

**A.VEERIYA VANDAYAR MEMORIAL SRI PUSHPAM COLLEGE  
(AUTONOMOUS),  
POONDI, THANJAVUR DIST.**

**Question Pattern for UG and PG Programmes for students to  
be admitted during 2014 – 2015 and afterwards**

**Total Marks: 75**

**QUESTIONS PATTERN**

**SECTION – A  
(Question 1 to 10)**

**10 x 2 = 20 Marks**

1. Short Answer Questions
2. Two Questions from each units (All are answerable)

**SECTION – B  
(Question 11 to 15)**

**5 x 5 = 25 Marks**

1. 5 Paragraph type questions with "either / or" type choice.
2. One question from each unit of the Syllabus.
3. Answer all the questions.

**SECTION – C  
(Question 16 to 20)**

**3 x 10 = 30 Marks**

1. 5 Essay type questions – any three are answerable.
2. One questions from each unit of the Syllabus.

*B.Sc. Botany*

Semester	Subject Code	Title Of The Paper	Hours Of Teaching / Week	No. of Credits
<b>I</b>	<b>14U1BOT1</b>	$\sqrt{\mathfrak{R}} \mid \zeta \mid \sqrt{\mathfrak{R}} \mid B \Delta$ $(\chi \mid \leftrightarrow \Sigma \mid f, E \rightarrow \mid \mid >, \Sigma \zeta f \mid \Delta,$ $\sqrt{\mathfrak{R}} \mid B \kappa \leftrightarrow \mid \zeta \rightarrow)$	<b>6</b>	<b>3</b>

{→: 1  $\neg \otimes \Phi \infty \perp$

...Σ↔Δ: 18

1.  $\sqrt{\leftrightarrow} \zeta \therefore o \equiv \mid \partial \mid \mid \zeta \mid \square \mid \mid \kappa \mid \otimes \wp \zeta \square \mid \zeta \otimes E \heartsuit \neg \wp \mid \tau > \Delta$

$(\mid \kappa o > \zeta B \Delta \xi \neg \kappa \mu \Delta)$

2.  $\Sigma \zeta \therefore \mathfrak{R} \mid \_ \mid \sigma \Theta \mid \square > \tau \infty \uparrow \dots > \mid$

$(\wp \mid \kappa \uparrow \square \mid > \lambda \mid E \oplus \heartsuit A)$

3.  $\wp \zeta \leftrightarrow \mid B \zeta \mid \square \bullet > \subseteq \mid \leftrightarrow \heartsuit \wp \zeta f \_ \mid \perp$

$(\bullet > \subseteq \mid \leftrightarrow \heartsuit \neg \wp \mid \mid \therefore, \bullet > \subseteq \mid \leftrightarrow \heartsuit \wp \lambda \mid \bullet > \subseteq \mid \leftrightarrow \uparrow > \zeta \mid \Delta,$

$\bullet > \subseteq \mid \leftrightarrow \dots > \sigma \lambda \mid \mu \mid)$

4.  $\wp \zeta \leftrightarrow \mid > \zeta \otimes \mid \square T \leftrightarrow \uparrow > \zeta \Phi$

5.  $\wp \otimes \mid \mathfrak{R} \dots \mid \zeta \otimes \mid f \mid \_ B \zeta \square \bullet \subseteq > \leftrightarrow \Delta \square \Sigma \zeta \mid$

$(\diamond \equiv \dots \mid \chi \mid \mid \therefore \diamond \mid \Sigma \zeta \dots f, \diamond \equiv \mid \perp \Sigma \zeta \mid (> \tau \infty \Sigma \zeta \mid, \gamma \subseteq \mid \leftrightarrow \zeta \Sigma \zeta \mid,$

$\mid \mid \spadesuit f \Sigma \zeta \mid, \therefore \mid \mid B \zeta \langle \Sigma \zeta \mid))$

6.  $\mid \kappa \leftrightarrow \xi \uparrow \mu \square \mid \sigma \leftrightarrow \zeta \leftrightarrow \mid \mid > (\mid \zeta \upsilon \rightarrow \Delta \mid \sigma \Theta \Delta \therefore \heartsuit \wp \mid \_ \mid \Gamma)$

{→: 2  $\chi \mid \leftrightarrow \Sigma \mid f$

...Σ↔Δ: 18

1.  $\dots \mid \otimes \mid \sigma \square \sqrt{\leftrightarrow} \zeta \mid \wp \zeta \kappa \Delta (1 \xi > \_ 15 \kappa \mid \leftrightarrow)$

2.  $\dots \mid \otimes \mid \sigma \square \wp B \square \equiv \mid \perp \neg > \zeta f \mid \Delta$

{→: 3  $E \rightarrow \mid \mid >$

...Σ↔Δ: 18

1.  $\dots \mid \otimes \mid \sigma \square \zeta \leftrightarrow \_ \neg \mid \zeta \mid \mathfrak{R} \zeta \Delta \kappa \zeta \spadesuit \Delta \wp \zeta \mid (1 \xi > \_ 10 \kappa \mid \leftrightarrow)$

2.  $\dots \mid \otimes \mid \sigma \square \therefore \dots \spadesuit \zeta \leftrightarrow \Rightarrow E > \Delta \xi \neg \kappa \mu \Delta$

$\{ \rightarrow: 4 \Sigma \zeta f | \Delta$

$\dots \Sigma \leftrightarrow \Delta: 18$

$\zeta. \neg \kappa. \wp \zeta \lceil \bullet \heartsuit \div \leftrightarrow \therefore \setminus \mathbb{B} [ \square \neg | \langle \rangle \therefore A \uparrow \rangle \lceil$

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$\{ \rightarrow: 5 \sqrt{\mathfrak{R}} | \mathbb{B} \kappa \leftrightarrow \lceil \zeta \rightarrow$

$\dots \Sigma \leftrightarrow \Delta: 18$

$E \rightarrow || \rangle, A ] \spadesuit \Delta, \Sigma \zeta f | \Delta, | \sigma | \rangle, \chi | \leftrightarrow \Sigma | f$

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*B.Sc. Botany*

Semester	Subject Code	Title Of The Paper	Hours Of Teaching/ Week	No. of Credits
<b>I</b>	<b>14U1BOE1</b>	<b>PART – II ENGLISH PROSE, POETRY AND COMMUNICATION SKILLS</b>	<b>6</b>	<b>3</b>

**Objective**

- To initiate the Students to understand English through Prose, Poetry and Basic Communicative Grammar

**Unit – I**

- 1) The Running Rivulets of Man,
- 2) Parliament is Marking Time,
- 3) The Lady in Silver Coat,
- 4) Mr. Applebaum at Play.

**Unit – II**

- 1) The Feigning Brawl of an Impostor,
- 2) Thy Life Is My Lesson,
- 3) Solve The Gamble,
- 4) The Stoic Penalty.

**Unit – III**

- 1) Nobility In Reasoning,
- 2) Malu the Frivolous Freak,
- 3) Bharath! Gird Up Your Loins!
- 4) Honesty is the Cream Of Chastity

**Unit – IV**

- John Milton – On His Blindness.  
Oliver Goldsmith – The Village Schoolmaster.  
William Wordsworth – The Daffodils.  
P.B.Shelley – Ozymandias.  
Keats – La Belle Dame Sans Merci.  
Hopkins – Thou Art Indeed, Just Lord.

**Unit – V**

- Parts of Speech, Nouns, Pronouns, Conjunctions, Adjectives, Articles, Verbs, Adverbs, Interjection – sentence.

*B.Sc. Botany*

Semester	Subject Code	Title of the Paper	Hours of Teaching / Weeks	No. of Credits
<b>I</b>	<b>14U1BOC1</b>	<b>Core – Algae, Fungi and Bryophytes</b>	<b>7</b>	<b>5</b>

**Objectives:**

- ❖ To study the classification of various types of Algae
- ❖ To Study the form, occurrence, cell structure and reproduction of various types of algae.
- ❖ To study the general characteristics of main classes of fungi.
- ❖ To study in detail on classification of bryophytes and their economic importance

**Unit I**

**Hrs 12**

Algae - Classification of Algae (Fritsch, 1953). A detailed study of the occurrence, form, cell structure, reproduction and life cycle of *Spirulina*, *Volvox* and *Caulerpa*.

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**Unit II**

**Hrs 12**

A detailed study of the occurrence, form, cell structure, reproduction and life cycle of *Ectocarpus* *Sargassum* and *Polysiphonia*. Economic importance of algae.

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**Unit III**

**Hrs 12**

Fungi - Study of the general characteristics features of fungi – classification (Alexopolous, 1962) – structure, reproduction and life history of *Albugo*, *Saccharomyces* and *Aspergillus*.

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**Unit IV**

**Hrs 12**

Structure, reproduction and life cycle of *Peziza*, *Puccinia* and *Polyporus*. Economic importance of fungi – Lichen – form, structure, reproduction and economic importance.

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**Unit V**

**Hrs 12**

Bryophytes - Classification of Bryophytes (Rothmaler, 1951) Studies on morphology, structure and reproduction of the following genera: *Riccia*, *Anthoceros* and *Funaria* – (no developmental details) Economic importance of Bryophytes.

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**Books for Reference:**

- B.P.Pandey - College Botany, Vol. I, S.Chand& Company, New Delhi.
- Gangulee Das &Kar - College Botany, Vol. II, New Central Book Agency, Calcutta.

*B.Sc. Botany*

Semester	Subject Code	Title of the Paper	Hours of Teaching / Weeks	No. of Credits
<b>I</b>	<b>14U1BOCP1</b>	<b>Core – ALGAE, FUNGI AND BRYOPHYTES</b>	<b>2</b>	<b>5</b>

**Objectives:**

- ❖ To know the vegetative and reproductive structures of various types of algae, fungi and bryophytes.

**Algae**

A study of the vegetative and reproductive structures of the following genera *Spirulina*, *Volvox*, *Caulerpa*, *Ectocarpus* *Sargassum* and *Polysiphonia*.

