MODIFIED CBCS CURRICULUM OF
BOTANY HONOURS PROGRAMME

SUBJECT CODE = 51

FOR UNDER GRADUATE COURSES UNDER RANCHI UNIVERSITY

Implemented from
Academic Session 2019-2022
Members of Board of Studies of CBCS Under- Graduate Syllabus as per Guidelines of the Ranchi University, Ranchi.

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   University Professor & Head,
   University Department of Botany, Ranchi University, Ranchi

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      University Department of Botany, Ranchi University, Ranchi
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        University Department of Botany, Ranchi University, Ranchi
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       University Department of Botany, Ranchi University, Ranchi
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       University Department of Botany, Ranchi University, Ranchi
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        Assistant Professor,
        University Department of Botany, Ranchi University, Ranchi
   viii. Mrs. Lady Rani
        Assistant Professor,
        University Department of Botany, Ranchi University, Ranchi

3. Spl. Invitee :-
   i. Dr. Jaikant Prasad Singh
      Assistant Professor,
      Department of Botany, R.L.S.Y. College, Ranchi

[Signature and dates]
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2. Course structure for B.Sc./ B.A./ B.Com.(Hons. Programme)
3. Subject Combinations allowed for B. Sc. Hons. Programme
4. Semester wise Examination Structure for Mid Sem & End Sem Examinations
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<td>8</td>
<td>Generic Elective (GE 1A)</td>
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<td>Generic Elective (GE 1B)</td>
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</tr>
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</thead>
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<td>Generic Elective (GE 2A)</td>
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<td>Generic Elective (GE 2B)</td>
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<td>Core Course- C 4</td>
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<td>18</td>
<td>C 3 + C 4 LAB</td>
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</tr>
</thead>
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</tr>
<tr>
<td>21</td>
<td>Generic Elective (GE 3B)</td>
</tr>
<tr>
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<td>Core Course – C 5</td>
</tr>
<tr>
<td>23</td>
<td>Core Course- C 6</td>
</tr>
<tr>
<td>24</td>
<td>Core Course- C 7</td>
</tr>
<tr>
<td>25</td>
<td>C 5 + C 6 + C 7 LAB</td>
</tr>
</tbody>
</table>

#### SEMESTER IV

<table>
<thead>
<tr>
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<th>Skill Enhancement Course (SEC 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>27</td>
<td>Generic Elective (GE 4A)</td>
</tr>
<tr>
<td>28</td>
<td>Generic Elective (GE 4B)</td>
</tr>
<tr>
<td>29</td>
<td>Core Course – C 8</td>
</tr>
<tr>
<td>30</td>
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</tr>
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<td>31</td>
<td>Core Course- C 10</td>
</tr>
<tr>
<td>32</td>
<td>C 8 + C 9 + C 10 LAB</td>
</tr>
</tbody>
</table>

#### SEMESTER V

<table>
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<th>Discipline Specific Elective (DSE 1)</th>
</tr>
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<tr>
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<td>35</td>
<td>DSE 1 + DSE 2 LAB</td>
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<td>36</td>
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</tr>
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# BOTANY HONS.
## CBCS CURRICULUM
### RANCHI UNIVERSITY

### COURSE STRUCTURE FOR UNDERGRADUATE ‘HONOURS’ PROGRAMME

**Table AI-1: Distribution of 164 Credits** [*wherever there is a Practical there will be no tutorial and vice-versa.]*

<table>
<thead>
<tr>
<th>Course</th>
<th>Papers</th>
<th>Credits</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Theory + Practical</td>
<td>Theory + Tutorial</td>
</tr>
<tr>
<td>I. Core Course</td>
<td>(CC 1 to 14)</td>
<td>14 Papers</td>
<td>14X4=56</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>14X5=70</td>
</tr>
<tr>
<td></td>
<td></td>
<td>14 Papers</td>
<td>14X2=28</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>14X1=14</td>
</tr>
<tr>
<td>II. Elective Course (EC)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A. Discipline Specific Elective</td>
<td>(DSE 1 to 4)</td>
<td>4 Papers</td>
<td>4X4=16</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4X5=20</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4 Papers</td>
<td>4X2=8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4X1=4</td>
</tr>
<tr>
<td>B. Generic Elective/ Interdisciplinary</td>
<td>(GE 1 to 4)</td>
<td>4 Papers</td>
<td>4X4=16</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4X5=20</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4 papers</td>
<td>4X2=8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4X1=4</td>
</tr>
<tr>
<td>III. Ability Enhancement Compulsory Courses (AECC)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. English/ Hindi Communication</td>
<td>1 Paper</td>
<td>1X2=2</td>
<td></td>
</tr>
<tr>
<td>2. Environmental Science</td>
<td>1 Paper</td>
<td>1x2=2</td>
<td></td>
</tr>
<tr>
<td>3. Skill Enhancement Course of the Core Course opted</td>
<td>2 Papers</td>
<td>2X2=4</td>
<td></td>
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</table>

**Total Credit = 140 + 24 =164**

**140 + 24 = 164**

**Note:** In the Academic Council Meeting of Ranchi University, Ranchi, held on 29.06.2019, it is resolved that Students will be offered Two Generic Elective Subjects (GE-A & GE-B) in C.B.C.S. U.G. Honours Courses of all streams, so that their ‘Eligibility for Admission’ in P.G., Vocational & Technical Courses in various Institutions is not hampered.

### Table AI-1.1: Course structure for B.Sc./ B.A./ B.Com./B.Voc. (Hons. Programme)

<table>
<thead>
<tr>
<th>Semester</th>
<th>Honours (Core Courses)</th>
<th>Allied (Elective Courses)</th>
<th>Ability Enhancement (Compulsory Courses)</th>
<th>Total Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>14 Papers</td>
<td>8 Papers</td>
<td>4 Papers</td>
<td></td>
</tr>
<tr>
<td>Sem-I</td>
<td>C-1, C-2</td>
<td>GE-1A, GE-1B</td>
<td>English Comm./ Hindi Comm. (02 Credits)</td>
<td>26 Credits</td>
</tr>
<tr>
<td></td>
<td>(6+6=12 Credits)</td>
<td>(6+6=12 Credits)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sem-II</td>
<td>C-3, C-4</td>
<td>GE-2A, GE-2B</td>
<td>EVS (02 Credits)</td>
<td>26 Credits</td>
</tr>
<tr>
<td></td>
<td>(6+6=12 Credits)</td>
<td>(06 Credits)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sem-III</td>
<td>C-5, C-6, C-7</td>
<td>GE-3A, GE-3B</td>
<td>SEC-1 (02 Credits)</td>
<td>32 Credits</td>
</tr>
<tr>
<td></td>
<td>(6+6=6=18 Credits)</td>
<td>(06 Credits)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sem-IV</td>
<td>C-8, C-9, C-10</td>
<td>GE-4A, GE-4B</td>
<td>SEC-2 (02 Credits)</td>
<td>32 Credits</td>
</tr>
<tr>
<td></td>
<td>(6+6=6=18 Credits)</td>
<td>(06 Credits)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sem-V</td>
<td>C-11, C-12</td>
<td>DSE-1, DSE-2</td>
<td></td>
<td>24 Credits</td>
</tr>
<tr>
<td></td>
<td>(6+6=12 Credits)</td>
<td>(6+6=12 Credits)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sem-VI</td>
<td>C-13, C-14</td>
<td>DSE-3, DSE-4</td>
<td></td>
<td>24 Credits</td>
</tr>
<tr>
<td></td>
<td>(6+6=12 Credits)</td>
<td>(6+6=12 Credits)</td>
<td></td>
<td></td>
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</tbody>
</table>

**Total = 164 Credits**

Session 2019-22 onwards
### Table AI-2 Subject Combinations allowed for B. Sc. Hons. Programme (164 Credits)

<table>
<thead>
<tr>
<th>Honours/Core Subject</th>
<th>Discipline Specific Elective Subject</th>
<th>Skill Enhancement Course</th>
<th>Compulsory Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>Botany</td>
<td>Botany Specific</td>
<td>SEC in Botany</td>
<td>Language Communication + EVS</td>
</tr>
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</table>

### Table AI-2.1 Semester wise Examination Structure for Mid Sem & End Sem Examinations:

<table>
<thead>
<tr>
<th>Sem</th>
<th>Core Honours, Allied DSE, Compulsory AECC Courses</th>
<th>Examination Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Code</td>
<td>Papers</td>
</tr>
<tr>
<td>I</td>
<td>C1</td>
<td>Algae and Microbiology +Lab</td>
</tr>
<tr>
<td></td>
<td>C2</td>
<td>Biomolecules and Cell Biology +Lab</td>
</tr>
<tr>
<td></td>
<td>GE1A</td>
<td>Refer Table AI-2.3 of the Syllabus of Subject opted</td>
</tr>
<tr>
<td></td>
<td>GE1B</td>
<td>Refer Table AI-2.3 of the Syllabus of Subject opted</td>
</tr>
<tr>
<td></td>
<td>AECC</td>
<td>Language Communication</td>
</tr>
<tr>
<td>II</td>
<td>C3</td>
<td>Mycology and Phytopathology +Lab</td>
</tr>
<tr>
<td></td>
<td>C4</td>
<td>Archegoniate +Lab</td>
</tr>
<tr>
<td></td>
<td>GE2A</td>
<td>Refer Table AI-2.3 of the Syllabus of Subject opted</td>
</tr>
<tr>
<td></td>
<td>GE2B</td>
<td>Refer Table AI-2.3 of the Syllabus of Subject opted</td>
</tr>
<tr>
<td></td>
<td>AECC</td>
<td>EVS</td>
</tr>
<tr>
<td>III</td>
<td>C5</td>
<td>Morphology and Anatomy +Lab</td>
</tr>
<tr>
<td></td>
<td>C6</td>
<td>Economic Botany +Lab</td>
</tr>
<tr>
<td></td>
<td>C7</td>
<td>Genetics +Lab</td>
</tr>
<tr>
<td></td>
<td>GE3A</td>
<td>Refer Table AI-2.3 of the Syllabus of Subject opted</td>
</tr>
<tr>
<td></td>
<td>GE3B</td>
<td>Refer Table AI-2.3 of the Syllabus of Subject opted</td>
</tr>
<tr>
<td></td>
<td>SEC 1</td>
<td>Elementary Computer Application Software +Lab</td>
</tr>
<tr>
<td>IV</td>
<td>C8</td>
<td>Molecular Biology +Lab</td>
</tr>
<tr>
<td></td>
<td>C9</td>
<td>Plant Ecology and Phytogeography +Lab</td>
</tr>
<tr>
<td></td>
<td>C10</td>
<td>Plant Systematics +Lab</td>
</tr>
<tr>
<td></td>
<td>GE4A</td>
<td>Refer Table AI-2.3 of the Syllabus of Subject opted</td>
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<td></td>
<td>GE14</td>
<td>Refer Table AI-2.3 of the Syllabus of Subject opted</td>
</tr>
<tr>
<td></td>
<td>SEC 2</td>
<td>Mushroom Culture Technology +T</td>
</tr>
<tr>
<td>V</td>
<td>C11</td>
<td>Reproductive Biology of Angiosperms +Lab</td>
</tr>
<tr>
<td></td>
<td>C12</td>
<td>Plant Physiology +Lab</td>
</tr>
<tr>
<td></td>
<td>DSE 1</td>
<td>Horticultural Practices &amp; Post Harvest Technology +Lab</td>
</tr>
<tr>
<td></td>
<td>DSE 2</td>
<td>Analytical Techniques in Plant Science +Lab</td>
</tr>
<tr>
<td>VI</td>
<td>C13</td>
<td>Plant Metabolism +Lab</td>
</tr>
<tr>
<td></td>
<td>C14</td>
<td>Plant Biotechnology +Lab</td>
</tr>
<tr>
<td></td>
<td>DSE 3</td>
<td>Plant Breeding +Lab</td>
</tr>
<tr>
<td></td>
<td>DSE 4</td>
<td>Research Methodology +Lab</td>
</tr>
</tbody>
</table>
Table AI-2.2 Generic Subject Papers for B. Sc. Hons. Programme (164 Credits);

All Four Papers of Any One Subject to be opted leaving aside the papers of Hons. Subject:

<table>
<thead>
<tr>
<th>Generic Elective Subject GE 4 Papers</th>
<th>Semester I GE1</th>
<th>Semester II GE2</th>
<th>Semester III GE3</th>
<th>Semester IV GE4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zoology</td>
<td>Animal Diversity +Lab</td>
<td>Human Physiology +Lab</td>
<td>Food, Nutrition &amp; Health +Lab</td>
<td>Environment &amp; Public Health +Lab</td>
</tr>
<tr>
<td>Geology</td>
<td>Essentials of Geology +Lab</td>
<td>Rocks &amp; Minerals +Lab</td>
<td>Fossils &amp; their Applications +Lab</td>
<td>Earth Resources +Lab</td>
</tr>
</tbody>
</table>

Table AI-2.3 Semester wise Structure for End Sem Examinations of Generic Elective in Botany:

<table>
<thead>
<tr>
<th>Sem</th>
<th>Core Honours, Allied DSE, Compulsory AECC Courses</th>
<th>Examination Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Code Papers</td>
<td>Mid Semester Theory (F.M.)</td>
</tr>
<tr>
<td>I</td>
<td>GE1 Biodiversity +Lab</td>
<td>---</td>
</tr>
<tr>
<td>II</td>
<td>GE2 Plant Ecology &amp; Taxonomy +Lab</td>
<td>---</td>
</tr>
<tr>
<td>III</td>
<td>GE3 Plant Anatomy &amp; Embryology +Lab</td>
<td>---</td>
</tr>
<tr>
<td>IV</td>
<td>GE4 Plant Physiology &amp; Metabolism +Lab</td>
<td>---</td>
</tr>
</tbody>
</table>
SEMESTER I  

Total 100 x 5 = 500 Marks

I. **ABILITY ENHANCEMENT COMPULSORY COURSE (AECC)**  
   (Credits: Theory-02)

Any One Compulsory Language Communication Prescribed by Ranchi University:
English Communication/ Hindi Communication / NH + MB Communication
(Refer AECC Curriculum of Ranchi University)

II. **GENERIC ELECTIVE (GE 1A):**  
   (Credits: 06)

All Four Papers (Refer Table AI 2.2) of any One Subject to be opted other than the Honours Subject. Refer Table AI 2.4 for name of papers and for Content in detail refer the Syllabus of Opted Generic Elective Subject.

III. **GENERIC ELECTIVE (GE 1B):**  
    (Credits: 06)

All Four Papers (Refer Table AI 2.2) of any One Subject to be opted other than the GE1 & Honours Subject. Refer Table AI 2.4 and for Content in detail refer the Syllabus of Opted Generic Elective Subject.
IV. CORE COURSE – C 1:  
(Credits: Theory-04, Practicals-02) 

Marks: 15 (MSE: 1Hr) + 60 (ESE: 3Hrs) = 75 
Pass Marks: Th (MSE + ESE) = 30 

Instruction to Question Setter for Mid Semester Examination (MSE):

There will be two group of questions. **Group A is compulsory** and will contain five questions of **very short answer type** consisting of 1 mark each. **Group B will contain descriptive type** three questions of five marks each, out of which any two are to answer.

Instruction to Question Setter for End Semester Examination (ESE):

There will be two group of questions. **Group A is compulsory** and will contain two questions. **Question No.1 will be very short answer type** consisting of ten questions of 1 mark each. **Question No.2 will be short answer type** of 5 marks. **Group B will contain descriptive type** five questions of fifteen marks each, out of which any three are to answer.

**Note:** There may be subdivisions in each question asked in Theory Examinations.

ALGAE AND MICROBIOLOGY  
Theory: 60 Lectures

Phycology and Microbiology

Unit 1: Introduction to microbial world

Microbial nutrition, growth and metabolism. Economic importance of viruses with reference to vaccine production, role in research, medicine and diagnostics, as causal organisms of plant diseases. Economic importance of bacteria with reference to their role in agriculture and industry (fermentation and medicine).  
(7 lectures)

Unit 2: Viruses

Discovery, physiochemical and biological characteristics; classification (Baltimore), general structure with special reference to viroids and prions; replication (general account), DNA virus (T-phage), lytic and lysogenic cycle; RNA virus (TMV).  
(7 lectures)

Unit 3: Bacteria

Discovery, general characteristics; Types-archaebacteria, eubacteria, wall-less forms (mycoplasma and spheroplasts); Cell structure; Nutritional types; Reproduction-vegetative, asexual and recombination (conjugation, transformation and transduction).  
(7 lectures)

Unit 4: Algae

General characteristics; Ecology and distribution; range of thallus organization; Cell structure and components; cell wall, pigment system, reserve food (of only groups represented in the syllabus), flagella; methods of reproduction; Classification; criteria, system of Fritsch, and evolutionary classification of Lee (only upto groups); Significant contributions of important phycologists (F.E. Fritsch, G.M. Smith, R.N. Singh, T.V. Desikachary, H.D. Kumar, M.O.P. Iyengar). Role of algae in the environment, agriculture, biotechnology and industry.  
(11 lectures)

Unit 5: Cyanophyta and Xanthophyta

Ecology and occurrence; Range of thallus organization; Cell structure; Reproduction, Morphology and life-cycle of Nostoc and Vaucheria.  
(8 lectures)

Unit 6: Chlorophyta and Charophyta

General characteristics; Occurrence; Range of thallus organization; Cell structure; Reproduction. Morphology and life-cycles of Chlamydomonas, Volvox, Oedogonium, Coleochaete, Chara. Evolutionary significance of Prochloron.  
(8 lectures)

Unit 7: Phaeophyta and Rhodophyta

Characteristics; Occurrence; Range of thallus organization; Cell structure; Reproduction. Morphology and life-cycles of Ectocarpus, Fucus and Polysiphonia.  
(12 lectures)

Session 2019-22 onwards
V.  CORE COURSE- C 2:  
(Credits: Theory-04, Practicals-02)  

Marks : 15 (MSE: 1Hr) + 60 (ESE: 3Hrs) = 75  
Pass Marks: Th (MSE +ESE) = 30  

Instruction to Question Setter for  
Mid Semester Examination (MSE):  

There will be two group of questions. Group A is compulsory and will contain five questions of very short answer type consisting of 1 mark each. Group B will contain descriptive type three questions of five marks each, out of which any two are to answer.  

