN/ICN principles - rule of priority and author citation. Interdisciplinary approach in taxonomy - Cytotaxonomy and Chemotaxonomy. Herbarium technique – importance of herbarium; preparation of herbarium and their preservation. Important herbaria in India, BSI.

Module 3: Detailed Study of Families (30 hrs)

Study the following families of Bentham and Hooker's System with special reference to their vegetative and floral characters; special attention should be given to common and economically important plants within the families: Annonaceae, Nymphaeaceae, Malvaceae, Rutaceae, Anacardiaceae, Leguminosae (Mimosaceae, Caesalpiniaceae and Fabaceae), Combretaceae, Myrtaceae, Cucurbitaceae, Umbelliferae (Apiaceae), Rubiaceae, Compositae (Asteraceae), Sapotaceae, Apocynaceae, Asclepiadaceae, Solanaceae, Convolvulaceae, Scrophulariaceae, Acanthaceae, Verbenaceae, Labiatae (Lamiaceae), Amaranthaceae, Euphorbiaceae, Orchidaceae, Palmae (Arecaceae), Graminae (Poaceae).

ECONOMIC BOTANY

Module 4: Economic Botany (6 hrs)

Study the following groups of plants with special reference to the botanical name, family and morphology of the useful part and uses: Cereals - Rice, Wheat; Millets Ragi; Pulses - Green gram, Bengal gram, Black gram; Sugar yielding plants – Sugarcane; Fruits - Apple, Pineapple, Orange, Mango and Banana; Vegetables - Bittergourd, Ladies finger, Carrot and Cabbage; Tuber crops - Tapioca; Beverages - Tea, Coffee; Oil yielding plants - Ground nut, Coconut, Gingelly; Spices – Cardamom, Pepper, Cloves, Ginger; Timber yielding plants - Teak wood and Rose wood; Fibre yielding plants - Coir, Jute, Cotton; Rubber yielding plants - Para rubber; Gums and Resins - White damer, Gum Arabic, Asafoetida; Insecticide yielding Plants - Tobacco and Neem.

Module 5: Ethnobotany (5 hrs)

Introduction, scope and significance of ethnobotany. Study of the following plants used in daily life by tribals and village folks for food, shelter and medicine: Food – *Artocarpus heterophylla*, *Corypha*; Shelter - *Bambusa*, *Ochlandra* and *Calamus*; Medicine – *Curcuma longa*, *Trichopus zeylanicus* and *Alpinia galanga.*

SEMESTER VI

CORE COURSE

BO6B12B18: BIOTECHNOLOGY AND BIOINFORMATICS

Credits – 3

Total Hours: 54

Course Outcomes:

CO1: Discuss the isolation and manipulation of DNA

CO2: Explain the techniques of biology to develop new products

CO3: Practice techniques in plant tissue culture and aseptic techniques in tissue culture

CO4: Apply the various softwares in storing and processing of biological data

Mapping of Course Outcomes with Programme Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	2	2	2	2
CO2	2	2	2	3	2
CO3	1	2	2	2	3
CO4	1	1	2	2	3

Syllabus Content

BIOTECHNOLOGY

Module 1: Plant Tissue Culture (20 hrs)

Plant tissue culture: The concept of biotechnology, landmarks in biotechnology; Plant tissue culture – Basic concepts, Cellular totipotency, *in vitro* differentiation – dedifferentiation and redifferentiation. Tissue culture medium – basic components in tissue culture medium – solid and liquid medium – suspension culture. Murashige and Skoog medium – composition and preparation. Aseptic techniques in tissue culture – sterilization – different methods – sterilization of instruments and glass wares, medium, explants, working principle of laminar air flow and autoclave; preparation of explants – surface sterilization.

Applications of Plant Tissue Culture: Micropropagation, methods - axillary bud proliferation, adventitious regeneration – shoot organogenesis and somatic embryogenesis - direct and indirect; meristem culture. Stages of micropropagation, hardening and

transplantation. Advantages and disadvantages of micropropagation somaclonal variations. Embryo culture, callus and cell suspension culture, *in vitro* production of haploids - anther and pollen culture; uses of haploids. Protoplast culture: isolation of protoplast, culture methods, applications; protoplast fusion - cybrids. Artificial seeds, advantages and disadvantages. *In vitro* production of secondary metabolites; cell immobilization, bioreactors- Stirred tank bioreactor (brief study only).

