M. Sc. BOTANY
SYLLABUS - 2014

SCHOOLS OF EXCELLENCE
with
CHOICE BASED CREDIT SYSTEM (CBCS)

SCHOOL OF BIOLOGICAL SCIENCES
St. JOSEPH’S COLLEGE (Autonomous)
Accredited at 'A' Grade (3rd Cycle) by NAAC
College with Potential for Excellence by UGC
TIRUCHIRAPPALLI - 620 002, INDIA
SCHOOLS OF EXCELLENCE WITH
CHOICE BASED CREDIT SYSTEM (CBCS)

POSTGRADUATE COURSES
St. Joseph’s College (Autonomous), a pioneer in higher education in India, strives to work towards the academic excellence. In this regard, it has initiated the implementation of five “Schools of Excellence” from this academic year 2014 – 15, to standup to the challenges of the 21st century.

Each School integrates related disciplines under one roof. The school system allows the enhanced academic mobility and enriched employability of the students. At the same time this system preserves the identity, autonomy and uniqueness of every department and reinforces their efforts to be student centric in curriculum designing and skill imparting. These five schools will work concertedly to achieve and accomplish the following objectives.

• Optimal utilization of resources both human and material for the academic flexibility leading to excellence.
• Students experience or enjoy their choice of courses and credits for their horizontal mobility.
• The existing curricular structure as specified by TANSCHE and other higher educational institutions facilitate the Credit-Transfer Across the Disciplines (CTAD) - a uniqueness of the choice based credit system.
• Human excellence in specialized areas
• Thrust in internship and / or projects as a lead towards research and
• The multi-discipline nature of the newly evolved structure (School System) caters to the needs of stake-holders, especially the employers.

What is Credit system?
Weightage to a course is given in relation to the hours assigned for the course. Generally one hour per week has one credit. For viability and conformity to the guidelines credits are awarded irrespective of the teaching hours. The following Table shows the correlation between credits and hours. However, there could be some flexibility because of practicals, field visits, tutorials and nature of project work.

For PG courses a student must earn a minimum of 110 credits. The total number of courses offered by a department is given above. However within their working hours few departments / School can offer extra credit courses.

### SUMMARY OF HOURS AND CREDITS
PG COURSES - BOTANY

<table>
<thead>
<tr>
<th>Part</th>
<th>Semester</th>
<th>Specification</th>
<th>No. of Courses</th>
<th>Hours</th>
<th>Credits</th>
<th>Total Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I-IV</td>
<td>Core Courses</td>
<td>10</td>
<td>56</td>
<td>49</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Theory Courses Laboratory Courses</td>
<td>7</td>
<td>26</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>Self Paced Learning</td>
<td>1</td>
<td>-</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>IV</td>
<td>Comprehensive Examination</td>
<td>1</td>
<td>-</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>IV</td>
<td>Project Dissertation &amp; Viva Voce</td>
<td>1</td>
<td>14</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>III-IV</td>
<td>Core Electives</td>
<td>3</td>
<td>12</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>I-III</td>
<td>IDC (WS)</td>
<td>1</td>
<td>4</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>IDC (Common)</td>
<td>1</td>
<td>4</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>IDC (BS)</td>
<td>1</td>
<td>4</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>I-IV</td>
<td>Additional Core Courses</td>
<td>1</td>
<td>12</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>IV</td>
<td>SHEPHERD &amp; Gender Studies</td>
<td>1</td>
<td>-</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td></td>
<td>120</td>
<td>110</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

IDC – Inter Departmental Courses
BS – Between School
WS – Within School

Total Hours : 120
Total Credits : 110

However, there could be some flexibility because of practicals, field visits, tutorials and nature of project work. For PG courses a student must earn a minimum of 110 credits. The total number of courses offered by a department is given above. However within their working hours few departments / School can offer extra credit courses.
Course Pattern
The Post Graduate degree course consists of five vital components. They are core courses, core electives, additional core courses, IDC’s and SHEPHERD. Additional Core courses are purely optional on the part of the student. SHEPHERD, the extension components are mandatory.

CORE COURSE
A core course is the course offered by the parent department related to the major subjects, components like theories, practicals, self paced learning, common core, comprehensive examinations, dissertations & viva voce, field visits, library record form part of the core courses.