End Semester Examination (ESE):  

There will be two group of questions. Group A is compulsory and will contain two questions. Question No.1 will be very short answer type consisting of ten questions of 1 mark each. Question No.2 will be short answer type of 5 marks. Group B will contain descriptive type five questions of fifteen marks each, out of which any three are to answer.  

Note: There may be subdivisions in each question asked in Theory Examinations.  

BIOMOLECULES AND CELL BIOLOGY  
Theory: 60 Lectures  

Unit 1: Biomolecules  
Types and significance of chemical bonds; Structure and properties of water; pH and buffers.  

Carbohydrates: Nomenclature and classification; Monosaccharides; Disaccharides; Oligosaccharides and polysaccharides.  
Lipids: Definition and major classes of storage and structural lipids; Fatty acids structure and functions; Essential fatty acids; Triacyl glycerols structure, functions and properties; Phosphoglycerides.  
Proteins: Structure of amino acids; Levels of protein structure-primary, secondary, tertiary and quaternary; Protein denaturation and biological roles of proteins.  
Nucleic acids: Structure of nitrogenous bases; Structure and function of nucleotides; Types of nucleic acids; Structure of A, B, Z types of DNA; Types of RNA; Structure of tRNA.  

(20 lectures)  

Unit 2: Bioenergetics  
Laws of thermodynamics, concept of free energy, endergonic and exergonic reactions, coupled reactions, redox reactions. ATP: structure, its role as a energy currency molecule.  

(4 lectures)  

Unit 3: Enzymes  
Structure of enzyme: holoenzyme, apoenzyme, cofactors, coenzymes and prosthetic group; Classification of enzymes; Features of active site, substrate specificity, mechanism of action (activation energy, lock and key hypothesis, induced - fit theroy), Michaelis – Menten equation, enzyme inhibition and factors affecting enzyme activity.  

(6 lectures)  

Unit 4: The cell  
Cell as a unit of structure and function; Characteristics of prokaryotic and eukaryotic cells; Origin of eukaryotic cell (Endosymbiotic theory).  

(4 lectures)  

Unit 5: Cell wall and plasma membrane  
Chemistry, structure and function of Plant cell wall. Overview of membrane function; fluid mosaic model; Chemical composition of membranes; Membrane transport – Passive, active and facilitated transport, endocytosis and exocytosis.  

(4 lectures)
Unit 6: Cell organelles

**Nucleus:** Structure-nuclear envelope, nuclear pore complex, nuclear lamina, molecular organization of chromatin; nucleolus.

**Cytoskeleton:** Role and structure of microtubules, microfilaments and intermediary filament.

**Chloroplast, mitochondria and peroxisomes:** Structural organization; Function; Semiautonomous nature of mitochondria and chloroplast.

**Endomembrane system:** Endoplasmic Reticulum – Structure, targeting and insertion of proteins in the ER, protein folding, processing; Smooth ER and lipid synthesis, export of proteins and lipids; Golgi Apparatus – organization, protein glycosylation, protein sorting and export from Golgi Apparatus; Lysosomes

(16 lectures)

Unit 7: Cell division

Phases of eukaryotic cell cycle, mitosis and meiosis; Regulation of cell cycle- checkpoints, role of protein kinases.

(6 lectures)
Instruction to Question Setter for
End Semester Examination (ESE):
There will be one Practical Examination of 3Hrs duration. Evaluation of Practical Examination may be as per the following guidelines:

<table>
<thead>
<tr>
<th>Component</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiment</td>
<td>30</td>
</tr>
<tr>
<td>Practical record notebook</td>
<td>10</td>
</tr>
<tr>
<td>Viva-voce</td>
<td>10</td>
</tr>
</tbody>
</table>

GROUP-A  

Microbiology
2. Types of Bacteria to be observed from temporary/permanent slides/photographs. Electron micrographs of bacteria, binary fission, endospore, conjugation, root Nodule.
3. Gram staining.
4. Endospore staining with malachite green using the (endospores taken from soil bacteria).

Phycology
Study of vegetative and reproductive structures of Nostoc, Chlamydomonas (electron micrographs), Volvox, Oedogonium, Coleochaete, Chara, Vaucheria, Ectocarpus, Fucus and Polysiphonia, Procholoron through electron micrographs, temporary preparations and permanent slides.

GROUP-B  

1. Qualitative tests for carbohydrates, reducing sugars, non-reducing sugars, lipids and proteins.
2. Study of plant cell structure with the help of epidermal peel mount of Onion/Rhoeo/ Crinum.
3. Demonstration of the phenomenon of protoplasmic streaming in Hydrilla leaf.
4. Measurement of cell size by the technique of micrometry.
5. Counting the cells per unit volume with the help of haemocytometer. (Yeast/pollen grains).
6. Study of cell and its organelles with the help of electron micrographs.
7. Cytochemical staining of : DNA- Feulgen and cell wall in the epidermal peel of onion using Periodic Schiff’s (PAS) staining technique.
8. Study the phenomenon of plasmolysis and deplasmolysis.
9. Study the effect of organic solvent and temperature on membrane permeability.
10. Study different stages of mitosis and meiosis.
Reference Books

- Campbell, MK (2012) Biochemistry, 7th ed., Published by Cengage Learning
- Campbell, PN and Smith AD (2011) Biochemistry Illustrated, 4th ed., Published by Churchill Livingstone
SEMMESTER II

Total 100 x 5 = 500 Marks

I. ABILITY ENHANCEMENT COMPULSORY COURSE (AECC)
    (Credits: Theory-02)

Marks : 100 (ESE: 3Hrs) =100

Pass Marks Th ESE = 40

Instruction to Question Setter for

End Semester Examination (ESE):

There will be objective type test consisting of hundred questions of 1 mark each. Examinees are required to mark their answer on OMR Sheet provided by the University.

AECC – ENVIRONMENT STUDIES

Unit 1 : Introduction to environmental studies
    Multidisciplinary nature of environmental studies;
    Scope and importance; Concept of sustainability and sustainable development.

(2 lectures)

Unit 2 : Ecosystems
    What is an ecosystem? Structure and function of ecosystem; Energy flow in an ecosystem:
    food chains, food webs and ecological succession. Case studies of the following ecosystems :
    - Forest ecosystem
    - Grassland ecosystem
    - Desert ecosystem
    - Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

(2 lectures)

Unit 3 : Natural Resources : Renewable and Non--renewable Resources
    Land resources and landuse change; Land degradation, soil erosion and desertification.
    Deforestation: Causes and impacts due to mining, dam building on environment, forests,
    biodiversity and tribal populations.
    Water : Use and over--exploitation of surface and ground water, floods, droughts, conflicts
    over water (international & inter--state).
    Energy resources : Renewable and non renewable energy sources, use of alternate energy
    sources, growing energy needs, case studies.

(5 lectures)

Unit 4 : Biodiversity and Conservation
    Levels of biological diversity : genetic, species and ecosystem diversity; Biogeographic
    zones of India; Biodiversity patterns and global biodiversity hot spots
    India as a mega--biodiversity nation; Endangered and endemic species of India
    Threats to biodiversity : Habitat loss, poaching of wildlife, man--wildlife conflicts, biological
    invasions; Conservation of biodiversity : In--situ and Ex--situ conservation of biodiversity.
Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value.

**Unit 5 : Environmental Pollution**
Environmental pollution: types, causes, effects and controls; Air, water, soil and noise pollution
Nuclear hazards and human health risks
Solid waste management: Control measures of urban and industrial waste.
Pollution case studies.

(5 lectures)

**Unit 6 : Environmental Policies & Practices**
Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture
Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context.

(4 lectures)

**Unit 7 : Human Communities and the Environment**
Human population growth: Impacts on environment, human health and welfare.
Resettlement and rehabilitation of project affected persons; case studies.
Disaster management: floods, earthquake, cyclones and landslides.
Environmental movements: Chipko, Silent valley, Bishnois of Rajasthan.
Environmental ethics: Role of Indian and other religions and cultures in environmental conservation.
Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi).

(3 lectures)

**Unit 8 : Field work**
Visit to an area to document environmental assets: river/ forest/ flora/fauna, etc.
Visit to a local polluted site--Urban/Rural/Industrial/Agricultural.
Study of common plants, insects, birds and basic principles of identification.
Study of simple ecosystems--pond, river, Delhi Ridge, etc.

(Equal to 4 lectures)
Suggested Readings:


II. **GENERIC ELECTIVE (GE 2A):**

GE2A paper of First subject selected in Sem-I to be studied. Refer Table A1 2.4 for name of papers and for Content in detail refer the Syllabus of Opted Generic Elective Subject.

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III. **GENERIC ELECTIVE (GE 2B):**

GE2B paper of Second subject selected in Sem-I to be studied. Refer Table A1 2.4 for name of papers and for Content in detail refer the Syllabus of Opted Generic Elective Subject.

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IV. **CORE COURSE - C 3:**

(Credits: Theory-04, Practicals-02)

| Marks | 15 (MSE: 1Hr) + 60 (ESE: 3Hrs) = 75 | Pass Marks | Th (MSE +ESE) = 30 |

**Instruction to Question Setter for Mid Semester Examination (MSE):**

There will be two group of questions. **Group A is compulsory** and will contain five questions of very short answer type consisting of 1 mark each. **Group B will contain descriptive type** three questions of five marks each, out of which any two are to answer.

**End Semester Examination (ESE):**

There will be two group of questions. **Group A is compulsory** and will contain two questions. **Question No.1 will be very short answer type** consisting of ten questions of 1 mark each. **Question No.2 will be short answer type** of 5 marks. **Group B will contain descriptive type** five questions of fifteen marks each, out of which any three are to answer.

**Note:** There may be subdivisions in each question asked in Theory Examinations.

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**MYCOLOGY AND PHYTOPATHOLOGY**

**Theory:** 60 Lectures

**Unit 1: Introduction to true fungi**
General characteristics; Affinities with plants and animals; Thallus organization; Cell wall composition; Nutrition; Classification.

(6 lectures)

**Unit 2: Chytridiomycota and Zygomycota**
Characteristic features; Ecology and significance; Thallus organisation; Reproduction; Life cycle with reference to Synchytrium, Rhizopus.

(5 lecture)

**Unit 4: Ascomycota**
General characteristics (asexual and sexual fruiting bodies); Ecology; Life cycle, Heterokaryosis and parasexuality; Life cycle and classification with reference to Saccharomyces, Aspergillus, Penicillium, Alternaria, Neurospora and Peziza.

(10 lectures)

**Unit 5: Basidiomycota**
General characteristics; Ecology; Life cycle and Classification with reference to black stem rust on wheat Puccinia (Physiological Specialization), loose and covered smut (symptoms only), Agaricus; Bioluminescence, Fairy Rings and Mushroom Cultivation.

(8 lectures)

**Unit 6: Allied Fungi**
General characteristics; Status of Slime molds, Classification; Occurrence; Types of plasmodia; Types of fruiting bodies.

(3 lectures)

**Unit 7: Oomycota**
General characteristics; Ecology; Life cycle and classification with reference to Phytophthora, Albugo.

(4 lectures)

**Unit 8: Symbiotic associations**
Lichen – Occurrence; General characteristics; Growth forms and range of thallus organization; Nature of associations of algal and fungal partners; Reproduction; Mycorrhiza-Ectomycorrhiza, Endomycorrhiza and their significance.

(4 lectures)

**Unit 9: Applied Mycology**
Role of fungi in biotechnology; Application of fungi in food industry (Flavour & texture, Fermentation, Baking, Organic acids, Enzymes, Mycoproteins); Secondary metabolites (Pharmaceutical preparations); Agriculture (Biofertilizers); Mycotoxins; Biological control (Mycfungicides, Mycoherbicides, Mycoinsecticides, Myconematicides); Medical mycology.

(10 Lectures)

**Unit 10: Phytopathology**
Terms and concepts; General symptoms; Geographical distribution of diseases; Etiology; Symptomology; Host-Pathogen relationships; Disease cycle and environmental relation; prevention and control of plant diseases, and role of quarantine. Bacterial diseases – Citrus canker and angular leaf spot of cotton. Viral diseases – Tobacco Mosaic viruses, vein clearing. Fungal diseases – Early blight of potato, Black stem rust of wheat, White rust of crucifers

(10 lectures)
V. CORE COURSE -C 4:

(Credits: Theory-04, Practicals-02)

Marks : 15 (MSE: 1Hr) + 60 (ESE: 3Hrs) = 75
Pass Marks: Th (MSE +ESE) = 30

Instruction to Question Setter for

Mid Semester Examination (MSE):

There will be two group of questions. Group A is compulsory and will contain five questions of very short answer type consisting of 1 mark each. Group B will contain descriptive type three questions of five marks each, out of which any two are to answer.

End Semester Examination (ESE):

There will be two group of questions. Group A is compulsory and will contain two questions. Question No.1 will be very short answer type consisting of ten questions of 1 mark each. Question No.2 will be short answer type of 5 marks. Group B will contain descriptive type five questions of fifteen marks each, out of which any three are to answer.

Note: There may be subdivisions in each question asked in Theory Examinations.

ARCHEGONIATE

Theory: 60 Lectures

Unit 1: Introduction
Unifying features of archegoniates; Transition to land habit; Alternation of generations. (4 lectures)

Unit 2: Bryophytes
General characteristics; Adaptations to land habit; Classification; Range of thallus organization. (6 lectures)

Unit 3: Type Studies- Bryophytes
Classification (up to family), morphology, anatomy and reproduction of Riccia, Marchantia, Pellia, Porella, Anthoceros, Sphagnum and Funaria; Reproduction and evolutionary trends in Riccia, Marchantia, Anthoceros and Funaria (developmental stages not included). Ecological and economic importance of bryophytes with special reference to Sphagnum. (12 lectures)

Unit 4: Pteridophytes
General characteristics; Classification; Early land plants (Cooksonia and Rhynia). (6 lectures)

Unit 5: Type Studies- Pteridophytes
Classification (up to family), morphology, anatomy and reproduction of Psilotum, Selaginella, Equisetum and Pteris (Developmental details not to be included). Apogamy, and apospory, heterospory and seed habit, telome theory, stelar evolution; Ecological and economic importance. (14 lectures)

Unit 6: Gymnosperms
General characteristics, classification (up to family), morphology, anatomy and reproduction of Cycas, Pinus and Gnetum (Developmental details not to be included); Ecological and economic importance. (18 lectures)
Instruction to Question Setter for
End Semester Examination (ESE):
There will be one Practical Examination of 3Hrs duration. Evaluation of Practical Examination may be as per the following guidelines:

Experiment = 30 marks
Practical record notebook = 10 marks
Viva-voce = 10 marks

GROUP-A 60 Lectures

1. Introduction to the world of fungi (Unicellular, coenocytic/septate mycelium, ascocarps & basidiocarps).
2. Rhizopus: study of asexual stage from temporary mounts and sexual structures through permanent slides.
3. Aspergillus and Penicillium: study of asexual stage from temporary mounts. Study of Sexual stage from permanent slides/photographs.
4. Peziza: sectioning through ascocarp.
5. Alternaria: Specimens/photographs and temporary mounts.
6. Puccinia: Herbarium specimens of Black Stem Rust of Wheat and infected Barberry leaves; sections/mounts of spores on wheat and permanent slides of both the hosts.
7. Agaricus: Specimens of button stage and full grown mushroom; sectioning of gills of Agaricus, fairy rings and bioluminescent mushrooms to be shown.
8. Study of phaneroplasmodium from actual specimens and/or photograph. Study of Stemonitis sporangia.
9. Albugo: Study of symptoms of plants infected with Albugo; asexual phase study through section/temporary mounts and sexual structures through permanent slides.
10. Lichens: Study of growth forms of lichens (crustose, foliose and fruticose) on different substrates. Study of thallus and reproductive structures (soredia and apothecium) through permanent slides. Mycorrhizae: ectomycorrhiza and endomycorrhiza (Photographs)

GROUP-B 60 Lectures

2. Marchantia- Morphology of thallus, whole mount of rhizoids & Scales, vertical section of thallus through Gemma cup, whole mount of Gemmae (all temporary slides), vertical section of Antheridiophore, Archegoniophore, longitudinal section of Sporophyte (all permanent slides).
3. Anthoceros- Morphology of thallus, dissection of sporophyte (to show stomata, spores, pseudoelaters, columella) (temporary slide), vertical section of thallus (permanent slide).
4. Pellia, Porella- Permanent slides.
5. Sphagnum- Morphology of plant, whole mount of leaf (permanent slide only).
6. Funaria- Morphology, whole mount of leaf, rhizoids, operculum, peristome, annulus, spores (temporary slides); permanent slides showing antheridial and archegonial heads, longitudinal section of capsule and protonema.
7. Psilotum- Study of specimen, transverse section of synangium (permanent slide).
8. Selaginella- Morphology, whole mount of leaf with ligule, transverse section of stem, whole mount of strobilus, whole mount of microsporophyll and megasporophyll (temporary slides), longitudinal section of strobilus (permanent slide).
9. Equisetum- Morphology, transverse section of internode, longitudinal section of strobilus, transverse section of strobilus, whole mount of sporangiophore, whole mount of spores (wet and dry) (temporary slide), transverse section of rhizome (permanent slide).
10. Pteris- Morphology, transverse section of rachis, vertical section of sporophyll, whole mount of sporangium, whole mount of spores (temporary slides), transverse section of rhizome, whole mount of prothallus with sex organs and young sporophyte (permanent slide).
11. Cycas- Morphology (coralloid roots, bulbil, leaf), whole mount of microsporophyll, transverse section of coralloid root, transverse section of rachis, vertical section of leaflet, vertical section of microsporophyll, whole mount of spores (temporary slides), longitudinal section of ovule, transverse section of root (permanent slide).
12. Pinus- Morphology (long and dwarf shoots, whole mount of dwarf shoot, male and female cones), transverse section of Needle, transverse section of stem, longitudinal section of male cone (permanent slide), transverse section of male cone, whole mount of microsporophyll, whole mount of Microspores (temporary slides), longitudinal section of female cone, tangential longitudinal section & radial longitudinal sections stem (permanent slide).
13. Gnetum- Morphology (stem, male & female cones), transverse section of stem, vertical section of ovule (permanent slide)

Reference Books

### ELEMENTARY COMPUTER APPLICATION SOFTWARES:

A Common Syllabus Prescribed by Ranchi University  

**Theory:** 30 Lectures

**Objective of the Course**
The objective of the course is to generate qualified manpower in the area of Information Technology (IT) and Graphic designing which will enable such person to work seamlessly at any Offices, whether Govt. or Private or for future entrepreneurs in the field of IT.