Module 2: Recombinant DNA Technology and its Applications (11 hrs)

Recombinant DNA technology: Steps in recombinant DNA construction – cloning vectors – plasmids pBR322, M13, bacteriophage-based vectors, Ti plasmids, YAC, BAC. Restriction enzymes- exonucleases, endonuclease. Ligases – ligation mechanism, transformation and selection of transformants – using antibiotic resistances markers. Different methods of gene transfer – chemically stimulated DNA uptake by protoplast, transduction, electroporation, microinjection, microprojectiles, Agrobacterium mediated gene transfer, gene library, gene banks.

DNA isolation, agarose gel electrophoresis, southern hybridization, autoradiography. DNA finger printing and its applications. PCR and its applications. DNA sequencing by Sanger's dideoxy method. Uses of refrigerated centrifuges, UV trans-illuminator, gel documentation system and Laminar Air Flow chamber (brief account only).

MODULE 3: Application of Biotechnology (5 hrs)

Achievements of recombinant DNA technology: in medicine (Human insulin and gene therapy); in agriculture – Bt cotton; in environmental cleaning - super bugs.

BIOINFORMATICS

MODULE 4: Basic Bioinformatics (7 hrs)

An introduction to bioinformatics, objectives and applications of bioinformatics. Biological data bases: types - primary, secondary and composite databases; nucleotide sequence databases – NCBI (GenBank), EMBL-ENA, DDBJ; Protein Sequence databases - SWISS-PROT, PIR; Protein structure database – PDB; bibliographic database – PubMed.

MODULE 5: Sequence Analysis and Molecular Phylogeny (11 hrs)

Sequence analysis tools - BLAST and FASTA, Molecular visualization tool - RASMOL (basic commands), Sequence alignment - Scoring matrices, global and local alignment, Pairwise and multiple sequence alignment; common software used in alignment - CLUSTAL W & CLUSTAL X (Brief account only). Molecular phylogeny - homologs, orthologs and paralogs;

phylogenetic tree - rooted and unrooted tree, advantages of phylogenetic tree, use of PHYLIP

software (Brief account only).

Genomics: A brief account on genomics and proteomics; major findings of the following genome projects – *E. coli*, Human, *Arabidopsis thaliana.*

SEMESTER VI

CHOICE BASED CORE COURSE

BO6B13aB18: PHYTOCHEMISTRY AND PHARMACOGNOSY

Credits – 3

Total Hours: 54

Course Outcomes:

CO1: Explain the various phytochemical approaches in the study of crude drugs and aromatic plants.

CO2: Analyse the various methods of extraction of phytochemicals.

CO3: Discuss the role of selected medicinal plants as a source of valuable phytochemicals important in modern and traditional medicine.

CO4: Explain the methods of drug evaluation to identify adulteration.

Mapping of Course Outcomes with Programme Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	2	1	1	2
CO2	1	3	2	1	3
CO3	1	2	2	3	2
CO4	1	2	2	2	2

Syllabus Content

PHYTOCHEMISTRY

Module 1: Introduction (2 hrs)

Introduction to phytochemical approaches: morphological, organoleptic, microscopic - to study drug and aromatic plants. Definition of Ayurvedic medicinal plants.

Module 2: Extraction of Phytochemicals and Study of the Active Principles (14 hrs)

Extraction and characterization techniques: cold extraction, hot extraction - Soxhlet-

Clevenger apparatus; Solvents - petroleum ether, chloroform, ethanol, water. Separation techniques –TLC, Column, HPLC, HPTLC, GC. Characterization techniques - MS, UV Spectra, IR Spectra.

Study of the Active Principles- Alkaloids - introduction, properties, occurrence, structure, classification, functions, and pharmacological uses. Triterpenoids. Introduction, properties, occurrence, classification, functions and pharmacological uses. Phenolics- Quinines – classification- benzoquinones, napthoquinones, anthraquinone and coumarins- properties, occurrence, functions and pharmacological uses.