**Fungi and Lichens**

A study of the vegetative and reproductive structures of the following genera, *Albugo*, *Yeast*, *Aspergillus*, *Peziza*, *Puccinia*, *Polyporus* and *Usnea*.

**Bryophytes:**

A study of the vegetative and reproductive structures of the following genera: *Riccia*, *Anthoceros* and *Funaria*.

*B.Sc. Botany*

Semester	Subject Code	Title of the Paper	Hours of Teaching /Week	No. of Credits
<b>I</b>	<b>14U1BOZOA1</b>	<b>Allied Zoology – 1</b>	<b>5</b>	<b>4</b>

**Objectives:**

1. To acquire a basic knowledge of animal diversity and organization.
2. To study the general aspects of Invertebrates and Parasites.
3. To study the general aspects of Chordata animals and their anatomy
4. To learn the general principles.

**Unit I**

**Hrs15**

1. Phylum Protozoa : Plasmodium, Protozoan Parasites
2. Phylum Coelenterata : Obelia -. external characters only.
3. Phylum Platyhelminthes : Taenia solium - Organisation and life history.

**Unit II**

**Hrs15**

4. Phylum Mollusca : Fresh water Mussel – external characters only.
5. Phylum Arthropoda : External characters of Prawn
6. Phylum Echinodermata : Type study : Star Fish

**Unit III**

**Hrs15**

General characters and outline classification of Chordata –  
A detailed study of Rat.

**UnitIV**

**Hrs15**

Cell biology: Structure and functions of eukaryotic cells,  
Plasma membrane, Mitochondria and Nucleus.  
Genetics: Mendelian Principles  
Evolution: Lamarckism and Darwinism

**Unit V**

**Hrs15**

Embryology: Types of vertebrate eggs and cleavage  
Physiology: Excretion in Man and Osmoionic regulation in fishes  
Ecology: Abiotic factors – Temperature and Light.

**References**

1. Ekambaranatha Iyer, M and Anatha Krishnan, T.N – Outlines of Zoology  
Verma and Agarwal- Animal Physiology and Ecology
2. Verma and Agarwal – Cytology and Genetics

*B.Sc. Botany*

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
<b>I &amp; II</b>	<b>14U2BOZOAPL</b>	<b>Practical – I – Allied Zoology (NS)</b>	<b>3+3</b>	<b>-</b>

**Objectives:**

1. To know the Digestive system, Nervous system of Earthworm and Cockroach.
2. To dissect and study the circulatory of Calotes.

**Dissection**

- Earth worm-Nervous system.
- Cockroach – Digestive and Nervous system.
- Freshwater – Mussel – Digestive system.
- Calotes - Arterial and Venous system.

**Mounting:**

- Earthworm - body setae and penial setae.
- Freshwater mussel Pedal ganglion.
- Cockroach and Honey bee - Mouth parts
- Shark - Placoid scales

**Spotters:**

Paramecium, Trypanosoma, Sponge gemmules, Obelia colony, Obelia medusa, Ephyra larva, Physalia, Fasciola hepatica, T.S. of liver fluke, micracidium larva, Redia larva, Cercaria larva, Taenia solium entire, Scolex, Nereis entire, T.S. of Nereis, Parapodium, Leech entire, T.S of leech, Glochium larva, Starfish entire, Bipinnaria larva. Amphioxus entire, Shark, Salamander, Calotes, Pigeon and Rat.

**Reference**

1. Ekambaranatha Iyer, M and Ananthakrishna, T.N. Outlines of Zoology.



**B.Sc. Botany**

Semester	Subject Code	Title Of The Paper	Hours Of Teaching /Week	No. of Credits
<b>II</b>	<b>14U2BOT2</b>	$\forall f \mathfrak{R}   \zeta \sqrt{\mathfrak{R}}   B \Delta -$ $\wp B[\xi   \oplus \uparrow > \tau \alpha - \sqrt{\mathfrak{R}}   \square \kappa \leftrightarrow \zeta \rightarrow$	<b>6</b>	<b>3</b>

{→: 1

...Σ↔Δ: 18

1.  $\int \ominus \zeta \spadesuit \otimes \Delta \wp \subseteq \int \square \dots > \kappa \zeta \leftrightarrow \Delta \square \dots | \zeta \langle \rightarrow \int \heartsuit \wp \rangle | \Delta$
2.  $\int \int \Sigma \zeta \Upsilon \mathfrak{R} | \leftrightarrow \otimes \int \square \dots > \kappa \zeta \leftrightarrow \Delta \square \square \gamma \Delta \int \int \xi | \oplus \square \int \int \uparrow > \zeta \int f | \Delta \square$   
 $\int \mathfrak{R} | \int | \zeta \emptyset | \wp \rangle | \Delta$
3.  $\bullet \subseteq \leftrightarrow \int \square \dots > \kappa \zeta \leftrightarrow \Delta \square \int \int \kappa \zeta^{\text{TM}} | \wp \rangle | \Delta (\forall \oplus | \dots \langle \zeta | | \otimes \subseteq \sqrt{[\wp \Delta \dots]})$
4.  $\therefore \zeta \setminus \mathfrak{R} | \kappa \zeta \otimes | \int \square \int \int \kappa \zeta \otimes | \Delta \square \partial \int \otimes \wp \uparrow \mu$

{→: 2

...Σ↔Δ: 18

1.  $\neg \wp \setminus B \zeta \alpha \kappa \zeta \int \square \int \neg \therefore \zeta \alpha \square \square 4. \therefore \zeta \setminus \mathfrak{R} | \equiv | \otimes |$
2.  $\Sigma \Delta \therefore \zeta \alpha \kappa \zeta \int \square \int \int \kappa \zeta \Phi \neg \therefore \zeta \alpha \square$   
 $(\chi B | \kappa \oplus \Upsilon B | \Sigma \int \Delta \dots \xi > \_ 10 \wp \zeta f \_ | \perp)$
3.  $\gamma \int f \zeta \perp \square \int \int \heartsuit \wp \zeta | \kappa$   
 $(\therefore \zeta | \alpha \uparrow \int \equiv | \perp \dots \xi > \_ 10 \wp \zeta f \_ | \perp)$
4.  $\int \int \therefore \equiv | B \zeta \alpha \kappa \zeta \int \square \neg \wp \setminus B \int \int \neg \therefore \zeta \alpha (\xi > \_ 10 \wp \zeta f \_ | \perp)$

{→: 3

...Σ↔Δ: 18

1.  $\int \int \mathfrak{R} | \int \int \int \therefore \subseteq \int \leftrightarrow \Delta \square (\xi > \_ > \subseteq \int \leftrightarrow \Delta \square | \_ \sigma: 10 \wp \zeta f \_ | \perp)$
2.  $\zeta \therefore \leftrightarrow \zeta \int \wp \leftrightarrow \int \square * \spadesuit \zeta \otimes E B \Delta | \therefore \div \perp | \langle \uparrow > \tau \alpha (\xi \setminus \kappa \mu \Delta)$
3.  $\int \int \int f \leftrightarrow \zeta \otimes \heartsuit \wp \mathfrak{R} | \sigma \leftrightarrow \zeta B \int \square \zeta \cup \oplus \zeta \int \mathfrak{R} \zeta \oplus \kappa \Rightarrow E \square \Sigma \zeta \otimes | \kappa \langle \Delta$
4.  $T \leftrightarrow \therefore \zeta \xi M \kappa \int \square \int \int \mathfrak{R} | \zeta \kappa \wedge | \int \int \Delta \wp | \Delta \square A B \kappa \zeta \heartsuit A$
5.  $\zeta \square \equiv \zeta | \therefore \int > \zeta [ \otimes \zeta ] A \square \xi | \psi [ \otimes > | \Delta (1 \xi > \_ 4 \wp \zeta f \_ | \perp)$

{→: 4  $\wp B[\xi | \oplus \uparrow > \tau \alpha$

...Σ↔Δ: 18

$\kappa \zeta \mathfrak{R} | B \partial \therefore \heartsuit A \square A \square \int \downarrow E \kappa | | \perp \square \kappa \otimes \zeta \Delta, \kappa \otimes \tau | \zeta \sqrt{f} \equiv | \perp \square \blacklozenge \uparrow \mu \heartsuit \div | \omega$   
 $\mathfrak{R} \mathfrak{R} | \Delta \int | \leftrightarrow, \langle | \leftrightarrow, \omega | \leftrightarrow \dots \kappa \rightarrow \wp \zeta | \perp \square \neg \otimes \zeta \cup | | \langle \heartsuit \div \rangle \uparrow \mu \heartsuit \neg \wp \zeta \int \perp | \zeta \beta \Delta \xi | \oplus \square \Omega \rightarrow \uparrow$   
 $> \cup \zeta \Xi | \perp \square \otimes \setminus B \zeta \spadesuit > \tau \alpha \kappa | \kappa \Delta \partial > \_.$   
 $\neg \otimes \zeta \_ \otimes B \_ \square \neg \otimes \zeta \_ \kappa | \square \sqrt{\mathfrak{R}} | \square \kappa | \square \sqrt{\mathfrak{R}} | B \kappa | \square \neg \wp B \int \downarrow \neg \otimes \zeta \_ \square \sqrt{\zeta} \square | \zeta$   
 $\leftrightarrow \square \Delta \square \partial \rightarrow \neg \wp \zeta \int \otimes \neg \wp B \int (\neg \wp \zeta \int \perp, \sqrt{f} \Delta, | \zeta \int \Delta, E | \spadesuit, \zeta \square \Delta, \neg \rightarrow \zeta \alpha \_ ) \square \sigma | \spadesuit \downarrow \neg \otimes \zeta \_$   
 $\square \sqrt{f} \downarrow \neg \otimes \zeta \_ \square \chi \setminus \downarrow \neg \otimes \zeta \_ \square \xi \cup \rightarrow \square \blacklozenge \downarrow \otimes \Delta \square \sigma \zeta ] | \perp \square \sqrt{f} \Omega | \int \square > [ \sigma \spadesuit \square \div \oplus \sigma | \spadesuit \square$   
 $\neg \rightarrow \setminus \Omega | \int \sigma | \spadesuit \square \zeta \heartsuit A \sigma | \spadesuit \square \kappa \setminus \kappa | \therefore ] .$

$\{ \rightarrow: 5 \quad \sqrt{\mathfrak{R}} | \square \kappa \leftrightarrow \Gamma \zeta \rightarrow$

$\dots \Sigma \leftrightarrow \Delta: 18$

$\sqrt{\mathfrak{R}} | \square \kappa \leftrightarrow \Gamma \zeta \rightarrow \square > \tau \infty \uparrow \mu | \oplus \neg \kappa \neq \Xi |.$

*B.Sc. Botany*

Semester	Subject Code	Title Of The Paper	Hours Of Teaching/ Week	No. of Credits
<b>II</b>	<b>14U2BOE2</b>	<b>PART – II ENGLISH EXTENSIVE READERS AND COMMUNICATIVE SKILLS</b>	<b>6</b>	<b>3</b>

**Objective**

- To impart language and communicative skills through short stories, one act plays and communicative grammar

**Unit – I**

K.A.Abbas – The Sparrows  
O’Henry – The Cop and the Anthem.  
Guy de Maupassant – The Necklace.  
R.K.Narayan – Engine Trouble.