#### A. INTRODUCTION TO COMPUTER SYSTEM

**Basic Computer Concept**
Computer Appreciation - Characteristics of Computers, Input, Output, Storage units, CPU, Computer System.  

(1 Lecture)

**Input and Output Devices**
Input Devices - Keyboard, Mouse, joystick, Scanner, web cam,  

(4 lectures)

**Computer Memory and Processors**

(5 lectures)

**Numbers Systems and Logic Gates**
Decimal number system, Binary number system, Octal number system, Hexadecimal number system, Inter-conversion between the number systems. Basic Logic gates-AND, OR, NOT, Universal logic gates- NAND, NOR  

(3 lectures)

**Computer Software**
Computer Software- Relationship between Hardware and Software, System Software, Application Software, Compiler, Names of some high level languages, Free domain software.  

(2 Lectures)
Internet & its uses
History of Internet, WWW and Web Browsers: Web Browsing software, Surfing the Internet, Chatting on Internet, Basic of electronic mail, Using Emails, Document handling, Network definition, Common terminologies: LAN, WAN, MAN, Node, Host, Workstation, Bandwidth, Network Components: Servers, Clients, Communication Media. Wireless network

Operating system-Windows

B. MICROSOFT OFFICE 2007 AND LATEST VERSIONS

Word Processing

Microsoft Excel (Spreadsheet)
Spreadsheet Concepts, Creating, Saving and Editing a Workbook, Inserting, Deleting Work Sheets, entering data in a cell / formula Copying and Moving from selected cells, handling operators in Formulae, Functions: Mathematical, Logical, statistical, text, financial, Date and Time functions, Using Function Wizard. Formatting a Worksheet: Formatting Cells changing data alignment, changing date, number, character or currency format, changing font, adding borders and colors, Printing worksheets, Charts and Graphs – Creating, Previewing, Modifying Charts. Integrating word processor, spread sheets, web pages. Pivot table, goal seek, Data filter and scenario manager

Microsoft Power Point (Presentation Package)

Reference Books
- Faithe wempen, word 2016 in depth 1st edition, que publishing(2015)
- Steven welkler, Office 2016 for beginners, Create Space Independent publishing Plateform (2016)
SKILL ENHANCEMENT LAB- SEC 1 LAB

A. MS-WORD LAB ASSIGNMENT

1. Write down the following Paragraph OR any one provided by your teacher;

Without a doubt, the Internet is one of the most important inventions of modern times. The Internet is a global interconnected computer networks which allow each connected computer to share and exchange information with each other. The origins of the Internet can be traced to the creation of Advanced Research Projects Agency Network (ARPANET) as a network of computers under the auspices of the U.S. Department of Defense in 1969.

Apply following effects on The paragraph:
   i. Paragraph **font-size** and **font-type** must be 12 Verdana.
   ii. Paragraph **alignment** must be justified and double line spacing.
   iii. **Highlight** the “(ARPANET)” with green color.
   iv. Make the “Internet” keywords **Bold and Italic**.
   v. Insert any “**WordArt**” and a **symbol** to your document.
   vi. Insert a **clipart** to your document.
   vii. Add following lines to your document:
       Internet, Intranet, Extranet, URL, WWW, Networking, Protocols, HTTP, TCP/IP

2. Create a Table of following fields:
   Name, Surname, Age, Gender, Job and apply the following effects
   i. Insert 10 records
   ii. Font size should be 12
   iii. Title size should be 14
   iv. Font type should be Times new Roman
   v. Title color should be blue
   vi. Text color should be black
   vii. Table border should be 2

3. Write a letter on ‘Road Safety’ and send to ‘Multiple Recipients’ using mail merge.

4. Type the paragraph given below:

Today, the Internet is a public, cooperative and self-sustaining facility accessible to hundreds of millions of people worldwide. Physically, the Internet uses a portion of the total resources of the currently existing public telecommunication networks. Technically, what distinguishes the Internet is its use of a set of protocols called TCP/IP (for Transmission Control Protocol/Internet Protocol). Two recent adaptations of Internet technology, the intranet and the extranet, also make use of the TCP/IP protocol. Today, the Internet is a public, cooperative and self-sustaining facility accessible to hundreds of millions of people worldwide. Physically, the Internet uses a portion of the total resources of the currently existing public telecommunication networks. Technically, what distinguishes the Internet is its use of a set of protocols called TCP/IP (for Transmission Control Protocol/Internet Protocol). Two recent adaptations of Internet technology, the intranet and the extranet, also make use of the TCP/IP protocol.
Apply the following:

i. Change Internet into Internets at a time
ii. Heilight TCP/IP in red color
iii. Replace protocol into protocols
iv. Find the word “Public”

B. MICROSOFT EXCEL LAB ASSIGNMENT

Basic Formatting and Spreadsheet Manipulation

1. Add rows and columns to an existing spreadsheet
2. Reformat data (center, comma and currency styles, bold, text color)
3. Work with a simple formula (product) and function (sum)

Assignment

1. Create a workbook as shown below.
2. To enter new rows or columns, simply click on the row or column header to select the whole row or column. Then right click with the mouse and choose insert.
3. Add the new row for S Spade with the data that’s shown below (between the original rows 7 and 8).
4. Add a column for gender and the data as shown below (between the original columns A and B). Enter the appropriate gender for yourself in the last row.

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Male/Female</td>
<td>Genre</td>
<td>Number of Songs</td>
</tr>
<tr>
<td>J Smith</td>
<td>F</td>
<td>Blues</td>
<td>50</td>
</tr>
<tr>
<td>B Doe</td>
<td>M</td>
<td>Country</td>
<td>110</td>
</tr>
<tr>
<td>S Spade</td>
<td>F</td>
<td>Country</td>
<td>200</td>
</tr>
<tr>
<td>F Zappa</td>
<td>M</td>
<td>Blues</td>
<td>1400</td>
</tr>
<tr>
<td>F Zappa</td>
<td>M</td>
<td>Alternative</td>
<td>2300</td>
</tr>
<tr>
<td>J Smith</td>
<td>F</td>
<td>Alternative</td>
<td>150</td>
</tr>
<tr>
<td>S Spade</td>
<td>F</td>
<td>Blues</td>
<td>1000</td>
</tr>
<tr>
<td>B Doe</td>
<td>M</td>
<td>Blues</td>
<td>75</td>
</tr>
<tr>
<td>youname</td>
<td>M</td>
<td>Blues</td>
<td>800</td>
</tr>
</tbody>
</table>

5. Center the data in columns B and C. Do this by selecting the whole column and click the center icon on the ribbon.
6. Bold the data in row 1, the column headings (ensure that the data all remains visible within the column boundaries).
7. Change the font color for row 1 to Blue.
8. Change the format of the data in column D to comma style (no decimal places showing). There is an icon on the home tab that sets it to comma style easily.
9. Add two new column labels to the right of the current columns; Unit Price and Total Cost. (They will be in columns E and F.) These two columns of data should be currency type so that the dollar sign is shown. There is an icon to quickly format the selected column as currency type.
10. All tunes are $.99, so enter that value for all rows in Column E. You can copy quickly by using the Auto Fill handle and drag that amount down. When you over your mouse over the tiny square in
the bottom right hand corner of the active cell, your mouse shape will become a skinny plus sign, and you can click and drag that cell to make a copy.

11. Calculate Total Cost (column F) as *column D times Column E*. You will type in a formula like this into cell F2:  \( \text{=D2*E2} \) (Be sure to begin the formula with an equal sign)

12. Use the AutoFill (skinny plus sign) again to copy the formula down column F; down to F10. Double check the picture below to make sure yours has the correct values

13. Add a border to all of the cells (A1-f10) using the Borders tool in the Fonts group on the Home Tab.

14. Change the page layout to landscape. Do this by clicking the Page Layout tab on the ribbon and then to Orientation to Landscape.

15. Save the file.

16. Click in cell F11 and Use the sum function or the shortcut icon that looks like \( \sum \) to get the total of the Total Cost column.

17. Ensure that the data is all visible within the column boundaries. Make the columns wider if needed.

18. Save the workbook. Your final spreadsheet should look like the following when printed.

<table>
<thead>
<tr>
<th>Name</th>
<th>Male/Female</th>
<th>Genre</th>
<th>Number of Songs</th>
<th>Unit Price</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>J Smith</td>
<td>F</td>
<td>Blues</td>
<td>50</td>
<td>$ 0.99</td>
<td>$ 49.50</td>
</tr>
<tr>
<td>B Doe</td>
<td>M</td>
<td>Country</td>
<td>110</td>
<td>$ 0.99</td>
<td>$ 108.90</td>
</tr>
<tr>
<td>S Spade</td>
<td>F</td>
<td>Country</td>
<td>200</td>
<td>$ 0.99</td>
<td>$ 198.00</td>
</tr>
<tr>
<td>F Zappa</td>
<td>M</td>
<td>Blues</td>
<td>1,400</td>
<td>$ 0.99</td>
<td>$ 1,386.00</td>
</tr>
<tr>
<td>F Zappa</td>
<td>M</td>
<td>Alternative</td>
<td>2,300</td>
<td>$ 0.99</td>
<td>$ 2,277.00</td>
</tr>
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**Create a sample table given below in Excel**

- Using formula find Total
- Find the maximum value using MAX function from the Units column
- Find minimum value from Total column

Session 2019-22 onwards
C. MS-POWERPOINT LAB ASSIGNMENT

Activity 1 : Using Text & Background/Themes
i. Create one new slide and insert any text.
ii. To make your slide more attractive, use the themes or background.
iii. Make sure it apply for every slide not only one slide.

Activity 2 : Apply Custom Animation On Text
i. Use the custom animation to add effects on your text. Set the text move after you click the mouse.
ii. If you have more than one text, add effects for each of text.

Activity 3 : Insert Image & WordArt
i. Insert one new blank slide.
ii. Choose one pictures or clip art from any source and insert in your new slide.
iii. Using the WordArt, make a note or title on your picture.
iv. Use the custom animation again to add effects on your picture and WordArt.

Activity 4 : Insert Text Box
i. Insert one new blank slide.
ii. Use the text box to insert one paragraph of text and adjust your text.

Activity 5 : Insert Smart Art
i. Insert one new blank slide.
ii. Insert the Smart Art and put your text on the Smart Art.

Session 2019-22 onwards
Activity 6 : Insert Audio
   i. Back to your first slide and insert one audio on that slide. The audio must play automatically when you show your slide.
   ii. Make sure the speaker also not appear when you show your slide. (the icon).
   iii. The audio must play when you show alls your slide, not only one slide.

Activity 7 : inserting Video
   i. Insert one new slide and insert one short video

Activity 8 : Save File
   i. Save your file

Activity 9 : Create Photo Album & Hyperlink
   i. Insert one new slide and put a text ex: “My Photo Album”
   ii. Create one photo album and adjust your text and your photos
   iii. Save your photo album with a new file
   iv. Make a hyperlink to your photo using the text “My Photo Album”

Reference Books:
- Faithe wempen, word 2016 in depth 1st edition, que publishing(2015)
- steven welkler, Office 2016 for bigners, Create Space Independent publishing plateform(2016)

II. GENERIC ELECTIVE (GE 3A):  
   (Credits: 06)
   GE3A paper of First subject selected in Sem-I to be studied. Refer Table AI 2.4 for name of papers and for Content in detail refer the Syllabus of Opted Generic Elective Subject.

III. GENERIC ELECTIVE (GE 3B):  
   (Credits: 06)
   GE3B paper of Second subject selected in Sem-I to be studied. Refer Table AI 2.4 for name of papers and for Content in detail refer the Syllabus of Opted Generic Elective Subject.
Instruction to Question Setter for
Mid Semester Examination (MSE):
There will be two group of questions. Group A is compulsory and will contain five questions of very short answer type consisting of 1 mark each. Group B will contain descriptive type three questions of five marks each, out of which any two are to answer.

End Semester Examination (ESE):
There will be two group of questions. Group A is compulsory and will contain two questions. Question No.1 will be very short answer type consisting of ten questions of 1 mark each. Question No.2 will be short answer type of 5 marks. Group B will contain descriptive type five questions of fifteen marks each, out of which any three are to answer.

Note: There may be subdivisions in each question asked in Theory Examinations.

MORPHOLOGY AND ANATOMY

Anatomy of Angiosperms
Unit 1: Introduction and scope of Plant Anatomy
Applications in systematics, forensics and pharmacognosy. (4 Lectures)

Unit 2: Structure and Development of Plant Body
Internal organization of plant body: The three tissue systems, types of cells and tissues. Development of plant body: Polarity, Cytodifferentiation and organogenesis during embryogenic development. (6 Lectures)

Unit 2: Tissues
Classification of tissues; Simple and complex tissues (no phylogeny); cytodifferentiation of tracheary elements and sieve elements; Pits and plasmodesmata; Wall ingrowths and transfer cells, adcrustation and incrustation, Ergastic substances. Hydathodes, cavities, lithocysts and laticifers. (12 Lectures)

Unit 3: Apical meristems
Evolution of concept of organization of shoot apex (Apical cell theory, Histogen theory, Tunica Corpus theory, continuing meristematic residue, cytohistological zonation); Types of vascular bundles; Structure of dicot and monocot stem. Origin, development, arrangement and diversity in size and shape of leaves; Structure of dicot and monocot leaf, Kranz anatomy. Organization of root apex (Apical cell theory, Histogen theory, Korper-Kappe theory); Quiescent centre; Root cap; Structure of dicot and monocot root; Endodermis, exodermis and origin of lateral root. (15 Lectures)

Unit 4: Vascular Cambium and Wood
Structure, function and seasonal activity of cambium; Secondary growth in root and stem. Axially and radially oriented elements; Types of rays and axial parenchyma; Cyclic aspects and reaction wood; Sapwood and heartwood; Ring and diffuse porous wood; Early and late wood, tyloses; Dendrochronology. Development and composition of periderm, rhytidome and lenticels. (15 Lectures)

Unit 5: Adaptive and Protective Systems
Epidermal tissue system, cuticle, epicuticular waxes, trichomes (uni-and multicellular, glandular and nonglandular, two examples of each), stomata (classification); Adercrustation and incrustation; Anatomical adaptations of xerophytes and hydrophytes. (8 Lectures)
V. **CORE COURSE -C 6:**

(Credits: Theory-04, Practicals-02)

Marks : 15 (MSE: 1Hr) + 60 (ESE: 3Hrs) = 75
Pass Marks: Th (MSE +ESE) = 30

**Instruction to Question Setter for**

**Mid Semester Examination (MSE):**
There will be two group of questions. **Group A is compulsory** and will contain five questions of very short answer type consisting of 1 mark each. **Group B will contain descriptive type** three questions of five marks each, out of which any two are to answer.

**End Semester Examination (ESE):**
There will be two group of questions. **Group A is compulsory** and will contain two questions. **Question No.1 will be very short answer type** consisting of ten questions of 1 mark each. **Question No.2 will be short answer type** of 5 marks. **Group B will contain descriptive type** five questions of fifteen marks each, out of which any three are to answer.

**Note:** There may be subdivisions in each question asked in Theory Examinations.

**ECONOMIC BOTANY**

Theory: 60 Lectures

**Unit 1: Origin of Cultivated Plants**
Concept of Centres of Origin, their importance with reference to Vavilov’s work. Examples of major plant introductions; Crop domestication and loss of genetic diversity; evolution of new crops/varieties, importance of germplasm diversity. (6 lectures)

**Unit 2: Cereals**
Wheat and Rice (origin, morphology, processing & uses); Brief account of millets. (6 lectures)

**Unit 3: Legumes**
Origin, morphology and uses of Chick pea, Pigeon pea and fodder legumes. Importance to man and ecosystem. (6 lectures)

**Unit 4: Sources of sugars and starches**
Morphology and processing of sugarcane, products and by-products of sugarcane industry. Potato – morphology, propagation & uses. (4 lectures)

**Unit 5: Spices**
Listing of important spices, their family and part used. Economic importance with special reference to fennel, saffron, clove and black pepper. (6 lectures)

**Unit 6: Beverages**
Tea, Coffee (morphology, processing & uses) (4 lectures)

**Unit 7: Sources of oils and fats**
General description, classification, extraction, their uses and health implications groundnut, coconut, linseed, soybean, mustard and coconut (Botanical name, family & uses). Essential Oils: General account, extraction methods, comparison with fatty oils & their uses. (10 lectures)

**Unit 8: Natural Rubber**
Para-rubber: tapping, processing and uses. (3 lectures)

**Unit 9: Drug-yielding plants**
Therapeutic and habit-forming drugs with special reference to Cinchona, Digitalis, Papaver and Cannabis; Tobacco (Morphology, processing, uses and health hazards). (8 lectures)

**Unit 10: Timber plants**
General account with special reference to teak and pine. (3 Lectures)

**Unit 11: Fibers**
Classification based on the origin of fibers; Cotton, Coir and Jute (morphology, extraction and uses). (4 lectures)

Session 2019-22 onwards
VI.  CORE COURSE -C 7:  
(Credits: Theory-04, Practicals-02)

Marks : 15 (MSE: 1Hr) + 60 (ESE: 3Hrs) = 75  
Pass Marks: Th (MSE +ESE) = 30

Instruction to Question Setter for

Mid Semester Examination (MSE):
There will be two group of questions. Group A is compulsory and will contain five questions of very short answer type consisting of 1 mark each. Group B will contain descriptive type three questions of five marks each, out of which any two are to answer.

End Semester Examination (ESE):
There will be two group of questions. Group A is compulsory and will contain two questions. Question No.1 will be very short answer type consisting of ten questions of 1 mark each. Question No.2 will be short answer type of 5 marks. Group B will contain descriptive type five questions of fifteen marks each, out of which any three are to answer.