Module 3: Plants of Importance (20 hrs)

Study of the following plants with special reference to habit, habitat, systematic position, morphology of the useful part, phytochemistry, major pharmacological action and name of any two major ayurvedic formulations - *Tinospora cordifolia, Aegle marmelos, Punica granatum, Adhatoda vasica, Withania somnifera, Sassurea lappa, Asparagus racemosus, Sida acuta, Azadirachta indica, Phyllanthus amarus, Datura stramonium* and *Acorus calamus.* Organoleptic evaluation of the following plants and important chemical test to identify each - *Papaver somniferum, Aloe vera, Ricinus communis, Glycyrrhiza glabra, Acacia catechu, and Curcuma longa.*

Module 4: Aromatic Plants and Their Uses (10 hrs)

Study of the following aromatic plants - volatile oils and methods of extraction *Vetiveria zizanoides, Cinnamomum zeylanicum, Syzygium aromaticum, Santalum album, Eucalyptus globulus, Ocimum basilicum, Rosa, Mentha piperita, Cymbopogon citratus, Cananga odorata, Pelargonium*

PHARMACOGNOSY

Module 5: Pharmocognosy and Ethnomedicine (8 hrs)

Introduction, classification of crude drugs- morphological, chemical and pharmacological. Methods of drug evaluation to identify adulteration; study of starch grains of maize, wheat, rice, potato, arrow root.Traditional plant medicines as a source of new drugs – The process of modern drug discovery using ethnopharmacology – Taxol, Artemisinin, Galathamine and Flavopyridole as examples of drug discovery based on ethnopharmacological approach. Jeevani-Pushpangadan model of benefit sharing.

SEMESTER VI

CHOICE BASED CORE COURSE

BO6C13bB23 - AGRIBUSINESS

Credits: 3

Total Hours: 54

Course Outcomes

CO1: Explain about entrepreneurship and agri business opportunities

CO2: Practice sustainable development and organic farming.

CO3: Assess the opportunities and techniques in the field of processing technology of value-added products and food sciences.

CO4: Explain the cultivation of different plants through horticultural techniques

Mapping of Course Outcomes with Programme Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	1	1	2	3
CO2	1	2	1	2	3
CO3	1	2	2	3	3
CO4	1	2	2	2	3

Syllabus Content

Module 1: Entrepreneurship (2 hrs)

Basic qualities of an Entreprenuer. Financial assistance from Banks, role of Institutions like MSME Training Institute, Khadi and village industries board, self-groups, Co-operative sector, Kudumbasree projects and microentreprises.

Module 2: Value Added Products and Processing Techniques (16 hrs)

Preparation and preservation techniques, causes of spoilage of food. Principles of preservation – asepsis, removal of microorganisms, anaerobic situation and special methods – drying, thermal

processing – pasteurization, sterilization and canning – low temperature, use of chemical preservatives and food additives. Preparation of wine, vinegar, pickles, jam, jelly, syrups, sauce, dry fruits, diary products – cheese, butter, yorghurt, paneer.

Processing techniques: Processing of latex: centrifuged laterx products and galvanized rubber products. Processing, storage and marketing of Cocoa, Coconut (vopra, coir and tender coconut), Rice (par boiled raw rice and rice flour), Pepper, Cardamom, Ginger, Arrowroot, Tapioca, Cashew, Mango, Jack fruit, Guava, Grapes, Lemon, Papaya, Musa, Garcinia.

Module 3: Nursery management, Organic Farming and Composting Techniques (12 hrs)

Prepatation of potting mixtures, polybsgs. Plant growing structures – green houses, shaded houses, polyshed, mist chamber, sprinkling system, drip irrigation. Modern strategie in propagation by root initiation of cutting, layering technique, budding and grafting technique; micropropagation. Planting, transplanting and hardening of seedlings, after care of seedlings. Packing and transport of seedlings.

Organic Farming and Composting Techniques- Organic manures and fertilizers, composition of fertilizers. NPK content of various fertilizers and preparation of fertilizer mixtures. Common organic manures - bone meal, cow dung, poultry waste, oil cakes, organic mixtures and compost. Preparation of compost - aerobic and anaerobic - advantages and limitations. Vermicompost - preparation; Vermiwash - preparation. Biofertilizers - definition and preparation of different types - Trichoderma, Rhizobium, PGPR, PSB, mycorrhiza. Application of biofertilizers. Biopesticides, Tobacco and Neem decoction. Biological control of disease and pests.