**Unit – II**

Anton Chekov – The Proposal  
O’Henry – While the Auto Watts

**Unit - III**

Saki – The Death Trap  
Mahesh Dattani –The Girl who touched the stars  
Claudia I.Haas – The Cellphone Epidemic

**Unit – IV**

Tense, Question Tag, Dialogue Writing, Paragraph Writing, Adjectives, Adverb

**Unit – V**

Voices, Degree of Comparison, Direct and Indirect

**Book Prescribed:**

Unit IV & V – Communicative grammar by the Department of English

*B.Sc. Botany*

Semester	Subject Code	Title of the Paper	Hours of Teaching / Weeks	No. of Credits
<b>II</b>	<b>14U2BOC3</b>	<b>Core - Fundamentals of Industrial Microbiology</b>	<b>7</b>	<b>5</b>

**Objectives:**

- ❖ To understand the various concepts of Industrial Microbiology.
- ❖ To study the classification, characteristics and structure of industrially important microbes used in industries.
- ❖ To study the isolation, identification and production of microbes used in industries.
- ❖ To study the various methods of culture preservation.
- ❖ To study the various methods of mutant selection.

**Unit I**

**Hrs 12**

History and development of industrial microbiology. Scope of industrial microbiology – experiments of Louis Pasteur – discovery of microbes.

**Unit II**

**Hrs 12**

Characteristics and ultrastructure of Bacteria, Mycoplasma and Viruses. Classification of bacteria (Bergey's manual - IX Ed. of determinative bacteriology).

**Unit III**

**Hrs 12**

Procedure for isolation, purification, identification and inoculum production of different microbes – Methods of sterilization and preparation of media – Methods of staining of different microbes.

**Unit IV**

**Hrs 12**

Culture preservation and stability – Preservation of microbes: Preservation by overlaying culture with mineral oil and lyophilisation (freeze drying).

**Unit V**

**Hrs 12**

Methods for selection of mutants – direct selection method for resistant mutants, Penicillin selection technique, Replica plating technique, other techniques – lethality and its use in mutant selection. Industrial application of microbes (Fundamental aspects).

**Books for Reference**

- P.D.Sharma (1998) - Microbiology, Rastogi & Company, Meerut.
- P.D.Sharma (1987) - The Fungi, Rastogi & Company, Meerut.
- N.S.Subbarao (1995) - Biofertilizers in Agriculture, Oxford, IBH.
- A.H.Patel (1994) - Industrial Microbiology, McMillan, India.
- F.G.Mott and Foster, J.W.(1988)- Microbial Physiology, John Wiley Sons.

*B.Sc. Botany*

Semester	Subject Code	Title of the Paper	Hours of Teaching /Weeks	No. of Credits
<b>II</b>	<b>14U2BOCP2</b>	<b>FUNDAMENTALS OF INDUSTRIAL MICROBIOLOGY</b>	<b>7</b>	<b>5</b>

**Objectives:**

- ❖ To know the various aspects like preparation of media.
- ❖ To know the methods of autoclaving and sterilization of glassware.
- ❖ To know the isolation and maintenance of different microbial groups

**Fundamentals of Microbiology**

Basic instruments for microbiology,

Microscope, Autoclave, Inoculation needle, Inoculation Chamber

(Laminar air flow), Bacterial oven, Distillation unit,

Preparation of media, autoclaving and sterilization of glassware.

Maintenance of culture room

Pure culture technique (spread plate, pour plate and streak plate).

Isolation and maintenance of microbes of different groups

Bacteria and fungi

Gram's staining

Standard plate count

Cell counting using Haemocytometer

Isolation of *Rhizobium* from root nodules.

*B.Sc. Botany*

Semester	Subject Code	Title of the Paper	Hours of Teaching /Week	No. of Credits
<b>II</b>	<b>14U2BOZOA2</b>	<b>Allied Zoology –II</b>	<b>5</b>	<b>4</b>

**Objectives:**

1. To acquire basic knowledge about the beneficial role of animals.
2. To study the various types cultures.

**Unit I**

**Hrs15**

Vermiculture and composting–types of earthworm–rearing technology Types of Vermicomposting: Small scale and Large scale method– economic importances.

**Unit II**

**Hrs15**

Sericulture –Types of silkworm; Biology and Life cycle of silkworm (*Bombyx mori*) – economic importance of silkworm.

**Unit III**

Apiculture – species of honeybee – Types of bee hive – nutritive and medicinal value of honey and Bee wax.

**Unit IV**

**Hrs15**

Aquaculture–construction of pond – Management of a pond – Freshwater cultivable fishes – fish feed– Economic importance.

**Unit V**

**Hrs15**

Poultry farming–types of poultry–Poultry nutrition–diseases and their prevention– Economics of poultry production.

**References**

1. Agarwal, W.C. – Economic Zoology
2. Pradip V. Jabde – Applied Zoology.

*B.Sc. Botany*

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
<b>I &amp; II</b>	<b>14U2BOZOAPL</b>	<b>Practical – I – Allied Zoology (NS)</b>	<b>3+3</b>	<b>2</b>

**Objectives:**

1. To know the Digestive system, Nervous system of Earthworm and Cockroach.
2. To dissect and study the circulatory of Calotes.

**Dissection**

- Earth worm-Nervous system.
- Cockroach – Digestive and Nervous system.
- Freshwater – Mussel – Digestive system.
- Calotes - Arterial and Venous system.

**Mounting:**

- Earthworm - body setae and penial setae.
- Freshwater mussel Pedal ganglion.
- Cockroach and Honey bee - Mouth parts
- Shark - Placoid scales

**Spotters:**

Paramecium, Trypanosoma, Sponge gemmules, Obelia colony, Obelia medusa, Ephysa larva, Physalia, Fasciola hepatica, T.S. of liver fluke, micracidium larva, Redia larva, Cercaria larva, Taenia solium entire, Scolex, Nereis entire, T.S. of Nereis, Parapodium, Leech entire, T.S of leech, Glochium larva, Starfish entire, Bipinnaria larva. Amphioxus entire, Shark, Salamander, Calotes, Pigeon and Rat.

**Reference**

1. Ekambaranatha Iyer, M and Ananthakrishna, T.N. Outlines of Zoology.

*B.Sc. Botany*

Semester	Subject Code	Title Of The Paper	Hours Of Teaching / Week	No. of Credits
<b>III</b>	<b>14U3BOT3</b>	$  \zeta \heartsuit \div B \equiv   \perp,   \textcircled{R}   \leftrightarrow   \perp,$ $\sqrt{R} B \kappa \leftrightarrow \zeta \rightarrow$	<b>6</b>	<b>3</b>

$\zeta \rightarrow: 1 \quad | \zeta \heartsuit \div B \equiv | \perp \quad 1$

... $\Sigma \leftrightarrow \Delta: 18$

1.  $E [ \heartsuit \wp ] | \zeta \leftrightarrow \Delta \square A | \zeta ( R | \zeta ) f \Delta \square | \zeta \spadesuit \_ \kappa )$
2.  $\therefore \setminus \dots \therefore || \Gamma \square \therefore \Gamma ( \kappa \spadesuit \Delta A R | | \zeta >$
3.  $( \kappa | E \subseteq \zeta \therefore \setminus \square \sigma \therefore | \Gamma B | \sqrt{ \Delta \wp | \Delta$
4.  $| \Delta \wp \leftrightarrow \zeta \therefore \zeta B \square \Delta \square \bullet \subseteq \leftrightarrow | \zeta ) f \Delta \square ( f \zeta \therefore \setminus \heartsuit \wp f \Gamma \Delta ( 84 \wp \zeta f \_ | \perp )$

$\zeta \rightarrow: 2 \quad | \zeta \heartsuit \div B \equiv | \perp \quad 2$

... $\Sigma \leftrightarrow \Delta: 18$

1.  $\neg \wp ) B A \leftrightarrow \zeta \square \Delta \square \sqrt{ | ( B \zeta [ \zeta | \therefore \zeta \oplus \Sigma \zeta B \spadesuit \zeta ( A \leftrightarrow \zeta \square \Delta ( 27 \wp \zeta f \_ | \perp )$
2.  $\Sigma ( \neg \kappa J \wp \zeta \square \bullet B \Delta \kappa \leftrightarrow | \zeta ) f \Delta ( \xi > \_ 20 \wp \zeta f \_ | \perp )$
3.  $\dots > \Delta \wp \zeta \kappa \setminus \square \Sigma \zeta \textcircled{R} | \heartsuit \wp f \Gamma \Delta ( \xi > \_ 10 \wp \zeta f \_ | \perp )$
4.  $( \oplus \zeta \heartsuit A \leftrightarrow \zeta \square \Delta \square \sigma \Gamma \zeta \uparrow \mu R | \zeta ) f \Delta \square \Sigma \div \partial \kappa > \zeta \leftrightarrow \heartsuit \wp f \Gamma \Delta ( \xi > \_ 10 \wp \zeta f \_ | \perp )$

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*B.Sc. Botany*

Semester	Subject Code	Title Of The Paper	Hours Of Teaching/ Week	No. of Credits
<b>III</b>	<b>14U3BOE3</b>	<b>PART – II ENGLISH SHAKESPEARE, EXTENSIVE READERS AND COMMUNICATIVE SKILLS</b>	<b>6</b>	<b>3</b>

**Objective**

- To introduce the language of the world renowned dramatist and novelist to enhance the vocabulary and communicative skills of the learners.