Note: There may be subdivisions in each question asked in Theory Examinations.

GENETICS

Unit 1: Mendelian genetics and its extension
Mendelism: History; Principles of inheritance; Chromosome theory of inheritance; Autosomes and sex chromosomes; Probability and pedigree analysis; Incomplete dominance and codominance; Multiple alleles, Lethal alleles, Epistasis, Pleiotropy, Recessive and Dominant traits, Penetrance and Expressivity, Numericals; Polygenic inheritance.  
(16 lectures)

Unit 2: Extrachromosomal Inheritance
Chloroplast mutation: Variegation in Four o’clock plant; Mitochondrial mutations in yeast; Maternal effects-shell coiling in snail; Infective heredity- Kappa particles in Paramecium.  
(6 lectures)

Unit 3: Linkage, crossing over and chromosome mapping
Linkage and crossing over-Cytological basis of crossing over; Recombination frequency, two factor and three factor crosses; Interference and coincidence; Numericals based on gene mapping; Sex Linkage.  
(12 lectures)

Unit 4: Variation in chromosome number and structure
Deletion, Duplication, Inversion, Translocation, Position effect, Euploid and Aneuploid  
(8 lectures)

Unit 5: Gene mutations
Types of mutations; Molecular basis of Mutations; Mutagens – physical and chemical (Base analogs, deaminating, alkylating and intercalating agents); Detection of mutations: CIB method. Role of Transposons in mutation. DNA repair mechanisms.  
(6 lectures)

Unit 6: Fine structure of gene
Classical vs molecular concepts of gene; Cis-Trans complementation test for functional allelism; Structure of Phage T4, rII Locus.  
(6 lectures)

Unit 6. Population and Evolutionary Genetics
Allele frequencies, Genotype frequencies, Hardy-Weinberg Law, role of natural selection, mutation, genetic drift. Genetic variation and Speciation.  
(6 lectures)

Session 2019-22 onwards
Instruction to Question Setter for

End Semester Examination (ESE):

There will be one Practical Examination of 3Hrs duration. Evaluation of Practical Examination may be as per the following guidelines:

<table>
<thead>
<tr>
<th>Experiment</th>
<th>= 45 marks</th>
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<tbody>
<tr>
<td>Practical record notebook</td>
<td>= 15 marks</td>
</tr>
<tr>
<td>Viva-voce</td>
<td>= 15 marks</td>
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</tbody>
</table>

GROUP-A 60 Lectures

1. Study of anatomical details through permanent slides/temporary stain mounts/macerations/museum specimens with the help of suitable examples.
3. Distribution and types of parenchyma, collenchyma and sclerenchyma.
4. Xylem: Tracheary elements-tracheids, vessel elements; thickenings; perforation plates; xylem fibres.
5. Wood: ring porous; diffuse porous; tyloses; heart- and sapwood.
6. Phloem: Sieve tubes-sieve plates; companion cells; phloem fibres.
7. Epidermal system: cell types, stomata types; trichomes: non-glandular and glandular.
9. Stem: monocot, dicot - primary and secondary growth; periderm; lenticels.
10. Leaf: isobilateral, dorsiventral, C4 leaves (Kranz anatomy).

GROUP-B 60 Lectures

2. Legumes: Soybean, Groundnut, (habit, fruit, seed structure, micro-chemical tests).
3. Sources of sugars and starches: Sugarcane (habit sketch; cane juice- micro-chemical tests), Potato (habit sketch, tuber morphology, T.S. tuber to show localization of starch grains, w.m. starch grains, micro-chemical tests).
4. Spices: Black pepper, Fennel and Clove (habit and sections).
5. Beverages: Tea (plant specimen, tea leaves), Coffee (plant specimen, beans).
7. Essential oil-yielding plants: Habit sketch of Rosa, Vetiveria, Santalum and Eucalyptus (specimens/photosgraphs).
10. Tobacco: specimen and products of Tobacco.
12. Fiber-yielding plants: Cotton (specimen, whole mount of seed to show lint and fuzz; whole mount of fiber and test for cellulose), Jute (specimen, transverse section of stem, test for lignin on transverse section of stem and fiber).
GROUP-C

60 Lectures

1. Meiosis through temporary squash preparation.
2. Mendel’s laws through seed ratios. Laboratory exercises in probability and chi-square.
3. Chromosome mapping using point test cross data.
4. Pedigree analysis for dominant and recessive autosomal and sex linked traits.
5. Incomplete dominance and gene interaction through seed ratios
8. Study of aneuploidy: Down’s, Klinefelter’s and Turner’s syndromes.
9. Photographs/Permanent Slides showing Translocation Ring, Laggards and Inversion Bridge.
10. Study of human genetic traits: Sickle cell anemia, Xeroderma Pigmentosum, Albinism, red-green Colour blindness, Widow’s peak, Rolling of tongue, Hitchhiker’s thumb and Attached ear lobe.

Reference Books:


Session 2019-22 onwards
SEMESTER IV

Total 100 x 6 = 600 Marks

I. SKILL ENHANCEMENT COURSE SEC 2:

Instruction to Question Setter for

End Semester Examination (ESE):

There will be two group of questions. Group A is compulsory and will contain three questions. Question No.1 will be very short answer type consisting of ten questions of 1 mark each. Question No.2 & 3 will be short answer type of 5 marks. Group B will contain descriptive type six questions of 20 marks each, out of which any four are to answer.

Note: There may be subdivisions in each question asked in Theory Examinations.

MUSHROOM CULTURE TECHNOLOGY

Unit 1: Introduction:
History. Nutritional and medicinal value of edible mushrooms; Poisonous mushrooms. Types of edible mushrooms available in India - Volvariella volvacea, Pleurotus citrinopileatus, Agaricus bisporus. (5 Lectures)

Unit 2: Cultivation Technology:
Infrastructure: substrates (locally available) Polythene bag, vessels, Inoculation hook, inoculation loop, low cost stove, sieves, culture rack, mushroom unit (Thatched house) water sprayer, tray, small polythene bag. Pure culture: Medium, sterilization, preparation of spawn, multiplication. Mushroom bed preparation - paddy straw, sugarcane trash, maize straw, banana leaves. Factors affecting the mushroom bed preparation - Low cost technology, Composting technology in mushroom production. (12 Lectures)

Unit 3: Storage and nutrition:
Short-term storage (Refrigeration - upto 24 hours) Long term Storage (canning, pickels, papads), drying, storage in salt solutions. Nutrition - Proteins - amino acids, mineral elements nutrition - Carbohydrates, Crude fibre content - Vitamins. (8 Lectures)

Unit 4: Food Preparation:
Types of foods prepared from mushroom. Research Centres - National level and Regional level. Cost benefit ratio - Marketing in India and abroad, Export Value. (5 lectures)

Reference Books:
II. **GENERIC ELECTIVE (GE 4A):** (Credits: 06)

GE4A paper of First subject selected in Sem-I to be studied. Refer Table AI 2.4 for name of papers and for Content in detail refer the Syllabus of Opted Generic Elective Subject.

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III. **GENERIC ELECTIVE (GE 4B):** (Credits: 06)

GE4B paper of Second subject selected in Sem-I to be studied. Refer Table AI 2.4 for name of papers and for Content in detail refer the Syllabus of Opted Generic Elective Subject.

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IV. **CORE COURSE - C 8:** (Credits: Theory-04, Practicals-02)

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<th>Pass Marks: Th (MSE + ESE) = 30</th>
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**Instruction to Question Setter for**

**Mid Semester Examination (MSE):**

There will be two group of questions. **Group A is compulsory and will contain five questions of very short answer type consisting of 1 mark each. Group B will contain descriptive type three questions of five marks each, out of which any two are to answer.**

**End Semester Examination (ESE):**

There will be two group of questions. **Group A is compulsory and will contain two questions. Question No.1 will be very short answer type consisting of ten questions of 1 mark each. Question No.2 will be short answer type of 5 marks. Group B will contain descriptive type five questions of fifteen marks each, out of which any three are to answer.**

**Note:** There may be subdivisions in each question asked in Theory Examinations.

**MOLECULAR BIOLOGY**

**Theory: 60 Lectures**

**Unit 1: Nucleic acids : Carriers of genetic information**

Historical perspective; DNA as the carrier of genetic information (Griffith’s, Hershey & Chase, Avery, McLeod & McCarty, Fraenkel-Conrat’s experiment.)

(4 lectures)

**Unit 2. The Structures of DNA and RNA / Genetic Material**

DNA Structure: Miescher to Watson and Crick- historic perspective, DNA structure, Salient features of double helix, Types of DNA, Types of genetic material, denaturation and renaturation, cot curves; Organization of DNA- Prokaryotes, Viruses, Eukaryotes.RNA Structure Organelle DNA -- mitochondria and chloroplast DNA. The Nucleosome Chromatin structure- Euchromatin, Heterochromatin- Constitutive and Facultative heterochromatin.

(10 lectures)

**Unit 2: The replication of DNA**

Chemistry of DNA synthesis (Kornberg’s discovery); General principles – bidirectional, semiconservative and semi discontinuous replication, RNA priming; Various models of DNA replication, including rolling circle, θ (theta) mode of replication, replication of linear ds-DNA, replication of the 5’end of linear chromosome; Enzymes involved in DNA replication.

(10 lectures)

**Unit 3: Central dogma and genetic code**

Key experiments establishing-The Central Dogma (Adaptor hypothesis and discovery of mRNA template), Genetic code (deciphering & salient features)

(2 lectures)

Session 2019-22 onwards
Unit 4: Transcription
Transcription in prokaryotes and eukaryotes. Principles of transcriptional regulation; Prokaryotes: Regulation of lactose metabolism and tryptophan synthesis in E.coli. Eukaryotes: transcription factors, heat shock proteins, steroids and peptide hormones; Gene silencing.  
(18 lectures)

Unit 5: Processing and modification of RNA
Split genes-concept of introns and exons, removal of introns, spliceosome machinery, splicing pathways, group I and group II intron splicing, alternative splicing eukaryotic mRNA processing (5’ cap, 3’ polyA tail); Ribozymes; RNA editing and mRNA transport.  
(8 lectures)

Unit 6: Translation
Ribosome structure and assembly, mRNA; Charging of tRNA, aminoacyl tRNA synthetases; Various steps in protein synthesis, proteins involved in initiation, elongation and termination of polypeptides; Fidelity of translation; Inhibitors of protein synthesis; Post-translational modifications of proteins.  
(8 lectures)
V. **CORE COURSE -C 9:** (Credits: Theory-04, Practicals-02)

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<td>15 (MSE: 1Hr) + 60 (ESE: 3Hrs) = 75</td>
<td>Th (MSE +ESE) = 30</td>
</tr>
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**Instruction to Question Setter for**

**Mid Semester Examination (MSE):**
There will be two group of questions. **Group A is compulsory** and will contain five questions of very short answer type consisting of 1 mark each. **Group B will contain descriptive type** three questions of five marks each, out of which any two are to answer.

**End Semester Examination (ESE):**
There will be two group of questions. **Group A is compulsory** and will contain two questions. **Question No.1 will be very short answer type** consisting of ten questions of 1 mark each. **Question No.2 will be short answer type** of 5 marks. **Group B will contain descriptive type** five questions of fifteen marks each, out of which any three are to answer.

**Note:** There may be subdivisions in each question asked in Theory Examinations.

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**PLANT ECOLOGY AND PHYTOGEOGRAPHY**

**Theory: 60 Lectures**

**Unit 1: Introduction**
Basic concepts; Levels of organization. Inter-relationships between the living world and the environment, the components and dynamism, homeostasis.  

**Unit 2: Soil**
Importance; Origin; Formation; Composition; Physical; Chemical and Biological components; Soil profile; Role of climate in soil development.  

**Unit 3: Water**
Importance: States of water in the environment; Atmospheric moisture; Precipitation types (rain, fog, snow, hail, dew); Hydrological Cycle; Water in soil; Water table.  

**Unit 4: Light, temperature, wind and fire**
Variations; adaptations of plants to their variation.  

**Unit 5: Biotic interactions**
Trophic organization, basic source of energy, autotrophy, heterotrophy; symbiosis, commensalism, parasitism; food chains and webs; ecological pyramids; biomass, standing crop.  

**Unit 6: Population ecology**
Characteristics and Dynamics .Ecological Speciation  

**Unit 7: Plant communities**
Concept of ecological amplitude; Habitat and niche; Characters: analytical and synthetic; Ecotone and edge effect; Dynamics: succession – processes, types; climax concepts.  

**Unit 8: Ecosystems**
Structure; Processes; Trophic organisation; Food chains and Food webs; Ecological pyramids.  

**Unit 9: Functional aspects of ecosystem**
Principles and models of energy flow; Production and productivity; Ecological efficiencies; Biogeochemical cycles; Cycling of Carbon, Nitrogen and Phosphorus.  

**Unit 10: Phytogeography**
Principles; Continental drift; Theory of tolerance; Endemism; Brief description of major terrestrial biomes (one each from tropical, temperate & tundra); Phytogeographical division of India; Local Vegetation.  

Session 2019-22 onwards
VI. **CORE COURSE - C 10:**

*(Credits: Theory-04, Practicals-02)*

| Marks : 15 (MSE: 1Hr) + 60 (ESE: 3Hrs) = 75 | Pass Marks: Th (MSE +ESE) = 30 |

**Instruction to Question Setter for**

**Mid Semester Examination (MSE):**

*There will be two group of questions. Group A is compulsory and will contain five questions of very short answer type consisting of 1 mark each. Group B will contain descriptive type three questions of five marks each, out of which any two are to answer.*

**End Semester Examination (ESE):**

*There will be two group of questions. Group A is compulsory and will contain two questions. Question No.1 will be very short answer type consisting of ten questions of 1 mark each. Question No.2 will be short answer type of 5 marks. Group B will contain descriptive type five questions of fifteen marks each, out of which any three are to answer.*

**Note:** There may be subdivisions in each question asked in Theory Examinations.

**PLANT SYSTEMATICS**

*(Theory: 60 Lectures)*

**Unit 1: Significance of Plant systematics**
Introduction to systematics; Plant identification, Classification, Nomenclature. Evidences from palynology, cytology, phytochemistry and molecular data. Field inventory; Functions of Herbarium; Important herbaria and botanical gardens of the world and India; Virtual herbarium; E-flora; Documentation: Flora, Monographs, Journals; Keys: Single access and Multi-access.

*(12 lectures)*

**Unit 2: Taxonomic hierarchy**
Concept of taxa (family, genus, species); Categories and taxonomic hierarchy; Species concept (taxonomic, biological, evolutionary).

*(6 lectures)*

**Unit 3: Botanical nomenclature**
Principles and rules (ICN); Ranks and names; Typification, author citation, valid publication, rejection of names, principle of priority and its limitations; Names of hybrids.

*(10 lectures)*

**Unit 4: Systems of classification**
Major contributions of Theophrastus, Bauhin, Tournefort, Linnaeus, Adanson, de Candolle, Bessey, Hutchinson, Takhtajan and Cronquist; Classification systems of Bentham and Hooker (upto series) and Engler and Prantl (upto series); Brief reference of Angiosperm Phylogeny Group (APG III) classification.

*(12 lectures)*

**Unit 5: Biometrics, numerical taxonomy and cladistics**
Characters; Variations; OTUs, character weighting and coding; Cluster analysis; Phenograms, cladograms (definitions and differences).

*(12 lectures)*

**Unit 6: Phylogeny of Angiosperms**
Terms and concepts (primitive and advanced, homology and analogy, parallelism and convergence, monophyly, Paraphyly, polyphyly and clades). Origin and evolution of angiosperms; Co-evolution of angiosperms and animals; Methods of illustrating evolutionary relationship (phylogenetic tree, cladogram).

*(10 lectures)*

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Session 2019-22 onwards
Instruction to Question Setter for

End Semester Examination (ESE):

There will be one Practical Examination of 3Hrs duration. Evaluation of Practical Examination may be as per the following guidelines:

<table>
<thead>
<tr>
<th>Experiment</th>
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<tr>
<td>Viva-voce</td>
<td>15 marks</td>
</tr>
</tbody>
</table>

GROUP-A

1. Preparation of LB medium and raising E.Coli.
2. Isolation of genomic DNA from E.Coli.
3. DNA isolation from cauliflower head.
4. DNA estimation by diphenylamine reagent/UV Spectrophotometry.
5. Study of DNA replication mechanisms through photographs (Rolling circle, Theta replication and semi-discontinuous replication).
6. Study of structures of prokaryotic RNA polymerase and eukaryotic RNA polymerase II through photographs.
7. Photographs establishing nucleic acid as genetic material (Messelson and Stahl’s, Avery et al, Griffith’s, Hershey & Chase’s and Fraenkel & Conrat’s experiments)
8. Study of the following through photographs: Assembly of Spliceosome machinery; Splicing mechanism in group I & group II introns; Ribozyme and Alternative splicing.

GROUP-B

1. Study of instruments used to measure microclimatic variables: Soil thermometer, maximum and minimum thermometer, anemometer, psychrometer/hygrometer, rain gauge and lux meter.
2. Determination of pH of various soil and water samples (pH meter, universal indicator/Lovibond comparator and pH paper)
3. Analysis for carbonates, chlorides, nitrates, sulphates, organic matter and base deficiency from two soil samples by rapid field tests.
4. Determination of organic matter of different soil samples by Walkley & Black rapid titration method.
5. Comparison of bulk density, porosity and rate of infiltration of water in soils of three habitats.
6. Determination of dissolved oxygen of water samples from polluted and unpolluted sources.
7. (a). Study of morphological adaptations of hydrophytes and xerophytes (four each).
8. (b). Study of biotic interactions of the following: Stem parasite (Cuscuta), Root parasite (Orobanche) Epiphytes, Predation (Insectivorous plants).
9. Determination of minimal quadrat size for the study of herbaceous vegetation in the college campus, by species area curve method (species to be listed).
10. Quantitative analysis of herbaceous vegetation in the college campus for frequency and comparison with Raunkiaer’s frequency distribution law.
11. Quantitative analysis of herbaceous vegetation for density and abundance in the college campus. 11. Field visit to familiarise students with ecology of different sites.