Module 4: Cultivation of Vegetables, Fruits, Medicinal Plants, Floriculture, Mushroom Cultivation and Apiculture (16 hrs)

Types - Home gardening, market gardening and truck gardening. Packing and transporting of vegetables. Organic farming of fruit crops - packing and transporting of fruits. Induction of flowering and weed control. Cultivation of medicinal and aromatic plants of common use and great demand.

Floriculture: Problems and prospects of floriculture in Kerala. Scope of growing Anthurium, Orchids and Jasmine in Kerala. Common cut flowers - Rose, Gerbera, Gladiolus, Aster, Chrysanthemum, Anthurium and Orchids. Common leaves used in flower arrangement - Cyprus, Podocarpus, Asparagus, Palms, Cycads and Ferns.

Mushrooms: Significance, nutritive value. Types of Mushrooms – Button – Pleurotus, Volvorella. Spawn production, storage and marketing. Growth of Mushrooms on paddy straw and saw dust by poly bag. Mushroom growing structures and maintenance of humidity. Pests and defects of mushrooms. Storage, transporting and marketing of mushrooms.

Apiculture: Scope and significance. Structure, installation and maintenance of an Apiarium. Extraction, processing, preservation and marketing of honey.

Module 5: Flower Arrangement and Ornamental Garden Designing (8 hrs)

Types - Western, Eastern (Japanese/ Ikebana) and modern. Wases, flower holders and floral foam. Wase life of flowers and leaves. After care of flower arrangements – Bouquets. Packing and maintenance of flowers and leaves.

Ornamental Garden Designing- Garden components. Lawn preparation by seeds, seedling and turfing. Maintenance of garden by Irrigation, Pruning, Repotting. Disease and Pest control.

SEMESTER VI

CHOICE BASED CORE COURSE

BO6B13cB18 - PLANT GENETIC RESOURCES MANAGEMENT

Credits: 3

Total Hours: 54

Course Outcomes:

CO1: Differentiate the role of conservation and sustainable use of plant genetic resources
CO2: Identify the underutilized plants of Kerala as a food source
CO3: Discuss the role and relevance of technology for systematic examination of diversity of life on earth
CO4: Compare practical uses of local flora in human culture

Mapping of Course Outcomes with Programme Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	2	2	2	3
CO2	2	2	2	3	2
CO3	2	2	2	3	2
CO4	3	2	2	3	3

Syllabus Content

Module 1: Introduction (4 hrs)

Introduction - historical developments in crop botany, Centers of origin - Vavilovian concept - primary and secondary centers. Exploration and collection of genetic resources – importance of wild relatives of crop plants and their genetic diversity in cropimprovement.

Module 2: Plant Genetic Resources, Regulations and Rules (14 hrs)

Major threats to the genetic resources: human interference and deforestation, alien invasive plants, over exploitation of resources. Endemism and biodiversity hot spots. Conservation of genetic resources: in situ - biosphere reserves, national parks and wildlife sanctuaries; ex situ - in vivo - botanic gardens, field gene banks; in vitro - seed banks - short term, medium term and long term storage of seeds, tissue culture storage and cryopreservation.

Regulations and rules- Role of Governmental and non-governmental organizations in plant genetic resource management; Governmental organizations - regional – TBGRI and KFRI; national - BSI and NBPGR; International- IPGRI (IBPGR) and ICRISAT; Non-Governmental Organizations - WWF andMNHS.

Module 3: Study of Biodiversity (5 hrs)

Remote sensing: principle, concept of remote sensing and components of remote sensing, application of remote sensing in conservation of endangered plants and habitat studies; IUCN - role and activities. Documentation of endangered and threatened plants - red data book.

Module 4: Ethnobotany and Conservation (4 hrs)

Ethnobotany in relation to conservation of genetic resources: mythology and conservation of ecosystems, sacred groves and their role in the conservation of gene pool; taboos for conservation of selected plant species.

Module 5: Crop plants and Unexploited and Underutilized Plants of Kerala (27 hrs)

Important Crop plants of Kerala - taxonomy and uses and cultivation of, food crops - Rice,Tapioca; Vegetables - Elephant foot yam, Cow pea, Bitter gourd; Spices. Ginger, Black pepper, Nutmeg, Cardamom; Medicinal plants - Vasaka, Aloe; Plantation crops – Rubber,Coffee; cashew, Coconut and Tea; Fruits - Banana, Pineapple and Mango.