**Unit – I**

Funeral Oration – Julius Caesar

Trial for a Pound of Flesh – The Merchant of Venice

**Unit – II**

He Kills Sleep – Macbeth

A Real Love at First Sight – Twelfth Night

**Unit – III**

When the Moor Kills, "So Good a wife" – Othello

In Love is a "Midsummer Madness" – Tempest

**Unit – IV**

The Mayor of Casterbridge (Abridged) – Thomas Hardy

**Unit – V**

Note making, Hints Developing, Expansion of Ideas and Proverbs, Sequence of Sentences Synonyms, Antonyms.

**Book Prescribed:**

Unit-I : II & III: Selected scenes from Shakespeare.

Unit IV: The Mayor of Casterbridge Abridged by E.F.Dodd

Unit V : Communicative Grammar.

*B.Sc. Botany*

Semester	Subject Code	Title of the Paper	Hours of Teaching / Weeks	No. of Credits
<b>III</b>	<b>14U3BOC3</b>	<b>Core - ANATOMY AND EMBRYOLOGY</b>	<b>7</b>	<b>5</b>

**Objectives:**

- ❖ To study the tissues, their classification and functions.
- ❖ To study the meristems, their classification and distribution
- ❖ To study the various aspects in roots and stems of dicots and monocots
- ❖ To study the mechanism of embryo formation and their development in dicots and monocots.

**Unit I**

**Hrs 12**

Anatomy - Tissues: Classification, meristems: General account – classification and distribution of meristematic tissues. Various concepts and apical organization of shoot and root.

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**Unit II**

**Hrs 12**

Permanent tissues - Structure and functions of parenchyma, collenchyma, sclerenchyma, xylem and phloem – Tissues systems: Epidermal, Ground and Vascular – Primary structure of normal dicot and monocot stem, leaf and root.

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**Unit III**

**Hrs 12**

Normal secondary growth of dicot stem and roots – annual rings, heart wood and sap wood – periderm formation – lenticels – wound healing. Anomalous secondary thickening in stems of dicots (*Achyranthes* and *Boerhaavia*) and secondary growth in monocot stems (*Dracaena*).

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**Unit IV**

**Hrs 12**

Structure of microsporangium – wall layers (Tapetum) – microsporogenesis and microspores. Development of male gametophytes; Types of ovules. Structure and development of megasporangia and megasporogenesis – development of female gametophyte (*Polygonum* type). Process of double fertilization and triple fusion.

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**Unit V**

**Hrs 12**

Endosperm formation-nuclear, cellular and helobial types (haustoria not included). Development of dicot (*Capsella* type) and monocot embryo (*Luzula* type) polyembryony and apomixis.

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**Books for Reference**

- Anatomy: A text book of Plant Anatomy–E.John Jothi Prakash, Emkay Pub., Delhi.
- Embryology: Developmental Botany –Annie Regland, Saras Publications.
- Gangulee Das & Kar – College Botany, Vol. II, New Central Agency, Calcutta.
- Pandey, B.P. – Plant Anatomy, S.Chand & Co., New Delhi.
- Bhojwani and Bhatnagar – Embryology of Angiosperms. Vikas Publishing House (P) Ltd, New Delhi.

*B.Sc. Botany*

Semester	Subject Code	Title of the Paper	Hours of Teaching / Weeks	No. of Credits
<b>III</b>	<b>14U3BOCP3</b>	<b>Core Practical – III ANATOMY AND EMBRYOLOGY</b>	<b>2</b>	<b>5</b>

**Objectives:**

- ❖ To understand the structure of meristems, stem and root.
- ❖ To understand the process of secondary thickening
- ❖ To study the different stages of anthers, ovules, endosperms and embryos

**Anatomy**

Simple tissues and Complex tissues

Shoot apical meristem, root apical meristem.

T.S of the following stem: *Tridax*, *Cucurbita*, *Leucas*, Maize and *Asparagus*,

*Anomalous* secondary growth: *Boerhaavia*, *Achyranthes*, *Dracaena*.

T.S of the following roots: *Canna*, *Cicer* and *Achyranthes*.

Cross section of the following leaves: *Mangifera*, *Nerium*, *Zea mays*.

Stomatal types.

**Embryology**

1. Study of the different stages of microsporangial development - T.S. of mature anther.
2. Study of the different kinds of pollens from locally available plants.
3. Study of types of ovules.
4. Study of the endosperms – Endosperm mounting
5. Dicot and monocot embryos – Stages of development. Embryo mounting

## B.Sc. Botany

Semester	Subject Code	Title of the paper	Hours of Teaching/ week	No. of Credits
III	14U3BOCHA3	Allied Chemistry –I	5	4

### Unit –I

**Atomic Structure :** Atomic number and mass number – isotopes (hydrogen, oxygen , chlorine and uranium) – Orbit and orbital – shapes of s, p, d orbitals - Aufbau principle Hund's rule – electronic configuration of hydrogen carbon, nitrogen, oxygen, - stability of half filled and completely filled orbitals with the examples if Cr, Cu and Ag.

**Types of chemical bonds :** Octet rule – formation of ionic, covalent , coordinate covalent bond with the examples of NaCl, H<sub>2</sub>, Cl<sub>2</sub>, HF molecules and BF<sub>3</sub> – NH<sub>3</sub> - VSEPR theory -shapes of BeCl<sub>2</sub>, BF<sub>3</sub>, H<sub>2</sub>O, PCl<sub>5</sub>, XeF<sub>6</sub> - inter and intra molecular hydrogen bonds and their consequences

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### Unit –II

**Kinetics:** Definition with suitable examples of rate, rate law, rate constants, order, molecularity, pseudo first order and half life period - factors that influence the rate of chemical reactions – effect of temperature on rate .

**Catalysis:** General characteristics of a catalyst –types (homogeneous & heterogeneous, positive & negative and enzyme) – catalytic promoter and catalytic poisoning - intermediates compound theory and adsorption theory.

**Energetics:** Units of heat - concept of internal energy, enthalpy, entropy – exothermic and endothermic reactions

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### Unit –III

**Acid – base concept:** Arrhenius, Lowry – Bronsted and Lewis concepts – strong & weak acids - pH, buffer solution – buffer action.

**Colloids:** Types- properties (Tyndall effect, Brownian movement, electrophoresis, electro osmosis) – purification by dialysis and ultrafiltration. Types of emulsions and gels

**Water chemistry:** Hard water – soft water, temporary and permanent Hardness – removal of hardness by reverse osmosis and ion exchange method.

**Soaps and detergents** – cleaning action of soap - merits and demerits of soap and detergent

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### Unit – IV

**Separation and purification techniques:** Solvent extraction with Soxhlet apparatus - crystallization, fractional crystallization, distillation, fractional distillation, steam distillation with suitable examples.

**Chromatography:** adsorption and partition principles – column (preparation of column, development and elution), paper (sampling, ascending & descending developments , R<sub>f</sub> values) and TLC (preparation of plate, sampling, ascending & descending developments) chromatography.

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### Unit -V

**Organic compounds:** Classification - functional groups – nomenclature of simple organic compounds.

## *B.Sc. Botany*

**Isomerism:** Definition – types (structural & stereo) - position, chain, functional isomerism and metamersm shown by butyl alcohol - Geometrical isomerism exhibited by maleic & fumaric acids - optical activity – condition for optical activity - optical isomerism exhibited by lactic acid & tartaric acid – racemisation – resolution .

**Dye chemistry:** chromophore – chromogen – auxochrome - classification of dyes according to application - requisites of dye - washing, light, rubbing and sweating fastness.

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### **References**

1. Puri B.R. Sharma L.R., Kalia K.K., Principles of Inorganic Chemistry, Milestone Publishers, Delhi (2008)
2. Puri B.R., Sharma L.R., Pathania M.S., Principles of Physical Chemistry, Vishal PublishingCo., Jalandar, (2004)
3. Bahl B.S. Arun Bahl, Advanced Organic Chemistry, S. Chand & Company Ltd., New Delhi, (2005).
4. Usharani S., Analytical Chemistry, Macmillian India Ltd., NewDelhi(2000)

*B.Sc. Botany*

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
<b>III &amp; IV</b>	<b>11U4BOCHAPL</b>	<b>Allied Chemistry Practical</b> (Non – semester)	<b>3+3</b>	<b>-</b>

**A. Volumetric Analysis**

1. Estimation of HCl (or H<sub>2</sub>SO<sub>4</sub>) by NaOH using a standard oxalic acid solution
2. Estimation of NaOH by H<sub>2</sub>SO<sub>4</sub> ( or HCl ) using a standard Na<sub>2</sub>CO<sub>3</sub> solution
3. Estimation of oxalic acid by KmnO<sub>4</sub> using a standard Mohr's salt solution
4. Estimation of Ferrous sulphate by KmnO<sub>4</sub> using a standard oxalic acid solution.
5. Estimation of Mohr's salt by KmnO<sub>4</sub> using a standard oxalic acid solution.
6. Estimation of KMnO<sub>4</sub> by thio using a standard K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> solution.
7. Estimation of K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> by thio using a standard CuSO<sub>4</sub> solution
8. Estimation of CuSO<sub>4</sub> by thio using a standard K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> solution

**B. Organic qualitative analysis**

Systematic analysis of an organic compound , Preliminary tests, detection of element present, Aromatic or aliphatic, Saturated or unsaturated, nature of the functional group and exhibiting confirmatory tests for given organic compounds.