Session 2019-22 onwards
GROUP-C

1. Study of vegetative and floral characters of the following families (Description, V.S. flower, section of ovary, floral diagram/s, floral formula/e and systematic position according to Bentham & Hooker’s system of classification):

- Ranunculaceae - *Ranunculus, Delphinium*
- Brassicaceae - *Brassica, Alyssum / Iberis*
- Myrtaceae - *Eucalyptus, Callistemon*
- Umbelliferae - *Coriandrum /Anethum / Foeniculum*
- Asteraceae - *Sonchus/Launaea, Vernonia/Ageratum, Eclipta/Tridax*
- Solanaceae - *Solanum nigrum/Withania*
- Lamiaceae - *Salvia/Ocimum*
- Euphorbiaceae - *Euphorbia hirta/E.mili, Jatropha*
- Liliaceae - *Asphodelus/Lilium/Allium*
- Poaceae - *Triticum/Hordeum/Avena*

2. Field visit (local) – Subject to grant of funds from the university.

3. Mounting of a properly dried and pressed specimen of any wild plant with herbarium label (to be submitted in the record book).

Reference Books:

SEMESTER V

4 Papers

Total 100 x 4 = 400 Marks

I. BOTANY SPECIFIC (DSE 1):

(Credits: Theory-05, Tutorials-01)

Marks : 15 (MSE: 1Hr) + 60 (ESE: 3Hrs) =75
Pass Marks: Th (MSE + ESE) = 30

Instruction to Question Setter for

Mid Semester Examination (MSE):

There will be two group of questions. Group A is compulsory and will contain five questions of very short answer type consisting of 1 mark each. Group B will contain descriptive type six questions of five marks each, out of which any four are to answer.

End Semester Examination (ESE):

There will be two group of questions. Group A is compulsory and will contain two questions. Question No.1 will be very short answer type consisting of ten questions of 1 mark each. Question No.2 will be short answer type of 5 marks. Group B will contain descriptive type six questions of fifteen marks each, out of which any four are to answer.

Note: There may be subdivisions in each question asked in Theory Examinations.

HORTICULTURAL PRACTICES & POST HARVEST TECHNOLOGY

Theory: 75 Lectures

Unit 1: Introduction
Scope and importance, Branches of horticulture; Role in rural economy and employment generation; Importance in food and nutritional security; Urban horticulture and ecotourism.

(4 lectures)

Unit 2: Ornamental plants
Types, classification (annuals, perennials, climbers and trees); Identification and salient features of some ornamental plants [rose, marigold, gladiolus, carnations, orchids, poppies, gerberas, tuberose, sages, cacti and succulents (opuntia, agave and spurges)] Ornamental flowering trees (Indian laburnum, gulmohar, Jacaranda, Lagerstroemia, fishtail and areca palms, semul, coraltree).

(4 lectures)

Unit 3: Fruit and vegetable crops
Production, origin and distribution; Description of plants and their economic products; Management and marketing of vegetable and fruit crops; Identification of some fruits and vegetable varieties (citrus, banana, mango, chillies and cucurbits).

(4 lectures)

Unit 4: Horticultural techniques
Application of manure, fertilizers, nutrients and PGRs; Weed control; Biofertilizers, biopesticides; Irrigation methods (drip irrigation, surface irrigation, furrow and border irrigation); Hydroponics; Propagation Methods: asexual (grafting, cutting, layering, budding), sexual (seed propagation), Scope and limitations.

(8 lectures)
Unit 5: Landscaping and garden design
Planning and layout (parks and avenues); gardening traditions - Ancient Indian, European, Mughal and Japanese Gardens; Urban forestry; policies and practices.

(6 lectures)

Unit 6: Floriculture
Cut flowers, bonsai, commerce (market demand and supply); Importance of flower shows and exhibitions.

(6 lectures)

Unit 7: Post-harvest technology
Importance of post harvest technology in horticultural crops; Evaluation of quality traits; Harvesting and handling of fruits, vegetables and cut flowers; Principles, methods of preservation and processing; Methods of minimizing loses during storage and transportation; Food irradiation - advantages and disadvantages; food safety.

(10 lectures)

Unit 8: Disease control and management
Field and post-harvest diseases; Identification of deficiency symptoms; remedial measures and nutritional management practices; Crop sanitation; IPM strategies (genetic, biological and chemical methods for pest control); Quarantine practices; Identification of common diseases and pests of ornamentals, fruits and vegetable crops.

(8 lectures)

Unit 9: Horticultural crops - conservation and management
Documentation and conservation of germplasm; Role of micropropagation and tissue culture techniques; Varieties and cultivars of various horticultural crops; IPR issues; National, international and professional societies and sources of information on horticulture. Unit 10: Field trip
Field visits to gardens, standing crop sites, nurseries, vegetable gardens and horticultural fields at IARI or other suitable locations.

(10 lectures)
II. **BOTANY SPECIFIC (DSE 2):**

(Credits: Theory-04, Practicals-02)

Marks : 15 (MSE: 1Hr) + 60 (ESE: 3Hrs) =75

Pass Marks: Th (MSE + ESE) = 30

**Instruction to Question Setter for**

*Mid Semester Examination (MSE):*

There will be two group of questions. **Group A is compulsory** and will contain five questions of very short answer type consisting of 1 mark each. **Group B will contain descriptive type** three questions of five marks each, out of which any two are to answer.

*End Semester Examination (ESE):*

There will be two group of questions. **Group A is compulsory** and will contain two questions. **Question No.1 will be very short answer type** consisting of ten questions of 1 mark each. **Question No.2 will be short answer type** of 5 marks. **Group B will contain descriptive type** five questions of fifteen marks each, out of which any three are to answer.

**Note:** There may be subdivisions in each question asked in Theory Examinations.

**ANALYTICAL TECHNIQUES IN PLANT SCIENCE**

**Instruction to Question Setter for**

Theory: 75 Lectures

**Unit 1: Imaging and related techniques**

Principles of microscopy; Light microscopy; Fluorescence microscopy; Confocal microscopy; Use of fluorochromes: (a) Flow cytometry (FACS); (b) Applications of fluorescence microscopy: Chromosome banding, FISH, chromosome painting; Transmission and Scanning electron microscopy – sample preparation for electron microscopy, cryofixation, negative staining, shadow casting, freeze fracture, freeze etching.

(15 lectures)

**Unit 2: Cell fractionation**

Centrifugation: Differential and density gradient centrifugation, sucrose density gradient, CsCl₂ gradient, analytical centrifugation, ultracentrifugation, marker enzymes.

(8 lectures)

**Unit 3: Radioisotopes**

Use in biological research, auto-radiography, pulse chase experiment.

(4 lectures)

**Unit 4: Spectrophotometry**

Principle and its application in biological research.

(4 lectures)

**Unit 5: Chromatography**

Principle; Paper chromatography; Column chromatography, TLC, GLC, HPLC, Ion-exchange chromatography; Molecular sieve chromatography; Affinity chromatography.

(8 lectures)

**Unit 6: Characterization of proteins and nucleic acids**

Mass spectrometry; X-ray diffraction; X-ray crystallography; Characterization of proteins and nucleic acids; Electrophoresis: AGE, PAGE, SDS-PAGE

(6 lectures)

**Unit 7: Biostatistics**

Statistics, data, population, samples, parameters; Representation of Data: Tabular, Graphical; Measures of central tendency: Arithmetic mean, mode, median; Measures of dispersion: Range, mean deviation, variation, standard deviation; Chi-square test for goodness of fit.

(15 lectures)

Session 2019-22 onwards
Instruction to Question Setter for
End Semester Examination (ESE):
There will be one Practical Examination of 3Hrs duration. Evaluation of Practical Examination may be as per the following guidelines:

<table>
<thead>
<tr>
<th>Experiment</th>
<th>= 30 marks</th>
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<tbody>
<tr>
<td>Practical record notebook</td>
<td>= 10 marks</td>
</tr>
<tr>
<td>Viva-voce</td>
<td>= 10 marks</td>
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</tbody>
</table>

GROUP-A

ANALYTICAL TECHNIQUES IN PLANT SCIENCE 60 Lectures

1. Study of Blotting techniques: Southern, Northern and Western, DNA fingerprinting, DNA sequencing, PCR through photographs.
2. Demonstration of ELISA.
3. To separate nitrogenous bases by paper chromatography.
4. To separate sugars by thin layer chromatography.
5. Isolation of chloroplasts by differential centrifugation.
6. To separate chloroplast pigments by column chromatography.
7. To estimate protein concentration through Lowry’s methods.
8. To separate proteins using PAGE.
9. To separation DNA (marker) using AGE.
10. Study of different microscopic techniques using photographs/micrographs (freeze fracture, freeze etching, negative staining, positive staining, fluorescence and FISH).
11. Preparation of permanent slides (double staining).

Reference Books:


Session 2019-22 onwards
III. **CORE COURSE - C 11:**  
(Credits: Theory-04, Practicals-02)

Marks: 15 (MSE: 1Hr) + 60 (ESE: 3Hrs) = 75  
Pass Marks: Th (MSE + ESE) = 30

**Instruction to Question Setter for Mid Semester Examination (MSE):**
There will be two group of questions. **Group A is compulsory and will contain five questions of very short answer type consisting of 1 mark each. Group B will contain descriptive type three questions of five marks each, out of which any two are to answer.**

**End Semester Examination (ESE):**
There will be two group of questions. **Group A is compulsory and will contain two questions. Question No.1 will be very short answer type consisting of ten questions of 1 mark each. Question No.2 will be short answer type of 5 marks. Group B will contain descriptive type five questions of fifteen marks each, out of which any three are to answer.**

**Note:** There may be subdivisions in each question asked in Theory Examinations.

**REPRODUCTIVE BIOLOGY OF ANGIOSPERMS**  
Theory: 60 Lectures

**Unit 1: Introduction**  
(4 lectures)

**Unit 2: Reproductive development**  
Induction of flowering; flower as a modified determinate shoot. Flower development: genetic and molecular aspects.  
(6 lectures)

**Unit 3: Anther and pollen biology**  
Anther wall: Structure and functions, microsporogenesis, callose deposition and its significance. Microgametogenesis; Pollen wall structure, MGU (male germ unit) structure, NPC system; Palynology and scope (a brief account); Pollen wall proteins; Pollen viability, storage and germination; Abnormal features: Pseudomonads, polyads, massulae, pollinia.  
(10 lectures)

**Unit 4: Ovule**  
Structure; Types; Special structures–endothelium, obturator, aril, caruncle and hypostase; Female gametophyte– megasporogenesis (monosporic, bisporic and tetrasporic) and megagametogenesis (details of Polygonum type); Organization and ultrastructure of mature embryo sac.  
(10 lectures)

**Unit 4: Pollination and fertilization**  
Pollination types and significance; adaptations; structure of stigma and style; path of pollen tube in pistil; double fertilization.  
(6 lectures)

**Unit 5: Self incompatibility**  
Basic concepts (interspecific, intraspecific, homomorphic, heteromorphic, GSI and SSI); Methods to overcome self- incompatibility: mixed pollination, bud pollination, stub pollination; Intra-ovarian and in vitro pollination; Modification of stigma surface, parasexual hybridization; Cybrids, in vitro fertilization.  
(10 lectures)

**Unit 6: Embryo, Endosperm and Seed**  
Structure and types; General pattern of development of dicot and monocot embryo and endosperm; Suspensor: structure and functions; Embryo-endosperm relationship; Nutrition of embryo; Unusual features; Embryo development in Paeonia. Seed structure, importance and dispersal mechanisms  
(10 lectures)

**Units 7: Polyembryony and apomixis**  
Introduction; Classification; Causes and applications.  
(6 lectures)

Session 2019-22 onwards
IV. **CORE COURSE -C 12:** (Credits: Theory-04, Practicals-02)

<table>
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<td>15 (MSE: 1Hr) + 60 (ESE: 3Hrs) = 75</td>
<td>Th (MSE +ESE) = 30</td>
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**Instruction to Question Setter for**

**Mid Semester Examination (MSE):**
There will be two group of questions. **Group A is compulsory** and will contain five questions of very short answer type consisting of 1 mark each. **Group B will contain descriptive type** three questions of five marks each, out of which any two are to answer.

**End Semester Examination (ESE):**
There will be two group of questions. **Group A is compulsory** and will contain two questions. **Question No.1 will be very short answer type** consisting of ten questions of 1 mark each. **Question No.2 will be short answer type** of 5 marks. **Group B will contain descriptive type** five questions of fifteen marks each, out of which any three are to answer.

**Note:** There may be subdivisions in each question asked in Theory Examinations.

**PLANT PHYSIOLOGY**

**Theory:** 60 Lectures

**Unit 1: Plant-water relations**

(10 lectures)

**Unit 2: Mineral nutrition**
Essential and beneficial elements, macro and micronutrients, methods of study and use of nutrient solutions, criteria for essentiality, mineral deficiency symptoms, roles of essential elements, chelating agents.

(8 lectures)

**Unit 3: Nutrient Uptake**
Soil as a nutrient reservoir, transport of ions across cell membrane, passive absorption, electrochemical gradient, facilitated diffusion, active absorption, role of ATP, carrier systems, proton ATPase pump and ion flux, uniport, co-transport, symport, antiport.

(8 lectures)

**Unit 4: Translocation in the phloem**
Experimental evidence in support of phloem as the site of sugar translocation. Pressure–Flow Model; Phloem loading and unloading; Source–sink relationship.

(8 lectures)

**Unit 5: Plant growth regulators**
Discovery, chemical nature (basic structure), bioassay and physiological roles of Auxin, Gibberellins, Cytokinins, Abscisic acid, Ethylene, brassinosteroids and Jasmonic acid.

(14 lectures)

**Unit 6: Physiology of flowering**
Photoperiodism, flowering stimulus, florigen concept, vernalization, seed dormancy.

(6 lectures)

**Unit 7: Phytochrome, crytochromes and phototropins**
Discovery, chemical nature, role in photomorphogenesis, low energy responses (LER) and high irradiance responses (HIR), mode of action.

(6 lectures)
Instruction to Question Setter for  
End Semester Examination (ESE):  
There will be one Practical Examination of 3Hrs duration. Evaluation of Practical Examination may be as per the following guidelines:

<table>
<thead>
<tr>
<th>Component</th>
<th>Marks</th>
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<tbody>
<tr>
<td>Experiment</td>
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</tr>
<tr>
<td>Practical record notebook</td>
<td>10</td>
</tr>
<tr>
<td>Viva-voce</td>
<td>10</td>
</tr>
</tbody>
</table>

GROUP-A  
60 Lectures

1. Anther: Wall and its ontogeny; Tapetum (amoeboid and glandular); MMC, spore tetrads, uninucleate, bicelled and dehisced anther stages through slides/micrographs, male germ unit (MGU) through photographs and schematic representation.
2. Pollen grains: Fresh and acetolized showing ornamentation and aperture, psuedomonads, polyads, pollinia (slides/photographs, fresh material), ultrastructure of pollen wall (micrograph); Pollen viability: Tetrazolium test. germination: Calculation of percentage germination in different media using hanging drop method.
3. Ovule: Types-anatropous, orthotropous, amphitropous/campylotropous, circinotropous, unitegmic, bitegmic; Tenuinucellate and crassinucellate; Special structures: Endothelium, obturator, hypostase, caruncle and aril (permanent slides/specimens/photographs).
4. Female gametophyte through permanent slides/photographs: Types, ultrastructure of mature egg apparatus.
5. Intra-ovarian pollination; Test tube pollination through photographs.
6. Endosperm: Dissections of developing seeds for endosperm with free-nuclear haustoria.
7. Embryogenesis: Study of development of dicot embryo through permanent slides; dissection of developing seeds for embryos at various developmental stages; Study of suspensor through electron micrographs.

GROUP-B  
60 Lectures

1. Determination of osmotic potential of plant cell sap by plasmolytic method.
2. Determination of water potential of given tissue (potato tuber) by weight method.
4. Calculation of stomatal index and stomatal frequency from the two surfaces of leaves of a mesophyte and xerophyte.
5. To calculate the area of an open stoma and percentage of leaf area open through stomata in a mesophyte and xerophyte (both surfaces).
6. To study the phenomenon of seed germination (effect of light).
7. To study the effect of different concentrations of IAA on Avena coleoptile elongation (IAA Bioassay).
8. To study the induction of amylase activity in germinating barley grains.

Demonstration experiments
1. To demonstrate suction due to transpiration.
2. Fruit ripening/Rooting from cuttings (Demonstration).
3. Bolting experiment/Avena coleptile bioassay (demonstration).
Reference Books:

SEMESTER VI

4 Papers

Total 100 x 4 = 400 Marks

I. BOTANY SPECIFIC (DSE 3):

(Credits: Theory-04, Practicals-02)

Marks : 15 (MSE: 1Hr) + 60 (ESE: 3Hrs) = 75
Pass Marks: Th (MSE +ESE) = 30

Instruction to Question Setter for

Mid Semester Examination (MSE):

There will be two group of questions. Group A is compulsory and will contain five questions of very short answer type consisting of 1 mark each. Group B will contain descriptive type six questions of five marks each, out of which any four are to answer.

End Semester Examination (ESE):

There will be two group of questions. Group A is compulsory and will contain two questions. Question No.1 will be very short answer type consisting of ten questions of 1 mark each. Question No.2 will be short answer type of 5 marks. Group B will contain descriptive type six questions of fifteen marks each, out of which any four are to answer.

Note: There may be subdivisions in each question asked in Theory Examinations.

PLANT BREEDING

Theory: 60 Lectures

Unit 1: Plant Breeding

(10 lectures)

Unit 2: Methods of crop improvement
Introduction: Centres of origin and domestication of crop plants, plant genetic resources; Acclimatization; Selection methods: For self pollinated, cross pollinated and vegetatively propagated plants; Hybridization: For self, cross and vegetatively propagated plants – Procedure, advantages and limitations.

(20 lectures)

Unit 3: Quantitative inheritance
Concept, mechanism, examples of inheritance of Kernel colour in wheat, Skin colour in human beings. Monogenic vs polygenic Inheritance.

(10 lectures)

Unit 4: Inbreeding depression and heterosis
History, genetic basis of inbreeding depression and heterosis; Applications.

(10 lectures)

Unit 5: Crop improvement and breeding
Role of mutations; Polyploidy; Distant hybridization and role of biotechnology in crop improvement.