Unexploited and Underutilized Plants: Underutilized plants and its importance for future food requirements. Botany and uses of the following under exploited edible plants - Vegetables - Averrhoa bilimbi (Bilimbi, Chemmeenpuli, Irumbampuli), Averrhoa carambola (Carambola apple, Chathurappuli),Dioscorea esculenta (Cherukizhangu, Nanakizhangu),Canavalia gladiate (Sword bean, Valpayar), Psophocarpus tetragonolobus (Winged bean,Chathurapayar), (Sessile joyweed), Sauropus androgynus (Velicheera, Chikurmanis,Sauropus), Ipomoea turbinate (Nithya Vazhuthana); Fruits; Artocarpus heterophyllus (Jack,Plavu, chakka), Artocarpus hirsutus (Anjili, Ayani, Wild jack), Aporosa cardiosperma (Vetti),Spondias pinnata (Ambazham, Hog plum), Syzygium cumini (Njara, Njaval, Black plum),Flacourtia montana (Kattuloovika). Millets - Echinochloa crus-galli (Barnyard grass, Indian BarnyardMillet)

SEMESTER VI

CORE COURSE

BO6BP03B18: ANATOMY, REPRODUCTIVE BOTANY, MICROTECHNIQUE, RESEARCH METHODOLOGY, BIOPHYSICS AND BIOSTATISTICS

Credits: 2

Total Hours: 81 (hours covered in semester V)

Course Outcomes:-

CO1: Prepare microsections of plant specimens to identify them based on anatomical features.
CO2: Practice different tools and techniques of biophysical instruments
CO3: Apply various computer programs and skills for conducting research
CO4: Apply statistical tools and techniques in data analysis

Mapping of Course Outcomes with Programme Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	1	2	1	3
CO2	1	1	1	1	3
CO3	1	1	1	1	3
CO4	1	1	1	1	3

Syllabus Content

ANATOMY, REPRODUCTIVE BOTANY AND MICROTECHNIQUE
ANATOMY

PRACTICAL **(18 hrs)**

1. Study of cell types and tissues.
2. Non-living inclusions - starch grains (Potato), cystolith, raphides, aleurone grains (Castor).
3. Primary structure of stem, root and leaf - Dicots and Monocots.
4. Dissect and identify the stomatal types - anomocytic, anisocytic, paracytic and diacytic.
5. Secondary structure of dicot stem and root.
6. Anomalous secondary structure of *Bignonia* stem, *Boerhaavia* stem, and *Dracaena* stem.

REPRODUCTIVE BOTANY

PRACTICAL (9 hrs)

1. Dissect and display parts of different types of flowers.
2. Identification of C.S. of anther, embryo sac and embryo.
3. Identification of various anther types - monothecous, dithecous.
4. Identify the different types of ovules.

MICROTECHNIQUE

PRACTICAL (9 hrs)

1. Familiarize preparation and use of stains, fixatives and mounting media.
2. Preparation of smears and squash.
3. Demonstration of microtome sectioning.
4. Maceration and identification of tracheary elements.
5. Preparation of single stained hand sections (Permanent – demonstration only).

RESEARCH METHODOLOGY, BIOPHYSICS AND BIOSTATISTICS
RESEARCH METHODOLOGY

PRACTICAL (18 hrs)

1. Prepare outline of a dissertation (IMRAD system).
2. Prepare a list of References (not less than 10) on a topic in biological science.
3. Review the literature on a given topic.
4. Collect information on a topic related to biological science using the internet.
5. Make a report based on the collected information from the internet (using MS-WORD).
6. Prepare tables/charts/graphs using EXCEL.
7. Prepare a worksheet using a set of data collected and find out the SUM.
8. Prepare a PowerPoint presentation based on the report in Experiment4.

BIOPHYSICS

PRACTICAL (9 hrs)

1. Measurement of pH and adjusting pH using pH meter.
2. Separation of plant pigments using TLC.
3. Determination of the concentration of a sample solution using colorimeter.

4. Demonstration of column chromatography.
5. Count the number of cells/spores using Haemocytometer.

BIOSTATISTICS

PRACTICAL (18 hrs)

1. Collect numerical data, tabulate and represent in different types of graphs and diagrams mentioned in the syllabus.
2. Problems related to mean, median, mode, standard deviation and Chi-square test.