**The following substance is prescribed:**

Benzoic Acid , Cinnamic acid, Phenol , Cresol, Aniline , Toludine, Urea, Benzaldehyde, Glucose

**Reference:**

1. Venkateswaran V. Veerasamy R. Kulandaivelu A.R., Basic principles of Practical Chemistry, 2nd edition, Sultan Chand & sons, New Delhi, (1997)

**B.Sc. Botany**

Semester	Subject Code	Title Of The Paper	Hours Of Teaching / Week	No. of Credits
<b>IV</b>	<b>14U4BOT4</b>	$\otimes \equiv   \sqrt{\mathfrak{R}} \mathfrak{J} \mathfrak{B} \Delta - \partial \oplus \sqrt{\mathfrak{R}} \mathfrak{J} \mathfrak{B} \Delta -$ $\neg \otimes \Delta \neg \therefore \zeta \alpha - \sqrt{\mathfrak{R}} \mathfrak{J} \mathfrak{B} \kappa \leftrightarrow \mathfrak{I} \zeta \rightarrow$	<b>6</b>	<b>3</b>

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*B.Sc. Botany*

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*B.Sc. Botany*

Semester	Subject Code	Title of The Paper	Hours of Teaching/ Week	No. of Credits
<b>IV</b>	<b>14U4BOE4</b>	<b>PART – II ENGLISH ENGLISH FOR COMPETITIVE EXAMINATIONS</b>	<b>6</b>	<b>3</b>

**Objective**

- To prepare the learners for competitive examinations and to know the fundamentals of practical communication.

**Unit – I**

**Grammar** – Number, Subject, Verb, Agreement, Articles, Sequence of Tenses, Common Errors.

**Unit – II**

**Word Power** - Idioms & Phrases, one word substitutes, Synonyms, Antonyms, Words we often confuse, foreign words & phrases, spelling.

**Unit – III**

Reading & Reasoning – Comprehension, Jumbled Sentences.

**Unit - IV**

**Writing Skills** – Paragraph, Precis Writing, Expansion of an idea, Report Writing, Essay, Letters, Reviews (Film & Book)

**Unit – V**

**Speaking**- Public speaking, Group Discussion, Interview, Spoken English.

**Prescribed Text:**

1. V.Saraswathi, English for Competitive Examinations, Chennai, Emerald Publishers, 2000

*B.Sc. Botany*

Semester	Subject Code	Title of the Paper	Hours of Teaching / Weeks	No. of Credits
<b>IV</b>	<b>14U4BOC4</b>	<b>Core – PTERIDOPHYTES AND GYMNOSPERMS</b>	<b>7</b>	<b>5</b>

**Objectives:**

- ❖ To study the classification of Pteridophytes (Reimer, 1954).
- ❖ To study the morphology, anatomy and reproduction of sporophytes and gametophytes of various Pteridophytes.
- ❖ To study the classification, morphology and reproductive structures of various types of Gymnosperms
- ❖ To study the reproductive structures of male and female gametophytes of different types of Gymnosperms.

**Unit I**

**Hrs 12**

Pteridophytes - Classification and general characters of Pteridophytes (K.R.Sporne, 1965) - Origin of Pteridophytes: Stelar evolution in Pteridophytes - Heterospory and seed habit - Alternation of generations.

**Unit II**

**Hrs 12**

External morphology, anatomy, reproduction and life cycle of *Psilotum*, *Lycopodium* and *Selaginella* (development details need not be studied).

**Unit III**

**Hrs 12**

External morphology, anatomy, reproduction and life cycle of *Equisetum*, *Ophioglossum* and *Dryopteris* (development details need not be studied). Economic importance of Pteridophytes.

**Unit IV**

**Hrs 12**

Gymnosperms – General characters - Classification of Gymnosperms (Sporne, 1965). Morphology of vegetative structures, anatomy of root, stem and leaf of the following genera: *Cycas*, *Pinus* and *Gnetum*.

**Unit V**

**Hrs 12**

Study of male and female reproductive structures (Cones, sporophylls, micro and megasporangia, male and female gametophytes) – Embryogeny in the following genera: *Cycas*, *Pinus* and *Gnetum*. Economic importance of gymnosperms.

**Books for Reference**

- V.Singh, P.C.Pandey and D.K.Jain – A text book of Botany – Rastogi Publication, Meerut, India.
- Pandey, B.P. – A text book of Botany (Bryophytes, Pteridophytes and Gymnosperms)
- Gangulee Das & Kar – College Botany, Vol. II, Central Book Depot, Calcutta.

*B.Sc. Botany*

Semester	Subject Code	Title of the Paper	Hours of Teaching / Weeks	No. of Credits
<b>IV</b>	<b>14U4BOCP4</b>	<b>Core Practical - IV</b>	<b>2</b>	<b>5</b>

**Objectives:**

- ❖ To study the morphology, anatomy and reproductive structures of different types of Pteridophytes and Gymnosperms.

**Pteridophytes**

Study of the morphology, anatomy and reproductive structures of following genera:

*Psilotum*

*Lycopodium*

*Selaginella*

*Equisetum*

*Ophioglossum*

*Dryopteris*

**Gymnosperms**

Study of the morphology, anatomy and reproductive structures of following genera:

*Cycas*

*Pinus*

*Gnetum*

## B.Sc. Botany

Semester	Subject code	Title of the paper	Hours of Teaching/ Week	No. of Credits
IV	14U4BOCHA2	Allied Chemistry –II	5	4

### Unit - I

**Concept of mole** : Definition of mole - Avagadro number - calculation of molecular masses of Urea, Glucose, HCl, H<sub>2</sub>SO<sub>4</sub>, NaOH, Na<sub>2</sub>CO<sub>3</sub> and sucrose - Molar volume, equivalent masses of acid and base ( HCl, H<sub>2</sub>SO<sub>4</sub>, NaOH, Na<sub>2</sub>CO<sub>3</sub>).

**Concentration terms**: % by weight, molarity, molality, normality, mole fraction - simple problems to prepare different normal / molar solution for the substances NaOH and Glucose - simple problems to prepare different normal / molar solution from the given strength of solutions using  $V_1V_2 = V_2N_2$  formula for the HCl, H<sub>2</sub>SO<sub>4</sub>, NaOH, solutions.

**Co-ordination compounds**: Double salts (Mohr's salt, potash alum) and complex salt - terminology in co-ordination chemistry - Werner's theory - IUPAC names simple co-ordination compounds -structure and uses of haemoglobin and chlorophyll.

### Unit – II

**Nuclear chemistry**: Nuclear fission, fusion, carbon dating - tracer techniques - atom bomb and hydrogen bomb.

**Industrial chemistry : Fertilizers**: Essential nutrients for plants -functions N,P,K nutrients- micronutrients and their role in plant life -preparation of urea, calcium superphosphate, super phosphate of lime, potassium sulphate - mixed fertilizers -

**Pesticides**: Insecticides (stomach & contact poison and fumigant), fungicides, herbicides, rodenticides and their adverse effect - alternative methods for pest control -

**Fuel Gases**: Water gas, natural gas, bio gas and producer gas (no manufacture).

### Unit – III

**Natural products**: *Alkaloids* - Definition- classification - occurrence and extraction- general physical properties - isolation, properties and structure (no structural elucidation) of Conine and Nicotine - *Terpenes*: Definition- classification - general physical properties - uses and structure (no structural elucidation) of Citral a - Pinene. Camphor and Menthol.

**Bio molecules**: *Amino acids*: Classifications - peptide formation - isoelectric point *Protein*: Classification based on chemical composition and molecular shape - primary and secondary structures - denaturation - *Lipid*: classification -structure of glycerides - explanation for solid state of animal fat and liquid state of vegetable oil.

### Unit – IV

**Carbohydrates** :Definition -classification -D,L notations - reactions of glucose - mutarotation - invert sugar - reducing and non reducing sugars - structure of starch and cellulose(no structural elucidation)- Gun cotton, cellulose acetate and viscose rayon.

**Fundamental concepts in organic chemistry**: Homolytic and heterolytic fissions - substitution, addition, elimination, and condensation reactions, electrophiles-nucleophiles and free radicals with suitable examples. Mechanism of chlorination of CH<sub>4</sub> - Electron displacement effect- inductive and mesomeric effects. Petroleum refinery products - Rectified spirit - methylated spirit - vinegar - formalin.

**Unit -V**

**Chemotherapy:** Drugs – sulpha drugs (structures of sulphapyridine, sulphadiazine, sulphaguanidine, sulphathiazole, sulphaacetamide ) – mode of action – uses – Definition of antimalarials, antipyretics , analgesics tranquilizers and sedatives , anti septics and disinfectants – structure , uses and side effects of Aspirin, Paracetamol Phenacetin - local and general anesthetics - *Antibiotics* : Definition – structure ,mode of action and side effect of Penicillin , Chloramphenicol and tetracycline.