CORE ELECTIVE
The core elective course is also offered by the parent department. The objective is to provide choice and flexibility within the School. There are three core electives. It is offered in different semester according to the choice of the school.

ADDITIONAL CORE COURSES (If any)
In order to facilitate the students gaining extra credit, the additional core courses are given. The students are encouraged to avail this option of enriching with the extra credits.

INTERDEPARTMENTAL COURSES (IDC)
IDC is an interdepartmental course offered by a department / School for the students belonging to other departments / school. The objective is to provide mobility and flexibility outside the parent department / School. This is introduced to make every course multi-disciplinary in nature. It is to be chosen from a list of courses offered by various departments.

There are three IDC’s. Among three, one is the Soft-Skill course offered by the JASS in the II Semester for the students of all the Departments. The other one is offered “With-in the school” (WS) and the third one is offered “Between the school” (BS). The IDC’s are of application oriented and inter disciplinary in nature.

Subject Code Fixation
The following code system (9 characters) is adopted for Post Graduate courses:

<table>
<thead>
<tr>
<th>Year of PG</th>
<th>Code of Revision of the Dept</th>
<th>Code of the Part of Part in the part</th>
<th>Specification of the Part</th>
<th>Running number</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>PBO</td>
<td>1</td>
<td></td>
<td>01</td>
</tr>
</tbody>
</table>

For Example:
I M.Sc. Botany, first semester, Plant Diversity-I
The code of the paper is 14PBO1101.
Thus, the subject code is fixed for other subjects.

Specification of the Part
1. Core Courses: (Theory, Practical, Self paced Learning, Common Core, Comprehensive Examination, Dissertation and Viva-voce)
2. Core Electives
3. Additional Core Courses (if any)
4. Inter Departmental Courses (WS, Soft Skill & BS)
5. SHEPHERD & Gender Studies

EXAMINATION
Continuous Internal Assessment (CIA):

| PG - Distribution of CIA Marks |
|--------------------|------------------|
| Passing Minimum: 50 Marks |
| Library Referencing | 5                |
| 3 Components       | 35               |
| Mid-Semester Test  | 30               |
| End-Semester Test  | 30               |
| CIA                | 100              |

MID-SEM & END–SEM TEST
Centralised – Conducted by the office of COE
1. Mid-Sem Test & End-Sem Test: (2 Hours each); will have Objective + Descriptive elements; with the existing question pattern PART-A; PART-B; and PART-C
2. CIA Component III for UG & PG will be of 15 marks and compulsorily objective multiple choice question type.
3. The CIA Component III must be conducted by the department / faculty concerned at a suitable computer centres.
4. The 10 marks of PART-A of Mid-Sem and End-Sem Tests will comprise only: OBJECTIVE MULTIPLE CHOICE QUESTIONS; TRUE / FALSE; and FILL-IN BLANKS.
5. The number of hours for the 5 marks allotted for Library Referencing/ work would be 30 hours per semester. The marks scored out of 5 will be given to all the courses (Courses) of the Semester.
SEMESTER EXAMINATION
Testing with Objective and Descriptive questions

Part-A: 30 Marks
Objective MCQs only
Answers are to be marked on OMR score-sheet. The OMR score-sheets will be supplied along with the Main Answer Book. 40 minutes after the start of the examination the OMR score-sheets will be collected.

Part-B + C = 70 Marks
Descriptive
Part-B: 5 x 5 = 25 marks; inbuilt choice;
Part-C: 3 x 15 = 45 marks; 3 out of 5 questions, open choice.

The Accounts Paper of Commerce will have
Part-A: Objective = 25
Part-B: 25 x 3 = 75 marks.

Duration of Examination must be rational; proportional to teaching hours 90 minute-examination / 50 Marks for courses of 2/3 hours/week (all Part IV UG Courses) 3-hours examination for courses of 4-6 hours/week.