SEMESTER VI

CORE COURSE

BO6BP04B18: PLANT PHYSIOLOGY, BIOCHEMISTRY ENVIRONMENTAL SCIENCE AND HUMAN RIGHTS

Credits: 2

Total Hours: 81 (hours covered in semester V)

Course Outcomes:-

CO1: Analyse the physiological processes of plant life through various experiments.
CO2: Identify the major organic molecules in plant samples
CO3: Identify different types of pollutants
CO4: Analyse water samples for various dissolved components

Mapping of Course Outcomes with Programme Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	1	1	1	2
CO2	1	3	1	1	2
CO3	1	3	1	3	2
CO4	1	3	1	3	2

Syllabus Content

PLANT PHYSIOLOGY AND BIOCHEMISTRY

PLANT PHYSIOLOGY

PRACTICAL **(27 hrs)**

Core Experiments (any four compulsory):

1. Determination of osmotic pressure of plant cell sap by plasmolytic/weighing method.
2. Compare the stomatal indices of hydrophytes, xerophytes and mesophytes (any two).
3. Separation of plant pigments by TLC/Paper chromatography.
4. Measurement of photosynthesis by Wilmott's bubbler/any suitable method.
5. Estimation of plant pigments by colorimeter.

Demonstration experiments:

1. Papaya petiole osmoscope.
2. Demonstration of tissue tension.
3. Relation between transpiration and absorption.
4. Necessity of chlorophyll, light and CO_2 in photosynthesis.
5. Simple respiroscope.
6. Respirometer and measurement of RQ.
7. Fermentation.
8. Measurement of transpiration rate using Ganong's potometer/Farmer's potometer.

BIOCHEMISTRY

PRACTICAL **(18 hrs)**

1. General test for carbohydrates – Molisch's test, Benedicts's tests, Fehling's test.
2. Colour test for starch - Iodine test.
3. Colour tests for proteins in solution – Xanthoproteic test, Biuret test, Million's test, Ninhydrin test.
4. Action of various enzymes in plant tissues: peroxidase, dehydrogenase.
5. Quantitative estimation of protein using colorimeter.

ENVIRONMENTAL SCIENCE AND HUMAN RIGHTS

PRACTICAL **(36 hrs)**

1. Estimation of CO_2, Cl, and alkalinity of water samples (Titrimetry)
2. Determination of pH of soil and water.
3. Assessment of diversity, abundance, and frequency of plant species by quadrat method (Grasslands, forests).
4. Study of the most probable number (MPN) of Coliform bacteria in water samples.
5. EIA studies in degraded areas (Sampling, Line transect, Quadrat).
6. Ecological adaptations in xerophytes, hydrophytes, epiphytes, halophytes and mangroves.

SEMESTER VI

CORE COURSE

BO6BP05B18: GENETICS, PLANT BREEDING, HORTICULTURE, CELL AND MOLECULAR BIOLOGY

Credits: 2

Total Hours: 81 (hours covered in semester VI)

Course Outcomes:-

CO1: Analyse Mendelian principles behind heredity and inheritance
CO2: Practice the different propagation and culture techniques of horticultural plants in gardening.
CO3: Interpret the different stages of cell division
CO4: Analyze the different chromosomal abnormalities in human

Mapping of Course Outcomes with Programme Specific Outcomes

Mapping	PSO1AN	PSO2R	PSO3E	PSO4U	PSO5A
CO1AN	1	1	1	1	3
CO2A	1	1	1	1	3
CO3A	1	1	2	1	3
CO4AN	1	1	2	1	3

Syllabus Content

GENETICS, PLANT BREEDING AND HORTICULTURE
GENETICS
PRACTICAL (18 hrs)

1. Students are expected to work out at least two problems each from: monohybrid, dihybrid, back- cross and test cross; all types of modified Mendelian ratios mentioned in the syllabus**.**

PLANT BREEDING

PRACTICAL **(9 hrs)**

1. Emasculation and bagging.
2. Demonstration of hybridization in plants.
3. Estimation of pollen sterility/viability.

HORTICULTURE

PRACTICAL **(18 hrs)**

1. Whip and tongue grafting and Approach grafting, T budding and Patch budding, Air layering.
2. Identification of different garden tools and their uses.
3. List out the garden components in the photograph of the garden given.
4. Visit to established horticultural/agricultural/ornamental/kitchen gardens and observe the components there.