**Polymers:** Homo and co- polymers with the examples of polythene and polyester, thermoplastic and thermosetting polymers (PVC and bakelite)

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**References:**

1. Puri B.R. Sharma L.R., Kalia K.K., Principles of Inorganic Chemistry, Milestone Publishers, Delhi (2008)
2. Puri B.R., Sharma L.R., Pathania M.S., Principles of Physical Chemistry, Vishal Publishing Co., Jalandar, (2004)
3. Bahl B.S. Arun Bahl, Advanced Organic Chemistry, S. Chand & Company Ltd., New Delhi, (2005).
4. Jaya shree Ghosh , A text book of pharmaceutical chemistry, 3<sup>rd</sup> ed., S.Chand & Company Ltd., New Delhi (2008)

*B.Sc. Botany*

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
<b>III &amp; IV</b>	<b>11U4BOCHAPL</b>	<b>Allied Chemistry Practical</b> (Non – semester)	<b>3+3</b>	<b>2</b>

**A. Volumetric Analysis**

1. Estimation of HCl (or H<sub>2</sub>SO<sub>4</sub>) by NaOH using a standard oxalic acid solution
2. Estimation of NaOH by H<sub>2</sub>SO<sub>4</sub> ( or HCl ) using a standard Na<sub>2</sub>CO<sub>3</sub> solution
3. Estimation of oxalic acid by KmnO<sub>4</sub> using a standard Mohr's salt solution
4. Estimation of Ferrous sulphate by KmnO<sub>4</sub> using a standard oxalic acid solution.
5. Estimation of Mohr's salt by KmnO<sub>4</sub> using a standard oxalic acid solution.
6. Estimation of KMnO<sub>4</sub> by thio using a standard K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> solution.
7. Estimation of K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> by thio using a standard CuSO<sub>4</sub> solution
8. Estimation of CuSO<sub>4</sub> by thio using a standard K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> solution

**B. Organic qualitative analysis**

Systematic analysis of an organic compound , Preliminary tests, detection of element present, Aromatic or aliphatic, Saturated or unsaturated, nature of the functional group and exhibiting confirmatory tests for given organic compounds.

**The following substance are prescribed:**

Benzoic Acid , Cinnamic acid, Phenol , Cresol, Aniline , Toludine, Urea, Benzaldehyde, Glucose

**Reference:**

1. Venkateswaran V. Veerasamy R. Kulandaivelu A.R., Basic principles of Practical Chemistry, 2nd edition, Sultan Chand & sons, New Delhi, (1997)

*B.Sc. Botany*

Semester	Subject Code	Title of the Paper	Hours of Teaching /Week	No. of Credits
<b>V</b>	<b>14U5BOC5</b>	<b>Core – TAXONOMY AND ECONOMIC BOTANY</b>	<b>7</b>	<b>5</b>

**Objectives**

- ❖ To study the different types of classification.
- ❖ To learn herbarium techniques
- ❖ To learn in detail the characters and economic importance of various families.
- ❖ To understand the concept of evolution and learn the various theories.

**Unit I**

**Hrs 18**

Classification – Outline of Bentham and Hooker; Engler and Prantl – Herbarium techniques – Nomenclature: Principles of priority and its limitations. Types and Typification.

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**Unit II**

**Hrs 18**

A detailed study of the range of characters and economic importance of the following families; Annonaceae, Capparidaceae, Rutaceae, Fabaceae, Caesalpiniaceae, Mimosaceae, Cucurbitaceae and Apiaceae.

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**Unit III**

**Hrs 18**

Asteraceae, Apocynaceae, Asclepiadaceae, Scrophulariaceae, Acanthaceae, Verbenaceae and Lamiaceae.

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**Unit IV**

**Hrs 24**

Amaranthaceae, Euphorbiaceae, Orchidaceae, Liliaceae, Cannaceae and Poaceae.

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**Unit V**

**Hrs 21**

Economic Botany – Economic importance of the following groups fibre, sugar, tuber, tannin, gum and resin yielding plants.

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**Books for Reference:**

- Rao, K.N. and Krishnamoorthy – Angiosperms, Viswanathan & Col.
- Sharma, O.P. – Plant Taxonomy, Tata McGraw.
- Gurucharansingh – Plant Systematics, Oxford SH.
- Ramasamy, S., Lakshminarayana, N. and Venkateswaralu, V., Taxonomy of systematic Botany, New Central Book, Depot, Calcutta.
- Gangulee Das & Kar – College Botany, Vol. III, Central Book Agency, Calcutta.
- Gangulee, Das and Dutta – College Botany, Vol. I, New Central Book Depot, Calcutta.



*B.Sc. Botany*

Semester	Subject Code	Title of the Paper	Hours of Teaching /Week	No. of Credits
<b>V</b>	<b>14U5BOC6</b>	<b>Core – CYTOGENETICS AND MOLECULAR BIOLOGY</b>	<b>7</b>	<b>5</b>

**Objectives**

**To enable the learners to**

- ❖ Understand the modern concept of cell structure, component and function.
- ❖ Know about the latest concept of prokaryotic and eukaryotic DNA structure and expression.
- ❖ To study the basis of Mendelian Genetics.
- ❖ To study the various factors for various mechanisms of sex determination in plants.
- ❖ Apply the knowledge gained from plant molecular biology in agriculture.
- ❖ Make venture in plant genomic research

**Unit I**

**Hrs 18**

Structure of Prokaryotic and eukaryotic cells–Ultra structure and functions of plasma membrane, Plastids, Mitochondria, Ribosomes, Golgibody, Microbodies– Peroxisomes and Glyoxysomes.

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**Unit II**

**Hrs 18**

Nucleus–Nucleolus. Morphology and Structure of Eukaryotic chromosomes. Special types of chromosomes–Lamp brush chromosome and polytene chromosome – Cell cycle and stages.

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**Unit III**

**Hrs 18**

Gregor John Mendel– Mendelian laws of Heredity (Law of segregation and law of independent assortment). Deviations from Mendelian ratios. Simple interaction– complementary factor–Supplementary factor. Sex linked inheritance (human); Sex determination in plants.

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**Unit IV**

**Hrs 24**

DNA: structure and types, DNA as a genetic material. Replication semi conservative. Structure of RNA and its types.

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**Unit V**

**Hrs 21**

Transcription–Initiation, Elongation, Termination, Genetic code, protein synthesis, Gene regulation – Lac operon, post translational modifications.

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**Books for Reference:**

1. Gupta, R.K., A text book of Cytology, Genetics and Evolution. Rastogi Publications.
2. Sharma, N.S., (2005). Molecular Cell Biology. International Book Distributors, Dehradun.
3. Sinha and Sinha. Cytogenetics, Plant breeding and Evolution. Vikas Publishing House.
4. Verma, P.S. and Agarwal, V.K., (1986). Cell Biology and Molecular Biology (Cytology) S.Chand and Company, New Delhi.
5. Old, R.W. and Primrose, S.B., (1994). Principles of Gene Manipulation Blackwell Science, London.
6. Grierson, D. and Convey, S.N., (1989). Plant Molecular Biology, Blackie Publishers.
7. Lea, P.J. and Leegood, R.C., (1999). Plant Biochemistry and Molecular Biology, John Wiley and Sons, London.
8. Power, C.B., (1984). Cell Biology, Himalaya Publishing Co. Mumbai.
9. De Roberts and De Roberts, (1998). Cell and Molecular Biology. K.M.Verghese and Company.

*B.Sc. Botany*

Semester	Subject Code	Title of the Paper	Hours of Teaching /Week	No. of Credits
<b>V</b>	<b>14U5BOEL1A</b>	<b>Major Elective – I BIOFERTILIZER</b>	<b>4</b>	<b>4</b>

**Objectives**

- ❖ To know the basic aspects of Biofertilizers
- ❖ To study the symbiotic association of various microbes
- ❖ To study in detail about various types of biofertilizers
- ❖ To know about the production and mass multiplication of various microbes used as fertilizers.

**Unit I**

**Hrs 18**

General account about the microbes used as biofertilizer – *Rhizobium* – taxonomy, physiology, host – *Rhizobium* interaction – isolation -, identification, mass multiplication, carrier based inoculants Actinorhizhal symbiosis - Frankia.

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**Unit II**

**Hrs 18**

*Azospirillum* – rhizosphere competence and host plant specificity, taxonomy and physiology, isolation and mass multiplication – carrier based inoculant, associative effect of different microorganisms.

*Azotobacter* – classification, characteristics, ecology, physiology – crop response to *Azotobacter* inoculum, maintenance and mass multiplication.

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**Unit III**

**Hrs 18**

Cyanobacteria (blue green algae), *Azolla* and *Anabaena azollae* association, nitrogen fixation, factors affecting growth, blue green algae and *Azolla* in rice cultivation.

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**Unit IV**

**Hrs 24**

Phosphate Solubilizing Microorganisms- Phosphobacterium, fungi, VA-Mycorrhizal association, types of mycorrhizal association, taxonomy, occurrence and distribution, colonization of VAM – isolation and inoculum production of VAM.

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**Unit V**

**Hrs 21**

Production and identification of different nitrogen fixing microbes. Assessment of nitrogen fixing ability of different strains under controlled and field conditions, culture production (fermentor).

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**Books for Reference:**

- N.S.Subba Rao – Biofertilizers in Agriculture and Forestry.
- Norris, J.R., Read, D.J. and Verma, A.K., - Methods in Microbiology, Vol. XXIV.
- Whitton and Carr – Biology of Cyanobacteria.
- Sprent and Sprent – Nitrogen fixation.

*B.Sc. Botany*

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
<b>V</b>	<b>14U5BOEL1B</b>	<b>Major Elective – I BIOINFORMATICS</b>	<b>4</b>	<b>4</b>

**Objectives**

- ❖ This subject was initiated with an aim to have basic knowledge in computer operating. Nowadays it is necessary to go to the websites and internet for future research work.

**Unit I**

**Hrs 18**

Introduction to computers and Bioinformatics. Types of hardware and software operating systems. Fundamentals of networking, operation of networks, telnet, ftp, www.internet.

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**Unit II**

**Hrs 18**

Biological Research on the Web: Using search engines, finding scientific articles, public biological databases - searching biological databases. Use of nucleic acid and protein data banks - NCBI, EMBL, DDBJ, SWISSPROT - multiple sequence alignment.

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**Unit III**

**Hrs 18**

Sequence analysis, pair wise alignment and Databases search. Phylogenetic analysis, profiles and motifs. Protein structure - visualizing, prediction and function from a sequence.