(10 lectures)
II. BOTANY SPECIFIC (DSE 4):

| Marks | 15 (MSE: 1Hr) + 60 (ESE: 3Hrs) = 75 | Pass Marks | Th (MSE +ESE) = 30 |

Instruction to Question Setter for
Mid Semester Examination (MSE):
There will be two group of questions. **Group A is compulsory** and will contain five questions of very short answer type consisting of 1 mark each. **Group B will contain descriptive type** three questions of five marks each, out of which any two are to answer.

End Semester Examination (ESE):
There will be two group of questions. **Group A is compulsory** and will contain two questions. **Question No.1 will be very short answer type** consisting of ten questions of 1 mark each. **Question No.2 will be short answer type** of 5 marks. **Group B will contain descriptive type** five questions of fifteen marks each, out of which any three are to answer.

Note: There may be subdivisions in each question asked in Theory Examinations.

RESEARCH METHODOLOGY

**Unit 1: Basic concepts of research**
Research-definition and types of research (Descriptive vs analytical; applied vs fundamental; quantitative vs qualitative; conceptual vs empirical). Research methods vs methodology. Literature-review and its consolidation; Library research; field research; laboratory research. (10 lectures)

**Unit 2: General laboratory practices**

**Unit 3: Data collection and documentation of observations**
Maintaining a laboratory record; Tabulation and generation of graphs. Imaging of tissue specimens and application of scale bars. The art of field photography. (6 lectures)

**Unit 4: Overview of Biological Problems**
History; Key biology research areas, Model organisms in biology (A Brief overview): Genetics, Physiology, Biochemistry, Molecular Biology, Cell Biology, Genomics, Proteomics Transcriptional regulatory network. (6 lectures)

**Unit 5: Methods to study plant cell/tissue structure**
Whole mounts, peel mounts, squash preparations, clearing, maceration and sectioning; Tissue preparation: living vs fixed, physical vs chemical fixation, coagulating fixatives, non-coagulant fixatives; tissue dehydration using graded solvent series; Paraffin and plastic infiltration; Preparation of thin and ultrathin sections. (6 lectures)

**Unit 6: Plant microtechniques**
Staining procedures, classification and chemistry of stains. Staining equipment. Reactive dyes and fluorochromes (including genetically engineered protein labeling with GFP and other tags). Cytogenetic techniques with squashed plant materials. (12 lectures)

**Unit 7: The art of scientific writing and its presentation**
Numbers, units, abbreviations and nomenclature used in scientific writing. Writing references. Powerpoint presentation. Poster presentation. Scientific writing and ethics, Introduction to copyright-academic misconduct/plagiarism. (8 lectures)
Instruction to Question Setter for End Semester Examination (ESE):

There will be one Practical Examination of 3Hrs duration. Evaluation of Practical Examination may be as per the following guidelines:

- **Experiment** = 30 marks
- **Practical record notebook** = 10 marks
- **Viva-voce** = 10 marks

**GROUP-A**

**60 Lectures**

**RESEARCH METHODOLOGY**

1. Experiments based on chemical calculations.
2. Plant microtechnique experiments.
3. The art of imaging of samples through microphotography and field photography.
4. Poster presentation on defined topics.
5. Technical writing on topics assigned.

**Reference Books:**

III. **CORE COURSE -C 13:**  
(Credits: Theory-04, Practicals-02)

| Marks : 15 (MSE: 1Hr) + 60 (ESE: 3Hrs) = 75 | Pass Marks: Th (MSE +ESE) = 30 |

**Instruction to Question Setter for**

**Mid Semester Examination (MSE):**

There will be two group of questions. **Group A is compulsory and will contain five questions of very short answer type consisting of 1 mark each. Group B will contain descriptive type three questions of five marks each, out of which any two are to answer.**

**End Semester Examination (ESE):**

There will be two group of questions. **Group A is compulsory and will contain two questions. Question No.1 will be very short answer type consisting of ten questions of 1 mark each. Question No.2 will be short answer type of 5 marks. Group B will contain descriptive type five questions of fifteen marks each, out of which any three are to answer.**

**Note:** There may be subdivisions in each question asked in Theory Examinations.

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### PLANT METABOLISM

#### Theory: 60 Lectures

**Unit 1: Concept of metabolism**  
Introduction, anabolic and catabolic pathways, regulation of metabolism, role of regulatory enzymes (allosteric, covalent modulation and Isozymes).  
(6 lectures)

**Unit 2: Carbon assimilation**  
Historical background, photosynthetic pigments, role of photosynthetic pigments (chlorophylls and accessory pigments), antenna molecules and reaction centres, photochemical reactions, photosynthetic electron transport, PSI, PSII, Q cycle, CO₂ reduction, photorespiration, C4 pathways; Crassulacean acid metabolism; Factors affecting CO₂ reduction.  
(14 lectures)

**Unit 3: Carbohydrate metabolism**  
Synthesis and catabolism of sucrose and starch.  
(2 lectures)

**Unit 4: Carbon Oxidation**  
Glycolysis, fate of pyruvate, regulation of glycolysis, oxidative pentose phosphate pathway, oxidative decarboxylation of pyruvate, regulation of PDH, NADH shuttle; TCA cycle, amphibolic role, anaplerotic reactions, regulation of the cycle, mitochondrial electron transport, oxidative phosphorylation, cyanide-resistant respiration, factors affecting respiration.  
(10 lectures)

**Unit 5: ATP-Synthesis**  
Mechanism of ATP synthesis, substrate level phosphorylation, chemiosmotic mechanism (oxidative and photophosphorylation), ATP synthase, Boyers conformational model, Racker’s experiment, Jagendorf’s experiment; role of uncouplers.  
(8 lectures)

**Unit 6: Lipid metabolism**  
Synthesis and breakdown of triglycerides, β-oxidation, glyoxylate cycle, gluconeogenesis and its role in mobilisation of lipids during seed germination, α oxidation.  
(8 lectures)

**Unit 7: Nitrogen metabolism**  
Nitrate assimilation, biological nitrogen fixation (examples of legumes and non-legumes); Physiology and biochemistry of nitrogen fixation; Ammonia assimilation and transamination.  
(8 lectures)

**Unit 8: Mechanisms of signal transduction**  
Receptor-ligand interactions; Second messenger concept, Calcium calmodulin, MAP kinase cascade.  
(4 lectures)

Session 2019-22 onwards
IV. CORE COURSE -C 14:

(Credits: Theory-04, Practicals-02)

Marks : 15 (MSE: 1Hr) + 60 (ESE: 3Hrs) = 75 Pass Marks: Th (MSE +ESE) = 30

Instruction to Question Setter for

Mid Semester Examination (MSE):

There will be two group of questions. Group A is compulsory and will contain five questions of very short answer type consisting of 1 mark each. Group B will contain descriptive type three questions of five marks each, out of which any two are to answer.

End Semester Examination (ESE):

There will be two group of questions. Group A is compulsory and will contain two questions. Question No.1 will be very short answer type consisting of ten questions of 1 mark each. Question No.2 will be short answer type of 5 marks. Group B will contain descriptive type five questions of fifteen marks each, out of which any three are to answer.

Note: There may be subdivisions in each question asked in Theory Examinations.

PLANT BIOTECHNOLOGY

Theory: 60 Lectures

Unit 1: Plant Tissue Culture
Historical perspective; Composition of media; Nutrient and hormone requirements (role of vitamins and hormones); Totipotency; Organogenesis; Embryogenesis (somatic and zygotic); Protoplast isolation, culture and fusion; Tissue culture applications (micropropagation, androgenesis, virus elimination, secondary metabolite production, haploids, triploids and hybrids; Cryopreservation; Germplasm Conservation).

(16 lectures)

Unit 2: Recombinant DNA technology
Restriction Endonucleases (History, Types I-IV, biological role and application); Restriction Mapping (Linear and Circular); Cloning Vectors: Prokaryotic (pUC 18 and pUC19, pBR322, Ti plasmid, BAC); Lambda phage, M13 phagemid, Cosmid, Shuttle vector; Eukaryotic Vectors (YAC).

(12 lectures)

Unit 3: Gene Cloning
Recombinant DNA, Bacterial Transformation and selection of recombinant clones, PCR mediated gene cloning; Gene Construct; construction of genomic and cDNA libraries, screening DNA libraries to obtain gene of interest by genetic selection; complementation, colony hybridization; PCR

(10 lectures)

Unit 4: Methods of gene transfer
Agrobacterium-mediated, Direct gene transfer by Electroporation, Microinjection, Microprojectile bombardment; Selection of transgenics– selectable marker and reporter genes (Luciferase, GUS, GFP).

(8 lectures)

Unit 5: Applications of Biotechnology
Pest resistant (Bt-cotton); herbicide resistant plants (RoundUp Ready soybean); Transgenic crops with improved quality traits (Flavr Savr tomato, Golden rice); Improved horticultural varieties (Moondust carnations); Role of transgenics in bioremediation (Superbug); edible vaccines; Industrial enzymes (Aspergillase, Protease, Lipase); Gently Engineered Products–Human Growth Hormone; Humulin; Biosafety concerns.

(14 lectures)
BOTANY PRACTICAL- C13 + C14 LAB

Marks : Pr (ESE: 3Hrs) =50  Pass Marks: Pr (ESE) = 20

Instruction to Question Setter for
End Semester Examination (ESE):
There will be one Practical Examination of 3Hrs duration. Evaluation of Practical Examination may be as per the following guidelines:

Experiment = 30 marks
Practical record notebook = 10 marks
Viva-voce = 10 marks

GROUP-A

1. Chemical separation of photosynthetic pigments.
2. Experimental demonstration of Hill’s reaction.
3. To study the effect of light intensity on the rate of photosynthesis.
4. Effect of carbon dioxide on the rate of photosynthesis.
5. To compare the rate of respiration in different parts of a plant.
6. To demonstrate activity of Nitrate reductase in germinating leaves of different plant sources.
7. To study the activity of lipases in germinating oilseeds and demonstrate mobilization of lipids during germination.
8. Demonstration of fluorescence by isolated chlorophyll pigments.

GROUP-B

1. (a) Preparation of MS medium.
   (b) Demonstration of in vitro sterilization and inoculation methods using leaf and nodal explants of tobacco, Datura, Brassica etc.
2. Study of anther, embryo and endosperm culture, micropropagation, somatic embryogenesis & artificial seeds through photographs.
3. Isolation of protoplasts.
4. Construction of restriction map of circular and linear DNA from the data provided.
5. Study of methods of gene transfer through photographs: Agrobacterium-mediated, direct gene transfer by electroporation, microinjection, microprojectile bombardment.
6. Study of steps of genetic engineering for production of Bt cotton, Golden rice, Flavr Savr tomato through photographs.
7. Isolation of plasmid DNA.
8. Restriction digestion and gel electrophoresis of plasmid DNA.
Reference Books

COURSES OF STUDY FOR GENERIC ELECTIVE ‘B. Sc. Hons’ PROGRAMME IN

“BOTANY”

SEMESTER I

<table>
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<tr>
<td>I. GENERIC ELECTIVE (GE 1):</td>
<td>(Credits: Theory-04, Practicals-02)</td>
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<tr>
<td></td>
<td>➢ All Four Generic Papers (One paper to be studied in each semester) of Botany to be studied by the Students of Other than Botany Honours.</td>
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<tr>
<td></td>
<td>➢ Students of Botany Honours must Refer Content from the Syllabus of Opted Generic Elective Subject.</td>
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Marks : 75 (ESE: 3Hrs) + 25 (Pr 3Hrs)=100
Pass Marks: Th ESE = 30 + Pr ESE =10

Instruction to Question Setter for

End Semester Examination (ESE):

There will be two group of questions. Group A is compulsory and will contain two questions. Question No.1 will be very short answer type consisting of ten questions of 1 mark each. Question No.2 will be short answer type of 5 marks. Group B will contain descriptive type six questions of fifteen marks each, out of which any four are to answer.

Note: There may be subdivisions in each question asked in Theory Examinations.

BIODIVERSITY

Theory: 60 Lectures

Unit 1: Microbes
Viruses – Discovery, general structure, replication (general account), DNA virus (T-phage); Lytic and lysogenic cycle, RNA virus (TMV); Economic importance; Bacteria – Discovery, General characteristics and cell structure; Reproduction – vegetative, asexual and recombination (conjugation, transformation and transduction); Economic importance.

(10 lectures)

Unit 2: Algae
General characteristics; Ecology and distribution; Range of thallus organization and reproduction; Classification of algae; Morphology and life-cycles of the following: Nostoc, Chlamydomonas, Oedogonium, Vaucheria, Fucus, Polysiphonia. Economic importance of algae.

(12 lectures)

Unit 3: Fungi
Introduction- General characteristics, ecology and significance, range of thallus organization, cell wall composition, nutrition, reproduction and classification; True Fungi- General characteristics, ecology and significance, life cycle of Rhizopus (Zygomycota) Penicillium, Alternaria (Ascomycota), Puccinia, Agaricus (Basidiomycota);
Symbiotic Associations-Lichens: General account, reproduction and significance; Mycorrhiza: ectomycorrhiza and endomycorrhiza and their significance

(12 lectures)

Session 2019-22 onwards
**Unit 4: Introduction to Archegoniate**
Unifying features of archegoniates, Transition to land habit, Alternation of generations.  

(2 lectures)

**Unit 5: Bryophytes**
General characteristics, adaptations to land habit, Classification, Range of thallus organization. Classification (up to family), morphology, anatomy and reproduction of Marchantia and Funaria. (Developmental details not to be included). Ecology and economic importance of bryophytes with special mention of Sphagnum.  

(10 lectures)

**Unit 6: Pteridophytes**
General characteristics, classification, Early land plants (Cooksonia and Rhynia). Classification (up to family), morphology, anatomy and reproduction of Selaginella, Equisetum and Pteris. (Developmental details not to be included). Heterospory and seed habit, stelar evolution. Ecology and economical importance of Pteridophytes.  

(8 lectures)

**Unit 4: Gymnosperms**
General characteristics; Classification (up to family), morphology, anatomy and reproduction of Cycas and Pinus (Developmental details not to be included). Ecology and economical importance.  

(6 lectures)
GE 1 LAB: BIODIVERSITY  60 Lectures

1. EMs/Models of viruses – T-Phage and TMV, Line drawing/Photograph of Lytic and Lysogenic Cycle.
2. Types of Bacteria from temporary/permanent slides/photographs; EM bacterium; Binary Fission; Conjugation; Structure of root nodule.
3. Gram staining
4. Study of vegetative and reproductive structures of Nostoc, Chlamydomonas (electron micrographs), Oedogonium, Vaucheria, Fucus* and Polysiphonia through temporary preparations and permanent slides. (* Fucus - Specimen and permanent slides)
5. Rhizopus and Penicillium: Asexual stage from temporary mounts and sexual structures through permanent slides.
7. Puccinia: Herbarium specimens of Black Stem Rust of Wheat and infected Barberry leaves; section/tease mounts of spores on Wheat and permanent slides of both the hosts.
8. Agaricus: Specimens of button stage and full grown mushroom; Sectioning of gills of Agaricus. 9. Lichens: Study of growth forms of lichens (crustose, foliose and fruticose)
10. Mycorrhiza: ecto mycorrhiza and endo mycorrhiza (Photographs)
11. Marchantia- morphology of thallus, w.m. rhizoids and scales, v.s. thallus through gemmae cup, w.m. gemmae (all temporary slides), v.s. antheridiophore, archegoniophore, l.s. sporophyte (all permanent slides).
12. Funaria- morphology, w.m. leaf, rhizoids, operculum, peristome, annullus, spores (temporary slides); permanent slides showing antheridial and archegonial heads, l.s. capsule and protonema.
13. Selaginella- morphology, w.m. leaf with ligule, t.s. stem, w.m. sporoblast, w.m. microsporophyll and megasporophyll (temporary slides), l.s. strobilus (permanent slide).
14. Equisetum- morphology, t.s. internode, l.s. strobilus, t.s. strobilus, w.m. sporangiophore, w.m. spores (wet and dry) (temporary slides); t.s rhizome (permanent slide).
15. Pteris- morphology, t.s. rachis, v.s. sporophyll, w.m. sporangium, w.m. spores (temporary slides), t.s. rhizome, w.m. prothallus with sex organs and young sporophyte (permanent slide).
16. Cycas- morphology (coralloid roots, bulbil, leaf), t.s. coralloid root, t.s. rachis, v.s. leaflet, v.s. microsporophyll, w.m. spores (temporary slides), l.s. ovule, t.s. root (permanent slide).
17. Pinus- morphology (long and dwarf shoots, w.m. dwarf shoot, male and female), w.m. dwarf shoot, t.s. needle, t.s. stem, l.s./t.s. male cone, w.m. microsporophyll, w.m. microspores (temporary slides), l.s. female cone, t.l.s. & r.l.s. stem (permanent slide).

Reference Books:
II. GENERIC ELECTIVE (GE 2) (Credits: Theory-04, Practicals-02)

Marks: 75 (ESE: 3Hrs) + 25 (Pr 3Hrs) = 100
Pass Marks: Th ESE = 30 + Pr ESE = 10

Instruction to Question Setter for End Semester Examination (ESE):

There will be two group of questions. Group A is compulsory and will contain two questions. Question No.1 will be very short answer type consisting of ten questions of 1 mark each. Question No.2 will be short answer type of 5 marks. Group B will contain descriptive type six questions of fifteen marks each, out of which any four are to answer.

Note: There may be subdivisions in each question asked in Theory Examinations.