CELL AND MOLECULAR BIOLOGY

PRACTICAL **(27 hrs)**

1. Make acetocarmine squash preparation of onion root tip to identify mitotic stages.
2. Study the mitotic index of onion root tip cells (Demonstration only).
3. Study of the different stages of meiosis and identification of different substages of prophase I using photomicrographs or pictures.
4. Identify and study the chromosomal anomalies, patterns and karyotype in man such as Down's syndrome, Turner's syndrome and Klinefelter's syndrome.

MOLECULAR BIOLOGY

PRACTICAL **(9 hrs)**

1. Work out elementary problems based on DNA structure, replication, transcription and translation and genetic code.

SEMESTER VI

CORE COURSE

BO6BP06B18: ANGIOSPERM MORPHOLOGY, TAXONOMY, BIOTECHNOLOGY AND BIOINFORMATICS

Credits: 2

Total Hours: 81 (hours covered in semester VI)

Course Outcomes:-

CO1: Evaluate morphological characters of plants and identify the family using the Bentham and Hooker system of classification.
CO2: Develop herbarium and botanical illustrations vital in scientific documentation
CO3: Experiment the extraction of DNA using various analytical methods from plant cells.
CO4: Apply the computing tools and databases to address biological issues

Mapping of Course Outcomes with Programme Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	3	1	3
CO2	1	1	1	1	3
CO3	1	2	2	2	3
CO4	1	1	1	1	3

Syllabus Content

ANGIOSPERM MORPHOLOGY, TAXONOMY AND ECONOMIC BOTANY

PRACTICAL **(45 hrs)**

1. Identify the following inflorescence and fruits with reference to their morphological specialities: (a) Inflorescence - simple raceme, spike, corymb, head, simple cyme, cyathium and hypanthodium. (b) Fruits - simple - (fleshy) - berry drupe, pepo, hespiridium. Dry indehiscent - nut. Dry dehiscent - legume, capsule (loculicidal), aggregate.
2. Preparation of floral formula and floral diagram from floral description (of families studied).
3. Identify the families mentioned in the syllabus by noting their vegetative and floral characters.

4. Students must describe the floral parts, draw the L.S., floral diagram and write the floral formula of at least one flower from each family.
5. Prepare herbarium of 25 plants with field notes.
6. Conduct field work for a period of not less than 3 days under the guidance of a teacher and submit field report.
7. Study the finished products of plants mentioned in the syllabus of economic botany with special reference to the morphology of the useful part, botanical name and family.
8. Identify and describe the ethnobotanical uses of the items mentioned in the syllabus.

BIOTECHNOLOGY AND BIOINFORMATICS

PRACTICAL (36 hrs)

1. Preparation of nutrient medium – Murashige and Skoog medium (Demonstration only).
2. Sterilization and inoculation of plant tissue in culture media.
3. Establishing shoot tip, axillary bud cultures (Demonstration only).
4. Immobilization of whole cells or tissues in sodium alginate.
5. Isolation of DNA from plant tissue.
6. Agarose gel electrophoresis of the isolated DNA (Demonstration only).
7. Familiarize the instruments included in the syllabus such as Autoclave, laminar air flow chamber, UV- trans-illuminator, PCR machine, Electrophoresis apparatus, centrifuge etc and prepare short notes with diagrammatic sketch or photographs.
8. Familiarizing GENBANK, DDBJ, ENA, SWISS-PROT and PDB databases (Demonstration only).
9. Analysis of structural features of proteins using RASMOL.
10. Local alignment of sequences using BLAST (Demonstration only).
11. Retrieving a few research papers related to genetic engineering from PubMed (Demonstration only).

SEMESTER VI

CORE COURSE

BO6BPRB18 - Project

Credits: 2

Total Hours: 0

Course Outcomes:-

CO1: Formulate hypothesis and design the experiments required for the research work
CO2: Employ extensive literature survey and data collection
CO3: Apply various tools and techniques relevant for research.
CO4: Develop scientific writing and presentation skills

Mapping of Course Outcomes with Programme Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	1	2	2	3
CO2	2	2	2	2	3
CO3	1	3	2	2	3
CO4	1	2	2	2	3