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**Unit IV**

**Hrs 24**

Chemical composition - Biomolecules, DNA, RNA. Structure of DNA, development of DNA sequence methods. Genefinder and feature detection in DNA.

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**Unit V**

**Hrs 21**

Gene finding, pair wise sequence comparison, sequence queries in biological databases - drug designing.

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**Books for Reference:**

1. Baldi, P. and Brunak, Bioinformatics, A Machine Approach, MIT press.
2. Khanimtiyaz Alam, (2006). Elementary Bioinformation (HB), Dehradun.
3. Gibas and Jamback, Developing Bioinformatics Computer Skills, O'Reilly Associates.
4. Misenes, S. and Cravetes, S.A., Methods in molecular biology, Vol.132, Bioinformatics methods and protocols.

*B.Sc. Botany*

5. Harshitha, D., (2006). Techniques of Teaching Computer Science, International book Distribution, Dehradun.

*B.Sc. Botany*

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
<b>V</b>	<b>14U5BOEL2A</b>	<b>Major Elective – II APPLIED MICROBIOLOGY</b>	<b>4</b>	<b>3</b>

**Objectives**

- ❖ To understand the fundamental of fermentation process.
- ❖ To know the microbial based industries
- ❖ To gain knowledge about Industrial fermentations and products

**Unit I**

**Hrs 18**

Introduction – general information on microbe based industries – Substrate for industrial fermentation.

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**Unit II**

**Hrs 18**

Food and Dairy Industries: Single Cell Protein (SCP) advantages – Microbes as source of SCP (Algae, Fungi, Bacteria) – Mass production of SCP (Spirulina, Bacterial SCP) – Yogurt and Cheese production.

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**Unit III**

**Hrs 18**

Pharmaceutical and related industries -Antibiotics – Sources and types – production of Penicillin and Streptomycin; Recombinant drugs and vaccines – insulin and Hep B Vaccine; Vitamins – production of B<sub>12</sub>.

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**Unit IV**

**Hrs 24**

Alcohol and organic acid industries Industrial production of Alcohol (Ethanol). Organic acids: Citric acid and Acetic acid production – Vinegar production.

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**Unit V**

**Hrs 21**

**Enzymes and Amino acids**

Microbial Enzymes – Amylase, Protease, Pectinase, Lipase. Microbes used for aminoacid production – Commercial production of L-Glutamic acids and L-Tryptophan.

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**Books for Reference:**

1. Adams, M.R. and Moss, M.O., (1995). Food Microbiology Tata McGraw Hill.
2. Agarwal, (2006). Industrial Microbiology: Fundamentals and Application. M/S. IBP Publishers and Distributes, New Delhi.
3. Crueger, F. and Anneliese Cruger, (2000). Biotechnology: Industrial Microbiology, Panima Publications.
4. Dubey, R.C. and Maheswari, D.K., (2003). A text book of Microbiology. S.Chand and Campus, New Delhi.
5. Kumaresan, V., (2001). Biotechnology Saras Publications, Nagarcoil.
6. Purohit, (2005). Microbiology Fundamentals and Applications. 6<sup>th</sup> Ed., International Book Distributors, Dehradun.
7. Ratledge and Kristenson, (2001). Basic Biotechnology. Oxford University Press.

*B.Sc. Botany*

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
<b>V</b>	<b>14U5BOEL2B</b>	<b>Major Elective – II LABORATORY TECHNIQUES</b>	<b>4</b>	<b>3</b>

**Objectives**

- ❖ To make the students to understand the various techniques and engage themselves in self-employment.

**Unit I**

**Hrs 18**

Preservation of plant materials–Fixation, Stains, preparation of medium for culture, PDA, MS Media.

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**Unit II**

**Hrs 18**

Sectioning of plant material – Hand sectioning, microtome sectioning. Double staining, Permanent and semi permanent mounts.

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**Unit III**

**Hrs 18**

Extraction and purification methods – Batch extraction, solvent extraction, filtration - Electrophoresis – principles and techniques PAGE, SDS-PAGE.

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**Unit IV**

**Hrs 24**

Cytochemical test for identification of proteins, lipid, starch & sugar in plant tissues. Preparation of suspension culture, use of rotary shakers.

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**Unit V**

**Hrs 21**

Biostatistics - Mean, Median, Mode, Standard deviation, Standard error, Student test, Chisquare test.

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**Books for Reference:**

1. Berlyn, G.P., Botanical Microtechniques and Cytochemical, M/S. IBD Publisher and Distribution.
2. Khanirjan, A., Fundamentals of Biostatistics, M/S. IBD Publishers, New Delhi.
3. Srivastava Meena, (2007). Principles of Laboratory Techniques and Methods, IBD Publishers, New Delhi.
4. Jayaram, J., (1988). Techniques in Biology – A College level study.
5. Johansen, Laboratory Techniques.
6. Jensen, W.A., Botanical Histochemistry, Tata McGraw Hill.
7. Harborne, J.B., Phytochemical Methods, International Book Dist., Dehradum.
8. Sass, J.E., (1958). Botanical Microtechnique, State College Press Amer. IOWA.

## *B.Sc. Botany*

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
<b>V</b>	<b>14U5BOCP5</b>	<b>Core – Practical – IV (Taxonomy, Cytogenetics and Molecular Biology)</b>	<b>4</b>	<b>5</b>

### **Objectives**

- ❖ To identify the families from locally available plants.
- ❖ To study the various cell organelles using slides and electron micrographs
- ❖ To study the floral biology of some important crops
- ❖ To know the various aspects of Mendelian genetics and molecular biology
- ❖ Mandatory – Botanical tour/Submission of Herbarium of 20 sheets.

### **Taxonomy**

Study of the following families with emphasis on identification

1. Annonaceae
2. Capparidaceae
3. Rutaceae
4. Fabaceae
5. Caesalpinaceae
6. Mimosaceae
7. Cucurbitaceae
8. Apiaceae
9. Asteraceae
10. Apocynaceae
11. Asclepiadaceae
12. Scrophulariaceae
13. Acanthaceae
14. Verbenaceae
15. Lamiaceae
16. Amaranthaceae
17. Euphorbiaceae
18. Arecaceae
19. Poaceae

### **Cytogenetics and Molecular Biology**

1. Cell division: Mitosis and Meiosis – Squash technique in Onion root tips and Tradescantia / Rheo flower bud respectively.
2. Photographs: Ultra structure of cell organelles.
3. Structure and types of chromosomes, DNA and RNA.
4. Simple problems on Monohybrid and Dihybrid ratios and interaction of genes factor inheritance (Charts).

## *B.Sc. Botany*

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
<b>VI</b>	<b>14U6BOC7</b>	<b>Core – Plant Physiology</b>	<b>7</b>	<b>5</b>

### **Objectives**

- ❖ To study in detail about diffusion, osmosis and water potential.
- ❖ To study the various aspects of enzymes.
- ❖ To learn about the light and dark reactions of photosynthesis
- ❖ To learn in detail about respiration and growth mechanisms.

### **Unit I**

**Hrs 18**

Diffusion, Osmosis, water potential, osmotic potential – plant cell as an osmotic system – plasmolysis – Inhibition. Absorption of water – mechanism – active and passive absorption. Absorption of mineral salts: mechanism – ion exchange – passive and active absorption, carrier concept.

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### **Unit II**

**Hrs 18**

Enzymes classification – new system – structure of enzymes – cofactors – mode of action – Induced fit theory – mechanism of enzyme action – Michaelis – Menton equation – Properties of enzymes – Factors affecting enzymes action – Enzyme inhibition (allosteric) and regulation Nitrogen metabolism: sources of nitrogen – molecular, inorganic and organic.

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### **Unit III**

**Hrs 18**

Absorption and utilization of light energy. Two pigment system – PS I and PS II Mechanism of photosynthesis – light reaction – photolysis of water – Electron transport (Z – Scheme) – cyclic and non-cyclic-photophosphorylation. Dark reaction – Calvin cycle (C<sub>3</sub> pathway). Hatch-Slack pathway (C<sub>4</sub> dicarboxylic acid pathway – NAD – Malate dependent) CAM pathway. Photorespiration.

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### **Unit IV**

**Hrs 24**

Respiration Mechanism – glycolysis (EMP pathway) – Anaerobic respiration – Alcoholic fermentation – Lactic acid fermentation. Krebs's cycle (TCA – Cycle). Electron Transport system and mechanism of oxidative phosphorylation, Pentose phosphate pathway and its significance ED pathway. Differences between oxidative and photophosphorylation. Factors affecting respiration – Internal and External

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### **Unit V**

**Hrs 21**

Growth – Growth hormones – Auxins, gibberellins and cytokinins – discovery, bioassay – chemical nature and physiological effects; Physiological effects of Ethylene & florigen – Phytochrome. Vernalization - mechanism.

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### **Books for Reference:**

- Jain, V.K., - Fundamental of Plant Physiology, S.Chand and Co. Ltd., New Delhi
- Pandey, S.N. and Sinha, B.K.- Plant Physiology, Vikas Publishing Co.
- Noggleand Fritz - Introduction to Plant Physiology, Prantice Hall of India.
- Salisbury and Ross - Plant Physiology
- Goodwin and Mercer - Plant Biochemistry
- Malik, C.P. - Plant Physiology, Oxford IBH.



*B.Sc. Botany*

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
<b>VI</b>	<b>14U6BOC8</b>	<b>Core - ENVIRONMENTAL BOTANY AND BIO-STATISTICS</b>	<b>7</b>	<b>5</b>

**Objectives**

- ❖ To study the various aspects of Ecology.
- ❖ To know about ecological pyramids, food chain and food webs
- ❖ To know in detail about various types of vegetation
- ❖ To study the biodiversity and pollution
- ❖ To study the importance of statistics in biology

**Unit I** **Hrs 18**  
Approaches to the study of ecology–Autecology–Synecology–Population, Community–units of vegetation. Ecosystem concept, components-abiotic, biotic (PLFR5).