EVALUATION
Percentage Marks, Grades & Grade Points
UG (Passing minimum 40 Marks)

<table>
<thead>
<tr>
<th>Qualitative Assessment</th>
<th>Grade Points</th>
<th>Grade</th>
<th>Mark Range (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exemplary</td>
<td>10</td>
<td>S</td>
<td>90 &amp; above</td>
</tr>
<tr>
<td>Outstanding</td>
<td>9</td>
<td>A+</td>
<td>85-89.99</td>
</tr>
<tr>
<td>Excellent</td>
<td>8</td>
<td>A</td>
<td>80-84.99</td>
</tr>
<tr>
<td>Very Good</td>
<td>7</td>
<td>B</td>
<td>70-79.99</td>
</tr>
<tr>
<td>Good</td>
<td>6</td>
<td>C</td>
<td>60-69.99</td>
</tr>
<tr>
<td>Pass (PG)</td>
<td>5</td>
<td>D</td>
<td>50-59.99</td>
</tr>
<tr>
<td>RA (PG)</td>
<td>0</td>
<td>RA</td>
<td>&lt; 50</td>
</tr>
</tbody>
</table>

CGPA - Calculation
Grade Point Average for a semester is calculated as indicated here under:

\[
\text{CGPA} = \frac{\text{Sum total of weighted Grade Points}}{\text{Sum of Credits}}
\]

Weighted Grade Points is *Grade point x Course Credits*. The final CGPA will only include: Core, Core Electives & IDCs. A Pass in SHEPHERD will continue to be mandatory although the marks will not count for the calculation of the CGPA.

<table>
<thead>
<tr>
<th>CLASS</th>
<th>Mark Range (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARTS</td>
<td></td>
</tr>
<tr>
<td>SCIENCE</td>
<td></td>
</tr>
<tr>
<td>Distinction</td>
<td>75 &amp; above,</td>
</tr>
<tr>
<td></td>
<td>first attempt</td>
</tr>
<tr>
<td>First</td>
<td>60 - 74.99</td>
</tr>
<tr>
<td>Second</td>
<td>50 - 59.99</td>
</tr>
</tbody>
</table>

Declaration of Result:

Mr./Ms. ________________ has successfully completed the Post Graduate in ________________ programme. The candidate’s Cumulative Grade Point Average (CGPA) is ___________ and the class secured _______________ by completing the minimum of 110 credits.

The candidate has also acquired ____________ (if any) additional credits from courses offered by the parent department.
# M. Sc. Botany
## Course Pattern - 2014 Set

<table>
<thead>
<tr>
<th>Sem.</th>
<th>Code</th>
<th>COURSE</th>
<th>Hours</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>14PBO1101</td>
<td>Plant Diversity- I (Thallophytes and Bryophytes)</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>I</td>
<td>14PBO1102</td>
<td>Laboratory Course 1</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>I</td>
<td>14PBO1103</td>
<td>Plant Diversity-II (Psilophytes, Gymnosperms and Paleobotany)</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>I</td>
<td>14PBO1104</td>
<td>Plant Anatomy, Embryology and Morphogenesis</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>I</td>
<td>14PBO1105</td>
<td>Laboratory Course 2</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>I</td>
<td>14PBO1201A</td>
<td>Cell and Molecular Biology OR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>14PBO1201B</td>
<td>Forestry and Wood Science</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

**Total for Semester I**  
30  
25

| II   | 14PBO2106   | Plant Physiology                             | 5     | 5       |
| II   | 14PBO2107   | Laboratory Course 3                          | 3     | 3       |
| II   | 14PBO2108   | Ecology and Phytophagy                       | 5     | 4       |
| II   | 14PBO2109   | Research Methodology                         | 5     | 5       |
| II   | 14PBO2110   | Laboratory Course 4                          | 4     | 3       |
| II   | 14PBO2202A  | Biophysics and Instrumentation OR            | 4     | 4       |
| II   | 14PSS2401   | IDC: Soft Skills                             | 4     | 4       |

**Total for Semester II**  
30  
28

| III  | 14PBO3111   | Plant Systematics                            | 6     | 5       |
| III  | 14PBO3112   | Laboratory Course 5                          | 4     | 3       |
| III  | 14PBO3113   | Biochemistry                                 | 5     | 5       |
| III  | 14PBO3114   | Laboratory Course 6                          | 3     | 3       |
| III  | 14PBO3201A  | Genetics OR                                  |       |         |
| III  | 14PBO3203B  | Pharmacognosy                                | 4     | 4       |
| III  | 14PBO3402   | IDC (WS): Bioprocess Technology             | 4     | 4       |
| III  | 14PBO3403   | IDC (BS): Horticulture and Landscaping       | 4     | 4       |