PLANT ECOLOGY & TAXONOMY Theory: 60 Lectures

Unit 1: Introduction (2 lectures)

Unit 2: Ecological factors
Soil: Origin, formation, composition, soil profile. Water: States of water in the environment, precipitation types. Light and temperature: Variation Optimal and limiting factors; Shelford law of tolerance. Adaptation of hydrophytes and xerophytes (10 lectures)

Unit 3: Plant communities
Characters; Ecotone and edge effect; Succession; Processes and types (6 lectures)

Unit 4: Ecosystem
Structure; energy flow trophic organisation; Food chains and food webs, Ecological pyramids production and productivity; Biogeochemical cycling; Cycling of carbon, nitrogen and Phosphorous (8 lectures)

Unit 5: Phytogeography
Principle biogeographical zones; Endemism (4 lectures)

Unit 6 Introduction to plant taxonomy
Identification, Classification, Nomenclature. (2 lectures)

Unit 7 Identification
Functions of Herbarium, important herbaria and botanical gardens of the world and India; Documentation: Flora, Keys: single access and multi-access (4 lectures)

Unit 8 Taxonomic evidences
Taxonomic evidences from palynology, cytology, phytochemistry and molecular data. (6 lectures)

Session 2019-22 onwards
Unit 9 Taxonomic hierarchy
Ranks, categories and taxonomic groups (2 lectures)

Unit 10 Botanical nomenclature
Principles and rules (ICN); ranks and names; binominal system, typification, author citation, valid publication, rejection of names, principle of priority and its limitations. (6 lectures)

Unit 11 Classification
Types of classification-artificial, natural and phylogenetic. Bentham and Hooker (upto series), Engler and Prantl (upto series). (6 lectures)

Unit 12 Biometrics, numerical taxonomy and cladistics
Characters; variations; OTUs, character weighting and coding; cluster analysis; phenograms, cladograms (definitions and differences). (4 lectures)

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GE 2 LAB: PLANT ECOLOGY & TAXONOMY 60 Lectures

1. Study of instruments used to measure microclimatic variables: Soil thermometer, maximum and minimum thermometer, anemometer, psychrometer/hygroimeter, rain gauge and lux meter.
2. Determination of pH, and analysis of two soil samples for carbonates, chlorides, nitrates, sulphates, organic matter and base deficiency by rapid field test.
3. Comparison of bulk density, porosity and rate of infiltration of water in soil of three habitats.
4. (a) Study of morphological adaptations of hydrophytes and xerophytes (four each).
   (b) Study of biotic interactions of the following: Stem parasite (Cuscuta), Root parasite (Orobanche), Epiphytes, Predation (Insectivorous plants)
5. Determination of minimal quadrat size for the study of herbaceous vegetation in the college campus by species area curve method. (species to be listed)
6. Quantitative analysis of herbaceous vegetation in the college campus for frequency and comparison with Raunkiaer’s frequency distribution law
7. Study of vegetative and floral characters of the following families (Description, V.S. flower, section of ovary, floral diagram/s, floral formula/e and systematic position according to Bentham & Hooker’s system of classification):
   Brassicaceae Brassica,Alyssum / Iberis; Asteraceae -Sonchus/Launaea, Vernonia/Ageratum, Eclipta/Tridax; Solanaceae -Solanum nigrum, Withania; Lamiaceae -Salvia, Ocimum; Liliaceae -Asphodelus / Lilium / Allium.
8. Mounting of a properly dried and pressed specimen of any wild plant with herbarium label (to be submitted in the record book).

Reference Books

Session 2019-22 onwards
III. GENERIC ELECTIVE (GE 3) (Credits: Theory-04, Practicals-02)  

Marks : 75 (ESE: 3Hrs) + 25 (Pr 3Hrs)=100  
Pass Marks: Th ESE = 30 + Pr ESE =10

Instruction to Question Setter for End Semester Examination (ESE):

There will be two group of questions. Group A is compulsory and will contain two questions. Question No.1 will be very short answer type consisting of ten questions of 1 mark each. Question No.2 will be short answer type of 5 marks. Group B will contain descriptive type six questions of fifteen marks each, out of which any four are to answer. 

Note: There may be subdivisions in each question asked in Theory Examinations.

PLANT ANATOMY & EMBRYOLOGY  
Theory: 60 Lectures

Unit 1: Meristematic and permanent tissues  
Root and shoot apical meristems; Simple and complex tissues  
(8 lectures)

Unit 2: Organs  
Structure of dicot and monocot root stem and leaf.  
(4 lectures)

Unit 3: Secondary Growth  
Vascular cambium – structure and function, seasonal activity. Secondary growth in root and stem, Wood (heartwood and sapwood)  
(8 lectures)

Unit 4: Adaptive and protective systems  
Epidermis, cuticle, stomata; General account of adaptations in xerophytes and hydrophytes.  
(8 lectures)

Unit 5: Structural organization of flower  
Structure of anther and pollen; Structure and types of ovules; Types of embryo sacs, organization and ultrastructure of mature embryo sac.  
(8 lectures)

Unit 6: Pollination and fertilization  (8 lectures)  
Pollination mechanisms and adaptations; Double fertilization; Seed-structure appendages and dispersal mechanisms.  
(8 lectures)

Unit 7: Embryo and endosperm  
Endosperm types, structure and functions; Dicot and monocot embryo; Embryoendosperm relationship  
(8 lectures)

Unit 8: Apomixis and polyembryony  
Definition, types and Practical applications  
(8 lectures)

Session 2019-22 onwards
GE 3 LAB: PLANT ANATOMY & EMBRYOLOGY 60 Lectures

1. Study of meristems through permanent slides and photographs.
2. Tissues (parenchyma, collenchyma and sclerenchyma); Macerated xylary elements, Phloem (Permanent slides, photographs)
5. Leaf: Dicot and Monocot leaf (only Permanent slides).
6. Adaptive anatomy: Xerophyte (Nerium leaf); Hydrophyte (Hydrilla stem).
7. Structure of anther (young and mature), tapetum (amoeboid and secretory) (Permanent slides).
8. Types of ovules: anatropous, orthotropous, circinotropous, amphitropous/ campylotropous.
10. Ultrastructure of mature egg apparatus cells through electron micrographs.
11. Pollination types and seed dispersal mechanisms (including appendages, aril, caruncle) (Photographs and specimens).
12. Dissection of embryo/endosperm from developing seeds.
13. Calculation of percentage of germinated pollen in a given medium.

Reference Books:
SEMESTER IV

GENERIC ELECTIVE

1 Paper

Total 100 x 1 = 100 Marks

IV. GENERIC ELECTIVE (GE 4)

(Credits: Theory-04, Practicals-02)

Marks : 75 (ESE: 3Hrs) + 25 (Pr 3Hrs)=100

Pass Marks: Th ESE = 30 + Pr ESE =10

Instruction to Question Setter for End Semester Examination (ESE):

There will be two group of questions. Group A is compulsory and will contain two questions. Question No.1 will be very short answer type consisting of ten questions of 1 mark each. Question No.2 will be short answer type of 5 marks. Group B will contain descriptive type six questions of fifteen marks each, out of which any four are to answer.

Note: There may be subdivisions in each question asked in Theory Examinations.

PLANT PHYSIOLOGY & METABOLISM

Theory: 60 Lectures

Unit 1: Plant-water relations
Importance of water, water potential and its components; Transpiration and its significance; Factors affecting transpiration; Root pressure and guttation.

(8 lectures)

Unit 2: Mineral nutrition
Essential elements, macro and micronutrients; Criteria of essentiality of elements; Role of essential elements; Transport of ions across cell membrane, active and passive transport, carriers, channels and pumps.

(8 lectures)

Unit 3: Translocation in phloem.
Composition of phloem sap, girdling experiment; Pressure flow model; Phloem loading and unloading

(6 lectures)

Unit 4: Photosynthesis
Photosynthetic Pigments (Chl a, b, xanthophylls, carotene); Photosystem I and II, reaction center, antenna molecules; Electron transport and mechanism of ATP synthesis; C3, C4 and CAM pathways of carbon fixation; Photorespiration.

(12 lectures)

Unit 5: Respiration
Glycolysis, anaerobic respiration, TCA cycle; Oxidative phosphorylation, Glyoxylate, Oxidative Pentose Phosphate Pathway.

(6 lectures)

Unit 6: Enzymes
Structure and properties; Mechanism of enzyme catalysis and enzyme inhibition.

(4 lectures)

Unit 7: Nitrogen metabolism
Biological nitrogen fixation; Nitrate and ammonia assimilation.

(4 lectures)

Unit 8: Plant growth regulators
Discovery and physiological roles of auxins, gibberellins, cytokinins, ABA, ethylene.

(6 lectures)

Unit 9: Plant response to light and temperature
Photoperiodism (SDP, LDP, Day neutral plants); Phytochrome (discovery and structure), red and far red light responses on photomorphogenesis; Vernalization.

(6 lectures)
GE 4 LAB: PLANT PHYSIOLOGY & METABOLISM 60 Lectures

1. Determination of osmotic potential of plant cell sap by plasmolytic method.
2. To study the effect of two environmental factors (light and wind) on transpiration by excised twig.
3. Calculation of stomatal index and stomatal frequency of a mesophyte and a xerophyte.
4. Demonstration of Hill reaction.
5. Demonstrate the activity of catalase and study the effect of pH and enzyme concentration.
6. To study the effect of light intensity and bicarbonate concentration on O₂ evolution in photosynthesis.
7. Comparison of the rate of respiration in any two parts of a plant.
8. Separation of amino acids by paper chromatography.

Demonstration experiments (any four)
1. Bolting.
2. Effect of auxins on rooting.
3. Suction due to transpiration.
4. R.Q.
5. Respiration in roots.

Reference Books:
SEMINAR I

ENGLISH COMMUNICATION

Theory: 30 Lectures

I. ENGLISH COMMUNICATION

Marks: 100 (ESE 3Hrs) =100

Pass Marks Th ESE = 40

Instruction to Question Setter for

End Semester Examination (ESE):

There will be two group of questions. Group A is compulsory and will contain three questions. Question No.1 will be very short answer type consisting of ten questions of 1 mark each. Question No.2 & 3 will be short answer type of 5 marks. Group B will contain descriptive type six questions of 20 marks each, out of which any four are to answer.

Note: There may be subdivisions in each question asked in Theory Examinations.

OBJECTIVE: To equip students effectively to acquire skills in reading, writing, comprehension and communication, as also to use electronic media for English Communication.


Unit II: Class-presentation (Oral for five minutes) on any of the above-mentioned topics: Descriptive writing, expansion of an idea.

Unit III: Writing skills –, notice writing, advertisement writing, précis writing, essay writing, letter writing (applications), Business letter formats (letters of enquiry, replies and complaints), resume writing, covering letter

Unit IV: Vocabulary building: One word substitution, synonyms and antonyms, idioms and phrases

Suggested Reading:

- Technical Communication, M.H. Rizvi, Tata McGrawhill
- Effective Business Communication, Asha Kaul
- Developing Communication Skills, Krishnamohan
- Functional Grammar and Spoken and Written Communication in English, Bikram K. Das, Orient Blackswan
- Precis, Paraphrase and Summary, P.N. Gopalkrishnan, Authors Press
- Communication Skills, Sanjay Kumar and Pushplata, Oxford Publication

Note: Latest edition of text books may be used.

OR

Session 2019-22 onwards
II. HINDI COMMUNICATION

Marks : 100 (ESE 3Hrs) =100 Pass Marks Th ESE = 40

नोट : थ्योरी परीक्षा में पूरे गए प्रश्न में उप-विभाजन हो सकते हैं।

हिंदी व्यकरण एवं संप्रेषण

(क्रेडिट: सैद्धांतिक -02)
(सैद्धांतिक: 30 व्याख्यान)

इकाई – 1 हिंदी व्याकरण और रचना,
संज्ञा, सर्वनाम, विशेषण, क्रिया, अव्यय, कारक, वचन, संधि, उपस्तर, प्रत्यय तथा समास,
हिंदी निष्पादन, पर्यायवाची भाव, विलोम भाव, अनेक भावों के लिए एक भाव,
भाव भुविद्व, वाक्य भुविद्व, मुहावरे और लोकोपक्षियता, पत्तल्व एवं संक्षेपण।

इकाई – 2 निबंध कला तथा समसामयिक एवं राष्ट्रीय विषयों पर निबंध लेखन

इकाई – 3 संप्रेषण (संचार)
—संप्रेषण की अवधारणा और महत्व, संप्रेषण के लिए आव, यक भार्त, संप्रेषण के प्रकार,
संप्रेषण का माध्यम, संप्रेषण कला, संप्रेषण की तकनीक, वचन कला, समाचार वाचन,
साक्षात्कार कला, रचनात्मक लेखन का लक्ष्य, रचनात्मक लेखन का आधार, भाव और
विचारांक प्रस्तुति, वाचक कला की उपयोगिता।

अनुशासित पुस्तकें :

- वृहत व्याकरण भारकर : डी.व. वचनदेव कुमार
- वृहत निवेंद्र भारकर : डी.व. वचनदेव कुमार
- अद्वृत्त हिंदी व्याकरण और रचना  : डी.व. कत्युदेव नन्दन प्रसाद
- रचना मानवा : प्रो. संभार नाथ तिबारी
- व्यवहारिक हिंदी  : डी.व. ज्ञान बहुदुर पाण्डेय
- रचनात्मक लेखन  : डी.व. रेवता गोपाल
- राजस्व हिंदी निबंध  : प्रो. आराध्यक राजेश
- सफल हिंदी निबंध  : रलेश वर
- निबंध सहचर  : डी.व. लक्षमण प्रसाद
- उपकर मुहावरे और लोकोपक्षिय  : प्रो. राजेश प्रसाद चबुयार्दी
- कहानियों कहावतों की : प्रताप अनम
- सम्मेलनपत्र हिंदी माध्य शिक्षण  : डी.व. वैनान नारंग
- शैली विज्ञान  : डी.व. सुभाष कुमार
- शैली विज्ञान प्रतिमान और विशेषण  : डी.व. पंडेय शारिरभूषण 'शीतलथु'
- भौतिक विज्ञान का इतिहास  : डी.व. पंडेय शारिरभूषण 'शीतलथु'

OR
III. AECC NH + MB COMMUNICATION  
(NON-HINDI + MATRI BHASHA)  
अहिन्दी + मातृभाषा  

(क्रेडिट: सैद्धांतिक 01 + 01 = 02)  

[A] NON-HINDI  
अहिन्दी  

Theory: 15 Lectures  
(क्रेडिट: सैद्धांतिक -01)  

Marks : 50 (ESE 1.5 Hrs) = 50  
Pass Marks Th ESE = 20  

प्रश्न पत्र के लिए निर्देश  
छात्री परीक्षा :  

प्रश्नों के दो समूह होंगे। खण्ड 'A' अभावित है जिसमें लघु उत्तरीय 5 अंक का दो प्रश्न होगा। खण्ड 'B' में तीन में से किन्हीं दो 20 अंकों के निर्देशानित्व/ वर्गनात्मक प्रश्नों के उत्तर देने होंगे।  

नोट : सैद्धांतिक परीक्षा में पूछे गए प्रश्न में उप-विवाहन हो सकते हैं।  

हिन्दी व्याकरण एवं संप्रेषण  
सैद्धांतिक: 15 व्याख्यान  

इकाई-1  
हिन्दी व्याकरण और रचना,  
संज्ञा, संज्ञानांक, वि रेखण, क्रिया, अवयव, कारक, वचन, संधि,उपसर्ग, प्रत्यय तथा समास,  
टिंग निर्णय, पर्यायवाची भाव, विलोम भाव, अनेक भावों के लिए एक भाव,  
भाव भूल्मित्रि, वाक्य भूल्मित्रि, मुहावरे और लोकोक्तियाँ, पल्लवन एवं संक्षेपण।  

इकाई-2  
संप्रेषण (संचार)  
—संप्रेषण की अवधारणा और महत्व, संप्रेषण के लिए आवश्यक भारी, संप्रेषण के प्रकार,  
संप्रेषण का माध्यम, संप्रेषण कला, संप्रेषण की तकनीक, वाचन कला, समाचार वाचन,  
साक्षात्कार कला, रचनात्मक लेखन का लक्ष्य, रचनात्मक लेखन का आधार, भाव और  
विवारों की प्रस्तुति, वाक्य कला की उपयोगिता।  

अनुशसित पुस्तकें :—  

- वृत्त व्याकरण भारती  
- वृत्त निबंध भारती  
- आधुनिक हिन्दी व्याकरण और रचना  
- रचना मान्यता  
- व्यवहारिक हिन्दी  
- रचनात्मक लेखन  
- राज्यस्व हिन्दी निबंध  
- सफल हिन्दी निबंध  
- निबंध सहयोग  
- उच्चकाल गृहावर्त और लोकोक्तियाँ  
- कहानियों आदतों की  
- संप्रेषणपरक हिन्दी भाषा विश्लेषण  
- शैली विज्ञान  
- शैली विज्ञान प्रतिवेदन और विश्लेषण  
- भौतिक विज्ञान का इतिहास  
- वर्तमान शिक्षा 'मीठांसु'  
- वर्तमान शिक्षा 'मीठांसु'  
- वर्तमान शिक्षा 'मीठांसु'  
- वर्तमान शिक्षा 'मीठांसु'  

Session 2019-22 onwards
Instruction to Question Setter for

End Semester Examination (ESE):

There will be two group of questions. **Group A is compulsory** and will contain two questions of 5 marks each. **Group B will contain descriptive type** three questions of 20 marks each, out of which any two are to answer.