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**Unit II** **Hrs 18**  
Food chain, food web and energy flow in pond ecosystem. Productivity concepts – Primary and secondary – Determination of productivity in aquatic ecosystem. Light and Dark bottle method. Ecosystem development (Ecological succession – Hydro, Xerosere).

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**Unit III** **Hrs 18**  
Factors influencing vegetation – climatic, edaphic and biotic – ecological classification of plants – hydro, xero and mesophytes – morphological and anatomical adaptations of hydrophytes and xerophytes.

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**Unit IV** **Hrs 24**  
A brief account on biodiversity. Applied ecology – atmospheric pollution – land pollution – water pollution and control methods. Botanical provinces of India.

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**Unit V** **Hrs 21**  
Importance of statistics in biology – Population – census and sampling methods – presentation of data (Graphic and diagrammatic)– frequency distribution, mean, median and mode; Standard deviation.

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**Books for Reference:**

- ❖ Sharma, P.D. – (1992) -Ecology and Environment, Rastogi Publications, Meerut, UP.
- ❖ David, N. Sen. (1978) - Concept in Indian Ecology, Shoban Lalin Chand & Co., M-5, Industrial Area, Jalankhar City 144 004, India.
- ❖ Sakal and Rohif, (Year) -Introduction to Bio-statistics, Freeman-Sanfrancisco.
- ❖ Idaikkandan, N.M. (Year) -Agricultural Statistics, Pergamon Press, Oxford.
- ❖ Khan and Khanum (Year) -Fundamentals of Biostatistics, International Book Dept.
- ❖ Ramakrishnan, P., (2001) - Biostatistics, Saras Publications.

*B.Sc. Botany*

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
<b>VI</b>	<b>14U6BOEL3A</b>	<b>Major Elective – III BIOTECHNOLOGY</b>	<b>5</b>	<b>4</b>

**Objectives**

- ❖ To know the outlines of genetic engineering
- ❖ To understand the application of genetic engineering
- ❖ To understand the mechanism of biological nitrogen fixation
- ❖ To know the various aspects of fermentation
- ❖ To study the basic aspects of various biofuels

**Unit I**

**Hrs 18**

Scope and importance of biotechnology. Basis of genetic engineering – foreign DNA –preparation, insertion of DNA into vectors. Enzymes of genetic engineering: restriction endonucleases & lipases – Gene cloning – vectors – plasmids (pBR322) and cosmids (PLFR5).

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**Unit II**

**Hrs 18**

Selection of recombinants – using antibiotic markers, radio labelling – replica plating – Transgenic plants for herbicide resistant – applications of genetic engineering.

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**Unit III**

**Hrs 18**

Biological nitrogen fixation – mechanism, use of *Azotobacter*, *Anabaena* and *Rhizobium* as biofertilizer organisms.

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**Unit IV**

**Hrs 24**

Fermentation: fermentor, media – Production of enzymes; (protease), alcohol and antibiotics (Penicillin).

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**Unit V**

**Hrs 21**

Biological waste treatments – sewage and reuse of wastes, primary and secondary treatments. Oxidation ponds. Anaerobic digestion and reuse of sewage.

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**Books for Reference:**

1. Horticulture – Principles and Practices – George Acquah.
2. Dubey, R.C. and Maheswari, D.K., (2003). A text book of Microbiology. S.Chand and Campus, New Delhi.
3. Kumaresan, V., (2001).Biotechnology Saras Publication, Nagarcoil.
4. Ratledge and Kristenson, (2001). Basic Biotechnology, Oxford University Press.

*B.Sc. Botany*

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
<b>VI</b>	<b>14U6BOEL3B</b>	<b>Major Elective – IV ENVIRONMENTAL BIOTECHNOLOGY</b>	<b>4</b>	<b>5</b>

**Objectives**

- ❖ To give an insight into environmental pollution and microbial processes in the environment.
- ❖ To provide knowledge on the use of microbes for a safe of environment and to treat hazardous waste using biotechnological processes.

**Unit I Introduction**

**Hrs 18**

The environment – soil, water and air. Pollution and its causes (Outline only) – Nonconventional energy sources – biogas production -methane and hydrogen production. Recycling of solid waste products – composting and silaging.

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**Unit II Source and treatment of polluted water and effluents**

**Hrs 18**

Biological treatment of sewage – characteristics of sewage and objectives in sewage treatment – Activated sludge process – trickling filters –Anaerobic digestion. Treatment of industrial effluents using bioreactors.

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**Unit III Soil and air pollution and their treatment**

**Hrs 18**

Soil pollution by Xenobiotics. Degradation of Xenobiotics – pathways of phenol, pentachlorophenol and polychlorinated biphenyl degradation. Purification of polluted air.

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**Unit IV Bioremediation**

**Hrs 24**

Introduction to bioremediation, *ex situ* and *in situ* bioremediation. Types of reactors used in bioremediation.

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**Unit V Biometallurgy and related topics**

**Hrs 21**

Biomineralization– bioleaching – Metal transformation – biofilms and biocorrosion. Pollution by radionuclides– uptake of radionuclides from polluted sites. Future prospects.

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**Books for Reference:**

1. Alan Scragg, (1999). Environmental Biotechnology, Pearson Education Limited.
2. Dubey, R.C., (2004). A text Book of Biotechnology aspect of Microbiology, British sun Publication.
3. Joseph, C. Deniel, (1996). Environmental aspects of Microbiology, British Sun Publication.
4. Keeshav Thehan, (1997). Biotechnology, New age International (P) Limited, New Delhi.
5. Sharma, P.D., (2005). Environmental Microbiology, Narosa Publishing House Pvt. Ltd., New Delhi.
6. Raina Maier, M., Iran Pepper, L., Charles, P. and Gerba, (2000). Environmental Microbiology, Academic Press UK.
7. Alexander, N., Glazer and Hiroshi Nikaido, (1994). Microbial Biotechnology.
8. Special issue on bioremediation and biodegradation. Indian Journal of Experimental Biology, September 2003. Vol. 41(9). National Institute of Science Communication and Information Resources, CSIR New Delhi.

*B.Sc. Botany*

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
<b>VI</b>	<b>14U6BOEL4A</b>	<b>Major Elective – III FERMENTATION TECHNOLOGY</b>	<b>5</b>	<b>3</b>

**Objectives**

- ❖ To train the students to perform fermentation
- ❖ To understand and apply the protocols for primary fermentation processes.

**Unit I**

**Hrs 18**

A general account on microbial biomass, enzymes, metabolites and recombinant products – Range of fermentation processes -Transformation processes.

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**Unit II**

**Hrs 18**

Strain isolation, preservation of industrially important microorganisms – media for industrial fermentation and their sterilization – Microbial growth, fed, batch and continuous cultures.

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**Unit III**

**Hrs 18**

Fermentor - basic function – body construction – aerators, agitators (impellers and spargers) asepsis – containment – Valves and steam traps – types of fermentors.

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**Unit IV**

**Hrs 24**

Methods of measuring, process variables – temperature, pressure and flow rate control – online analysis of chemical factors and control systems (pH, DO, foaming etc) – computerized control systems - biosensors.

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**Unit V**

**Hrs 21**

Foam separation, precipitation, filtration, centrifugation, cell disruption, liquid – liquid extraction, chromatography membrane process.

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**Books for Reference:**

1. Agarwal, (2006). Industrial Microbiology: Fundamental and Application, M/S. IBD Publishers and Distributors, New Delhi.
2. Patel, A.H., 2003. Industrial Microbiology, MacMillan.
3. Stanley, P.F.A., Whilttaker and Hall, S.J., (1995). Principles of Fermentation Technology, 1<sup>st</sup> Ed. Pergamon Press, U.K.
4. Alexander, N. Glazer and Hiroshi nikaido, (1994). Microbial Biotechnology, Fundamentals and Applied Microbiology W.H.Freeman and Co., New York.
5. Rajak, (2005). Microbial Biotechnology for sustainable Development and Productivity, M/S. IBD Publishers and Distributors, New Delhi.

*B.Sc. Botany*

0Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
<b>VI</b>	<b>14U6BOEL4B</b>	<b>Major Elective – IV PRESERVATION OF FRUITS AND VEGETABLES</b>	<b>5</b>	<b>3</b>

**Objectives**

- ❖ To understand the fundamentals of fermentation process.
- ❖ To know the microbial based industries.
- ❖ To gain knowledge about Industrial fermentations and their products.

**Unit I**

**Hrs 18**

Principles of preservation, Methods of preservation – refrigeration, freezing, canning, drying and dehydration, chemical preservatives.

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**Unit II**

**Hrs 18**

Food spoilage – causes and factors: Causes – physical, chemical and biological factors – pH, temperature, available moisture.

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**Unit III**

**Hrs 18**

Canning of Fruits: mango, apple and banana. Canning of vegetables: bean, carrot and tomato.

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**Unit IV**

**Hrs 24**

Methods processing of the following fruits. Banana, dates, grape, fig and mango – Preparation of jam, jelly juice squash, pickles, marmelods and dried fruits.

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**Unit V**

**Hrs 21**

Asepsis – packing and packing materials, metal, glass, papers, plastics and films, laminates, Edible films and wooden packaging.

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**Books for Reference:**

1. Siddappa, G.S. and Tandon, G.L., (1998). Preservation of Fruits and Vegetables Lal G., Indian Council of Agricultural Research, New Delhi.
2. Preservation and Canning of Fruits and Vegetable (EIRI), 2006. M/S. IRD Publishers, New Delhi.
3. Frazier, W.C. and West Holf, D.C., (1995). Food Microbiology. Tata McGraw Hill Publishing Col. Ltd., New Delhi.
4. Kulshrestha, S.K., (1994). Food Preservation, Vikas Publishing House, New Delhi.
5. Swaminathan, M., (1992). Handbook of food Science and Experimental foods, the Bangalore printing and Publishing Col. Ltd., Bangalore.