**Total for Semester III**  
30  
28

| IV   | 14PBO4115   | Microbiology and Immunology                  | 6     | 5       |
| IV   | 14PBO4116   | Genetic Engineering and Biotechnology         | 6     | 5       |
| IV   | 14PBO4117   | Laboratory Course 7                          | 4     | 3       |
| IV   | 14PBO4118   | Comprehensive Examination                    | --    | 2       |
| IV   | 14PBO4119   | Self-paced Learning: Plant Breeding and Evolution | -- | 2       |
| IV   | 14PBO4120   | Dissertation & Viva Voce                    | 14    | 7       |

**Total for Semester IV**  
30  
24

**Total for all Semesters**  
120  
110

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**Sem. I**  
14PBO1101  
**PLANT DIVERSITY - I**  
*(Thallophytes and Bryophytes)*

**Objectives**

1. To understand the major groups of cryptogramatic plants and their characteristics.
2. To trace their interrelationships and study their evolutionary trends.

**Unit I**

Algae: Introduction and history of phycology. Algology in India (Contributions of eminent Indian algologists). Criteria used in algal classification (Fritsch & De Silva) - Life cycles and mass culture of algae - General characteristics, thallus variations, reproduction, distribution and economic importance of major groups of algae. Cyanophyta: Oscillatoria, Nostoc and Scytonema.

**Unit II**


**Unit III**

Fungi - general features, occurrence and distribution; Classification of fungi (Ainsworth, 1973; Alexopoulos and Mims, 1983), recent trends in the classification of fungal cell ultrastructure; General characters of major classes: Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina and Deuteromycotina. Thallus organization; cell wall composition; ecology of fungi, mode of nutrition (saprobic, biotropic and symbiotic); reproduction (vegetative, asexual and sexual), Spore dispersal mechanisms.

**Unit IV**

in Ascolichens, Basiodiolichens and Deuterolichens. Lichens as indicators of Pollution. Economic importance of lichens.

**Unit V**

**Books**

**Reference**
Unit III

Unit IV
A general account of distribution, morphology, anatomy, reproduction and life cycle of the following genera: Cycadopsida - Cycas, Coniferopsida - Cupressus - Gnetopsida - Gnetum.

Unit V

Books

Reference

Sem. I
14PB01104
PLANT ANATOMY, EMBRYOLOGY AND MORPHOGENESIS

Objectives
1. To understand the basic principles of differentiation of cell types.
2. To know the process of growth and development through totipotency.

Unit I

Unit II

Unit III

Unit IV
Fertilization: Double fertilization; embryo development - different types. Endosperm development, types of endosperm, haustorial behavior of endosperm. Xenia and metaxenia. Polyembryony - types and causes. Seed formation, dormancy and germination. Apomixis, Parthenogenesis.

Unit V
Morphogenesis and organogenesis in plants: Organization of shoot and root apical meristems; shoot and root development, leaf development and phyllotaxy; transition of flowering, floral meristems and floral development.
Books

Reference

Sem. I  Hours/Week: 4  Credits: 3
14PBO1105
Laboratory Course-II
(Pteridophytes, Gymnosperms, Palaeobotany, Anatomy, Embryology and Morphogenesis)

Pteridophytes
Psilotum, Lycopodium, Selaginella, Equisetum, Alsophila and Marsilea.

Gymnosperms
Cycas, Cupressus and Gnetum.

Palaeobotany
Rhynia, Lepidodendron, Calamites, Lyginopteris, Williamsonia and Cordaites.

Plant Anatomy and Embryology
• Study of cambia - non storied and storied.
• Study the anomalous primary and secondary features in Aristolochia, Bignonia, Boerhaavia, Nyctanthes and Dracaena.
• Study of stomata, trichomes, and laticifers.
• Examine of shoot apices in Hydrilla and Philodendron.
• Examine of root apical meristem in Philodendron.
• Study of leaf anatomy - structure, stomata, trichomes, types of stomata.
• Study of pollen morphotypes (at least 6 examples: Malvaceae, Asteraceae, Convolvulaceae, Labiatae and Gramineae.)