**Note:** There may be subdivisions in each question asked in Theory Examinations.

**Unit I:** Novel

1. The English Teacher (R.K. Narayan)

**Unit II:** Poetry

1. Stopping by words on a Snowy Evening (Robert Frost)
2. A slumber did My Sprit Seal (William Woodworth)
3. My Native Land (H.L.V. Derozio)
4. The Night of Scorpion (Nissim Ezekiel)
5. Break, Break, Break (A.L. Tennyson)
6. Starlit Night (G.M. Hopkins)

**Unit III:** Grammar

1. Common Errors
2. Fill up the blanks with prepositions.
3. One word substitution.

**Suggested Reading:**

- A String of Poems (Edited by: S.M.P.N. Singh Sashi and A.B. Sharan)
- The Winged Word (Edited by: David Green)
Distribution of Credits Semester wise for Undergraduate Honours Courses

Table B-1: UG (B.A./ B.Sc./B.Com./B.Voc Honours Programme)

Semester wise distribution of 164 Credits

<table>
<thead>
<tr>
<th>Semester</th>
<th>CC</th>
<th>AECC</th>
<th>GE-A</th>
<th>GE-B</th>
<th>SEC</th>
<th>DSE</th>
<th>Total credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semester I</td>
<td>12</td>
<td>02</td>
<td>06</td>
<td>06</td>
<td></td>
<td></td>
<td>20</td>
</tr>
<tr>
<td>Semester II</td>
<td>12</td>
<td>02</td>
<td>06</td>
<td>06</td>
<td></td>
<td></td>
<td>20</td>
</tr>
<tr>
<td>Semester III</td>
<td>18</td>
<td></td>
<td>06</td>
<td>06</td>
<td>02</td>
<td></td>
<td>26</td>
</tr>
<tr>
<td>Semester IV</td>
<td>18</td>
<td></td>
<td>06</td>
<td>06</td>
<td>02</td>
<td></td>
<td>26</td>
</tr>
<tr>
<td>Semester V</td>
<td>12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>12</td>
<td>24</td>
</tr>
<tr>
<td>Semester VI</td>
<td>12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>12</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>84</td>
<td>04</td>
<td>24</td>
<td>24</td>
<td>04</td>
<td>24</td>
<td>140 + 24 = 164</td>
</tr>
</tbody>
</table>

CC=Core Course; AECC=Ability Enhancement Compulsory Course; GE=Generic Elective; SEC=Skill Enhancement Course; DSE=Discipline Specific Elective
Table B-3: Sample calculation for SGPA for B.Sc./B.A./B.Com/B.Voc. Honours Programme

<table>
<thead>
<tr>
<th>Course</th>
<th>Credit</th>
<th>Grade Letter</th>
<th>Grade Point</th>
<th>Credit Point (Credit X Grade)</th>
<th>SGPA (Credit Point/Credit)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Semester I</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C-1</td>
<td>06</td>
<td>A</td>
<td>8</td>
<td>48</td>
<td></td>
</tr>
<tr>
<td>C-2</td>
<td>06</td>
<td>B+</td>
<td>7</td>
<td>42</td>
<td></td>
</tr>
<tr>
<td>AECC-1</td>
<td>02</td>
<td>B</td>
<td>6</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>GE-1A</td>
<td>06</td>
<td>B</td>
<td>6</td>
<td>36</td>
<td></td>
</tr>
<tr>
<td>GE-1B</td>
<td>06</td>
<td>B+</td>
<td>7</td>
<td>42</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>26</td>
<td></td>
<td></td>
<td>180</td>
<td>6.92 (180 / 26)</td>
</tr>
<tr>
<td><strong>Semester II</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C-3</td>
<td>06</td>
<td>B</td>
<td>6</td>
<td>36</td>
<td></td>
</tr>
<tr>
<td>C-4</td>
<td>06</td>
<td>C</td>
<td>5</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>AECC-2</td>
<td>02</td>
<td>B+</td>
<td>7</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>GE-2A</td>
<td>06</td>
<td>A+</td>
<td>9</td>
<td>54</td>
<td></td>
</tr>
<tr>
<td>GE-2B</td>
<td>06</td>
<td>B+</td>
<td>7</td>
<td>42</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>26</td>
<td></td>
<td></td>
<td>176</td>
<td>6.76 (176 / 26)</td>
</tr>
<tr>
<td><strong>Semester III</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C-5</td>
<td>06</td>
<td>A+</td>
<td>9</td>
<td>54</td>
<td></td>
</tr>
<tr>
<td>C-6</td>
<td>06</td>
<td>0</td>
<td>10</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>C-7</td>
<td>06</td>
<td>A</td>
<td>8</td>
<td>48</td>
<td></td>
</tr>
<tr>
<td>SEC-1</td>
<td>02</td>
<td>A</td>
<td>8</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>GE-3A</td>
<td>06</td>
<td>0</td>
<td>10</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>GE-3B</td>
<td>06</td>
<td>B+</td>
<td>7</td>
<td>42</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>32</td>
<td></td>
<td></td>
<td>280</td>
<td>8.75 (280 / 32)</td>
</tr>
<tr>
<td><strong>Semester IV</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C-8</td>
<td>06</td>
<td>B</td>
<td>6</td>
<td>36</td>
<td></td>
</tr>
<tr>
<td>C-9</td>
<td>06</td>
<td>A+</td>
<td>9</td>
<td>54</td>
<td></td>
</tr>
<tr>
<td>C-10</td>
<td>06</td>
<td>B</td>
<td>6</td>
<td>36</td>
<td></td>
</tr>
<tr>
<td>SEC-2</td>
<td>02</td>
<td>A+</td>
<td>9</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>GE-4A</td>
<td>06</td>
<td>A</td>
<td>8</td>
<td>48</td>
<td></td>
</tr>
<tr>
<td>GE-4B</td>
<td>06</td>
<td>B+</td>
<td>7</td>
<td>42</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>32</td>
<td></td>
<td></td>
<td>234</td>
<td>7.31 (234 / 32)</td>
</tr>
<tr>
<td><strong>Semester V</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C-11</td>
<td>06</td>
<td>B</td>
<td>6</td>
<td>36</td>
<td></td>
</tr>
<tr>
<td>C-12</td>
<td>06</td>
<td>B+</td>
<td>7</td>
<td>42</td>
<td></td>
</tr>
<tr>
<td>DSE-1</td>
<td>06</td>
<td>0</td>
<td>10</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>DSE-2</td>
<td>06</td>
<td>A</td>
<td>8</td>
<td>48</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>24</td>
<td></td>
<td></td>
<td>186</td>
<td>7.75 (186 / 24)</td>
</tr>
<tr>
<td><strong>Semester VI</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C-13</td>
<td>06</td>
<td>A+</td>
<td>9</td>
<td>54</td>
<td></td>
</tr>
<tr>
<td>C-14</td>
<td>06</td>
<td>A</td>
<td>8</td>
<td>48</td>
<td></td>
</tr>
<tr>
<td>DSE-3</td>
<td>06</td>
<td>B+</td>
<td>7</td>
<td>42</td>
<td></td>
</tr>
<tr>
<td>DSE-4</td>
<td>06</td>
<td>A</td>
<td>8</td>
<td>48</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>24</td>
<td></td>
<td></td>
<td>192</td>
<td>8.0 (192 / 24)</td>
</tr>
<tr>
<td>CGPA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grand Total</td>
<td>140+24=164</td>
<td></td>
<td></td>
<td>1248</td>
<td>7.61 (1248 / 164)</td>
</tr>
</tbody>
</table>

Table B-4: Sample calculation for CGPA for B.Sc./B.A./B.Com/B.Voc. Honours Programme

<table>
<thead>
<tr>
<th>Semester I</th>
<th>Semester II</th>
<th>Semester III</th>
<th>Semester IV</th>
<th>Semester V</th>
<th>Semester VI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credit:26;</td>
<td>Credit:26;</td>
<td>Credit:32;</td>
<td>Credit:32;</td>
<td>Credit:24;</td>
<td>Credit:24;</td>
</tr>
<tr>
<td>SGPA:6.92</td>
<td>SGPA: 6.76</td>
<td>SGPA: 8.75</td>
<td>SGPA: 7.31</td>
<td>SGPA: 7.75</td>
<td>SGPA: 8.0</td>
</tr>
</tbody>
</table>

Thus CGPA= (26x6.92+26x6.76+32x8.75+32x7.31+24x7.75+24x8.0)/164=7.61

Session 2019-22 onwards
MARKS DISTRIBUTION FOR EXAMINATIONS AND FORMAT OF QUESTION PAPERS

Marks Distribution of Mid Semester Theory Examinations:

Table No. C1: Marks distribution of Theory Examinations of Mid Semester

<table>
<thead>
<tr>
<th>Topic</th>
<th>Code</th>
<th>Full Marks</th>
<th>Pass Marks</th>
<th>Time</th>
<th>Group-A (Very short answer type Compulsory Questions)</th>
<th>Group-B (Descriptive Questions with Choices)</th>
<th>Total No. of Questions to Set</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mid Sem*</td>
<td>T15</td>
<td>15</td>
<td>---</td>
<td>1 Hr</td>
<td>5 x 1 = 5</td>
<td>2 (out of 3) x 5 =10</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>T25</td>
<td>25</td>
<td>---</td>
<td>1 Hr</td>
<td>5 x 1 = 5</td>
<td>4 (out of 6) x 5 =20</td>
<td>5</td>
</tr>
</tbody>
</table>

Marks Distribution of End Semester Theory Examinations:

Table No. C2: Marks distribution of Theory Examinations of End Semester

<table>
<thead>
<tr>
<th>Topic</th>
<th>Code</th>
<th>Full Marks</th>
<th>Pass Marks including Mid Sem</th>
<th>Time</th>
<th>Group-A# (Very short answer type Compulsory Questions)</th>
<th>Group-B (Descriptive Questions with Choices)</th>
<th>Total No. of Questions to Set</th>
</tr>
</thead>
<tbody>
<tr>
<td>End Sem</td>
<td>T60</td>
<td>60</td>
<td>30</td>
<td>3 Hrs</td>
<td>Q.No.1 (10x1) + 1x5 =15</td>
<td>3 (out of 5) x15 =45</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>T75</td>
<td>75</td>
<td>40</td>
<td>3 Hrs</td>
<td>Q.No.1 (10x1) + 1x5 =15</td>
<td>4 (out of 6) x15 =60</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>T100</td>
<td>100</td>
<td>40</td>
<td>3 Hrs</td>
<td>Q.No.1 (10x1) + 2x5 =20</td>
<td>4 (out of 6) x20 =80</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>T50 +T50</td>
<td>50X2=100</td>
<td>20</td>
<td>3 Hrs</td>
<td>2 x 5 = 10</td>
<td>2 (out of 3) x20 =40</td>
<td>2</td>
</tr>
</tbody>
</table>

# Question No.1 in Group-A carries 10 very short answer type 1 Mark Questions.

Marks Distribution of Mid/End Semester Practical Examinations:

Table No. C3: Marks distribution of Practical Examinations of End Semester

<table>
<thead>
<tr>
<th>Topic</th>
<th>Code</th>
<th>Full Marks</th>
<th>Pass Marks</th>
<th>Time</th>
<th>Distribution of Marks</th>
<th>Total No. of Questions to Set</th>
</tr>
</thead>
<tbody>
<tr>
<td>End Sem</td>
<td>P25</td>
<td>25</td>
<td>10</td>
<td>3 Hrs</td>
<td>15</td>
<td>Pr. with components of both papers</td>
</tr>
<tr>
<td></td>
<td>P50</td>
<td>50</td>
<td>20</td>
<td>3 Hrs</td>
<td>30</td>
<td>Pr. with components of all three papers</td>
</tr>
<tr>
<td></td>
<td>P75</td>
<td>75</td>
<td>30</td>
<td>3 Hrs</td>
<td>45</td>
<td>Pr. with components of all four papers</td>
</tr>
<tr>
<td></td>
<td>P100</td>
<td>100</td>
<td>40</td>
<td>3 Hrs</td>
<td>60</td>
<td></td>
</tr>
</tbody>
</table>

Abbreviations:  
T = Theory Examination, P = Practical Examination.

Mid Sem*: There will be 15 Marks Theory Examination in Practical Subjects and 25 Marks Theory Examination in Non-Practical Subjects/ Papers. 25 Marks Theory Examination may include 10 Marks questions from Assignment/ Project/ Tutorial where ever applicable.

Note: There may be subdivisions in each question asked in Theory Examinations.

Session 2019-22 onwards
Ranchi University, Ranchi

Mid Sem No.                      Exam Year

F.M. =15                          Time=1Hr.

Subject/ Code

General Instructions:

i. **Group A** carries very short answer type compulsory questions.
   (खंड 'A' में अभ्यंत लघु उत्तरीय अनिवार्य प्र. न हैं)

ii. **Answer 2 out of 3** subjective/ descriptive questions given in **Group B**.
    (खंड 'B' के तीन में से किन्हीं दो वि प्रारंभिक प्र. नै के उत्तर दे)

iii. Answer in your own words as far as practicable.
     (रच्या संस्तव अपने भाषा में उत्तर दे)

iv. Answer all sub parts of a question at one place.
    (एक प्र. के सभी भागो उत्तर एक साथ लिखें)

v. Numbers in right indicate full marks of the question.
   (पूर्ण नामी ओर लिखे गये हैं)

**Group A**

1. ............. [5x1=5]
2. .............
3. .............
4. .............
5. .............

**Group B**

6. ............. [5]
7. ............. [5]
8. ............. [5]

Note: There may be subdivisions in each question asked in Theory Examination.
Ranchi University, Ranchi

Mid Sem No.                             Exam Year
Subject/ Code
F.M. =25                                      Time=1Hr.

General Instructions:

1. **Group A** carries very short answer type compulsory questions.
   (खण्ड 'A' में अत्यंत लघु उल्लंघन अध्याय प्र ण न हैं)
2. **Answer 4 out of 6** subjective/ descriptive questions given in **Group B**.
   (खण्ड 'B' के 4 में से किन्हीं चार विषय सच्चिदान्तक प्र णों के उत्तर दे।)
3. Answer in your own words as far as practicable.
   (यथासंवेदन अपने भाषा में उत्तर दे।)
4. Answer all sub parts of a question at one place.
   (एक प्रण में सभी भागों के उत्तर एक साथ लिखे।)
5. Numbers in right indicate full marks of the question.
   (पूर्णांक दामी और लिखे गये हैं।)

<table>
<thead>
<tr>
<th>Group A</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. ................</td>
<td>[5x1=5]</td>
</tr>
<tr>
<td>2. ................</td>
<td></td>
</tr>
<tr>
<td>3. ................</td>
<td></td>
</tr>
<tr>
<td>4. ................</td>
<td></td>
</tr>
<tr>
<td>5. ................</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group B</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>6. ................</td>
<td>[5]</td>
</tr>
<tr>
<td>7. ................</td>
<td>[5]</td>
</tr>
<tr>
<td>8. ................</td>
<td>[5]</td>
</tr>
<tr>
<td>9. ................</td>
<td>[5]</td>
</tr>
<tr>
<td>10. .............</td>
<td>[5]</td>
</tr>
<tr>
<td>11. .............</td>
<td>[5]</td>
</tr>
</tbody>
</table>

**Note:** There may be subdivisions in each question asked in Theory Examination.
Ranchi University, Ranchi

End Sem No.  Exam Year

Subject/ Code

F.M. =50  P.M.=20  Time=1.5Hrs.

General Instructions:

i. **Group A** carries short answer type compulsory questions.

ii. **Answer 2 out of 3** subjective/descriptive questions given in **Group B**.

iii. Answer in your own words as far as practicable.

iv. Answer all sub parts of a question at one place.

v. Numbers in right indicate full marks of the question.

---

**Group A**

1. ...............  [5]

2. ...............  [5]

**Group B**

3. ...............  [20]

4. ...............  [20]

5. ...............  [20]

**Note:** There may be subdivisions in each question asked in Theory Examination.
Ranchi University, Ranchi

End Sem No.                             Exam Year
F.M. =60  P.M.=30 (Including Mid Sem)   Time=3Hrs.

General Instructions:
  i.  Group A carries very short answer type compulsory questions.
  ii. Answer 3 out of 5 subjective/ descriptive questions given in Group B.
      (खंड ‘B’ के पूंजी में से किन्हीं तीन वि. शानिंग वर्णनात्मक प्र. प्र. के उत्तर दें)
  iii. Answer in your own words as far as practicable.
       (व्यावस्थापन अपने भाषाओं में उत्तर दें)
  iv.  Answer all sub parts of a question at one place.
       (एक प्र. न के सभी मार्गों के उत्तर एक साथ लिखें)
  v.  Numbers in right indicate full marks of the question.
       (पूर्णांक दायीं ओर लिखे गए हैं)

  

Group A

1.  [10x1=10]
    i.  ...............  [10x1=10]
    ii. ............... 
    iii. ............... 
    iv.  ............... 
    v.   ............... 
    vi.  ............... 
    vii. ............... 
    viii. .............. 
    ix.   ............... 
    x.    ............... 

2.  ...............  [5]

Group B

3.  ...............  [15]
4.  ...............  [15]
5.  ...............  [15]
6.  ...............  [15]
7.  ...............  [15]

Note: There may be subdivisions in each question asked in Theory Examination.
Ranchi University, Ranchi

End Sem No.                             Exam Year

**Subject/ Code**

F.M. = 75                             P.M. = 40 (Including Mid Sem)   Time = 3 Hrs.

**General Instructions:**

i. **Group A** carries very short answer type **compulsory** questions.

ii. **Answer 4 out of 6** subjective/ descriptive questions given in **Group B**.

iii. Answer in your own words as far as practicable.

iv. Answer all sub parts of a question at one place.

v. Numbers in right indicate full marks of the question.

**Group A**

1. [10x1 = 10]

   i. ............
   
   ii. ............
   
   iii. ............
   
   iv. ............
   
   v. ............
   
   vi. ............
   
   vii. ............
   
   viii. ............
   
   ix. ............
   
   x. ............

2. ............... [5]

**Group B**

3. ............... [15]

4. ............... [15]

5. ............... [15]

6. ............... [15]

7. ............... [15]

8. ............... [15]

**Note:** There may be subdivisions in each question asked in Theory Examination.
Ranchi University, Ranchi

End Sem No.                             Exam Year

Subject/ Code

F.M. =100
P.M.=40
Time=3Hrs.

General Instructions:

i. Group A carries very short answer type compulsory questions.

ii. Answer 4 out of 6 subjective/ descriptive questions given in Group B.
(खंड ‘B’ के छ भ म से कावना विशिष्टविषयक प्रश्नों के उत्तर दें)

iii. Answer in your own words as far as practicable.
(उपलब्ध सबभाष में उत्तर दें)

iv. Answer all sub parts of a question at one place.
(एक प्रश्न के सभी भागों के उत्तर एक रूप से लिखें)

v. Numbers in right indicate full marks of the question.
(पूर्णांक दाएं ओर लिखे गए हैं)

Group A

1. [10x1=10]
   i. ............
   ii. ............
   iii. ............
   iv. ............
   v. ............
   vi. ............
   vii. ............
   viii. ............
   ix. ............
   x. ............

2. ............. [5]
3. ............. [5]

Group B

4. ............. [20]
5. ............. [20]
6. ............. [20]
7. ............. [20]
8. ............. [20]
9. ............. [20]

Note: There may be subdivisions in each question asked in Theory Examination.