• Isolation of zygotic globular, heart-shaped, torpedo stage and mature embryos from suitable seeds and polyembryony in citrus, jamun (Syzygium cumini) etc. by dissections.
• Tests for pollen viability using stains and in vitro germination. Pollen germination using hanging drop and sitting drop cultures, suspension culture and surface culture.
• Wound healing.

Sem. I  Hours/Week: 4  Credits: 4
14PBO1201A
Core Elective-I
CELL AND MOLECULAR BIOLOGY

Objectives
1. To understand the structural organization and function of different cell organelles.
2. To study the basic principles of the central dogma of life.

Unit I
Major intracellular compartments in eukaryotic cells (brief study only). Structural organization of cell membranes: chemical composition; structure and function of membrane carbohydrates, membrane proteins and membrane lipids. Membrane functions.

Unit II

Unit III
Cell communication: general principles. Signaling molecules and their receptors, external and internal signals that modify metabolism, growth, and development of plants. Receptors: Cell surface receptors - ion-channel linked receptors, G-protein coupled receptors, and Tyrosine-kinase linked receptors (RTK). Plant two-component signaling systems. Genetic code: Cracking the genetic code - simulation synthetic polynucleotides and mixed copolymers, synthetic triplets. Important features of the genetic code, proof for the triplet code, Exceptions to the standard code.
Unit IV


Unit V


Book


Reference

1. De Robertis and De Robertis, 1990, Cell and Molecular Biology, Saunders College, Philadelphia, USA.
2. Freifelder D. 1987, Molecular Biology. Jones and Bartlett, Boston, USA.
Books

Reference

Sem. II
14PBO2106
PLANT PHYSIOLOGY

Objectives
1. To study the recent aspects of various physiological processes in plants.
2. To understand the application of physiology in agriculture.

Unit I

Unit II

Unit III

Unit IV

Unit V
Dormancy of seeds - causes and methods of breaking dormancy. Physiology of seed germination. Ageing and senescence - types and physiological/
biochemical changes. *Stress Physiology*: Response of plants to abiotic stresses; mechanism of tolerance to abiotic stress (drought and salinity).

**Book**

**Reference**

**Sem. II**

**Credits: 3**
14PBO2107

**Laboratory Course-III**
**PLANT PHYSIOLOGY**

1. Determination of water potential (Shardakov’s method).
2. Determination of solute potential.
3. Hill reaction.
4. Estimation of total acidity in CAM plants.
5. Apparent photosynthesis.
6. Effect of CO₂ concentration on photosynthesis
7. Effect of quality of light on photosynthesis
8. Estimation of total free aminoacids and proline.
9. *In vivo* assay of NR and NiR.
10. Estimation of IAA.
11. Estimation of starch by perchloric method.

**Sem. II**

**Hours/Week: 5**

14PBO2108

**ECOLOGY AND PHYTOGEOGRAPHY**

**Objectives**
1. To understand the basic concepts of ecosystem and biodiversity.
2. To study the principle of sustainable utilization and management of bioresources.

**Unit I**
Introduction to ecology, evolutionary ecology, environmental concepts - laws and limiting factors, ecological models. Characteristics of population: population size and exponential growth, limits of population growth, population dynamics, life history pattern, fertility rate and age structure, population growth. Competition and coexistence, intra-species interactions, inter- species interactions, scramble and contest competition model, mutualism and commensalism. Modes of speciation and reproductive isolating mechanisms. Community structure and community dynamics.

**Unit II**

**Unit III**
Atmospheric ozone depletion, acid rains, global warming, global climate changes and their consequences on food crops and biodiversity. Climate change conferences - UNFCCC and IPCC. Coping with environmental variations and the mechanisms of evolution - genetic drift, gene flow, mutation and natural selection. Species richness - number of species in a community; and evenness - distribution of individuals among species.

**Unit IV**
Biodiversity - the types and their measurements; and species diversity and its importance. Phytogeography: Climate, atmosphere and the geological time scale; geographical history, continental drift, land bridges, shifting of
poles and plates. Megacentres of origin of crop diversity; phytogeographic regions of the world, and their characteristics with emphasis on vegetation. Phytogeography of the Western Ghats.

Unit V

Book

Reference

Sem. II
14PBO2109

RESEARCH METHODOLOGY

Objectives
1. To identify the influencing factors of research parameters.
2. To test the significance, validity and reliability of the research.

Unit I

Unit II

Unit III
Bibliometrics: definition and relevance; Laws - Lotka’s Law, Bradford’s Law, Zipf’s Law. Bibliometrics databases, h-index, PageRank, Impact Factor and evaluation. The use of bibliometrics in research: Citation Research, Science Citation Index. The Institute for Scientific Information (ISI) and Thomson Reuter’s Webmetric. Plagiarism, tailored research and retraction.

Unit IV
Biostatistics: Introduction, Classification of data; Frequency Distribution: Discrete, Continuous and Cumulative Frequency Distributions - Tabulation of data- Diagramatic and graphic representation of data; Histogram, Frequency polygon, Frequency curve, Ogive curve, Bar Charts: Simple, Multiple, Subdivided, percentage - Pie diagram.- Measures of Central values: Mean, Median and Mode- Measures of Dispersion: Range, Mean Deviation and Standard Deviation.

UNIT V
Coefficient of Variation - Skewness and Kurtosis. Probability: binomial, poisson and normal distributions. Correlation: types, methods, Regression analysis, Large sample (Z), small sample testing: t-test, chi-square and F test. ANOVA - one and two way, Duncan Multiple Range Test. Principles of
experimental design - randomization, replication, local control, size and shape of the plot, CRD, RBD.

Books
4. Pillai and Bagavathi, 2008 Statistics, S.Chand & Company Ltd, New Delhi

Reference

Reference for Bibliometrics

_____

24

25
Laboratory Course-IV:
Ecology and Phytogeography and
Research Methodology

Ecology and Phytogeography
1. Chemical analysis of water and Soil - Calcium and Magnesium, Total hardness, Carbonates and Bicarbonates, Nitrates and Dissolved oxygen.
2. Vegetation Analysis: Quadrat, Line transect, Species Density, abundance and richness, Basal area and relative dominance.
3. Study of primary productivity (Winkler’s method).
4. Field trip.

Research Methodology
1. Sampling by Random Number Table
2. Data Collection
3. Classification of Data: Discrete, continuous and cumulative.
4. Statistical diagrams: Histogram, Frequency curve, Bar chart and Ogive curve
5. Measures of Central Values: Mean, Median and Mode
7. Exercises with Tests of Significance
8. Exercises in the calculation of Citation Index
9. Determination of Impact Factor of Author, Article and Journal.

Core Elective:
BIOPHYSICS AND INSTRUMENTATION

Objectives
1. To understand how physical principles are applied to biological system.
2. To know the principles and applications of instruments.

Unit I
Introduction to biophysics, its importance in modern biology. Bioenergetics: First and second law of thermodynamic, internal energy, enthalpy, entropy, concept of free energy, standard free energy change of a chemical reaction, ATP and high energy phosphate compounds.

Unit II
Biophotonics: Redox potential, Oxidation and reduction, redox potential and its calculation by Nernst equation, examples of redox potential in biological system. Osmosis and osmotic pressure, role of osmosis in cell volume regulation. Iso, hypo, and hypertonic solutions, their influence on the cell. Ionic diffusion. Active and passive bioelectric properties of membranes.

Unit III
Microscopy: Bright field microscopy - magnification, resolving power, contrast. Dark field microscopy, phase-contrast microscopy, fluorescent microscopy, electron microscopy (SEM and TEM).

Unit IV

Unit V
Sem. II Hours/Week: 4
14PBO2202B Credits: 4

Core Elective:
PLANT PATHOLOGY

Objectives
1. To study the process of plant pathogenesis and disease establishment
2. To understand the basis of defence mechanism against pathogens and disease control

Unit I

Unit II
Pathogenesis - pathogens and their mode of dissemination, prepeneetration, penetration and post penetration, entry through natural openings, wounds and intact plant surfaces, role of enzymes and toxins in disease development.

Unit III
Effect of infection on physiology of host viz. photosynthesis, respiration, carbohydrate metabolism, nitrogen metabolism, phenols, shikimic acid pathway, importance of phenol oxidation in plant diseases.

Unit IV
Defense mechanisms in plants, morphological and structural defense mechanisms, defense structures, existing before infection, biochemical defense mechanisms, pre-existing defense mechanisms. Phytoalexins, defense through induced synthesis of proteins and enzymes.

Unit V
Control of plant diseases: biological, cultural and chemical methods, fungicidal, chemotherapy. Plant diseases: causal organisms, symptoms, disease cycle and control measures for the following diseases rots, damping off, rusts, wilt, root rot, leaf spot and leaf blight (one example for each type).

Book

Reference
IDC-1: SOFT SKILLS

Objectives
* Introducing learners to the relevant soft skills at the territory level in order to make them gain competitive advantage both professionally and personally.

Module I:
Basics of communication and Effective communication

Module II:
Resume writing and Interview skills

Module III:
Group discussion and team building

Module IV:
Numerical Ability
Average, Percentage, Profit and Loss, Simple Interest, Compound Interest, Time and Work, Pipes and Cisterns, Time and Distance, Problems on Trains, Boats and Streams Calendar, Rations and Proportions.

Module V:
Test of reasoning
Verbal Reasoning: Series Completion, Analogy, Data Sufficiency, Assertion and Reasoning, Logical Deduction. Non-Verbal Reasoning: Series, Classification

References
1. Aggarwal, R.S. 2010 Quantitative Aptitude, S.Chand & Sons
PLANT SYSTEMATICS

Objectives
1. To understand the relevance of molecular techniques in plant systematics.
2. To study the classical taxonomy with reference to different parameters.

Unit I
History of developments in Taxonomy: Natural systems; Phyletic systems; Phenetics; Cladistics. Concepts of Taxonomic hierarchy: Species, Genus, Family and other categories; species concept and intraspecific categories - subspecies, varieties and forms. Botanical nomenclature: History of ICBN, rule of priority, typification, author citation, retention, rejection and changing of names, naming a new species, synonyms, effective and valid publication.

Unit II

Unit III
Data sources of Taxonomy: Concepts of character; Sources of taxonomic characters - Morphology, anatomy, palynology, embryology, cytology, phytochemistry and genome analysis - nuclear and mitochondrial analysis.

Unit IV
Study of the following families (Bentham & Hooker) in detail with special reference to their salient features, interrelationships, evolutionary trends and economic significance: Menispermaceae, Nymphaeaceae, Capparaceae, Caryophyllaceae, Meliaceae. Aizoaceae, Rubiaceae, Asteraceae, Convolvulaceae, Solanaceae.

Unit V

Books

Reference
3. Young DA and Seiyler DS (eds.) Phytochemical and angiosperm phylogeny. Praeger publications. NY.
Sem. III  
14PBO3113  

Hours/Week: 5  
Credits: 5  

BIOCHEMISTRY

Objectives
1. To fathom the chemical environment and the dynamics of the biological system.
2. To elucidate the interrelationships of the various pathways.

Unit I
Carbohydrates: Homoglycans: chemical structure and properties of starch, glycogen, cellulose, dextrin and inulin. Heteroglycan: chemical structure and properties of agar, alginic acid (sea weed polysaccharide), glycosaminoglycans and pectins. Glycocalyx oligosaccharide.

Unit II
Lipids and Biomembranes: Triglycerides, phosphoglycerols, derived lipids - steroids, prostaglandins and leukotrienes. Membrane lipids and their alignment in membrane. Membrane proteins and membrane receptors: adrenalin receptors, acetylcholine receptors and insulin receptors.

Unit III

Unit IV

Unit V
Enzymes: Principles of catalysis, activation barrier and energy changes in reaction profile, initial velocity and principles of enzyme kinetics: Michaelis-Menten Equation, Km and Vmax measurements - LB blot; active site organization; and role of cofactors / vitamins. Enzyme regulation: pH, temperature and [S]. Inhibitions and regulation of glutamine synthetase.

Book

Reference
1. Apps et al., 1992, Biochemistry, ELBS.
2. Caret et al., 1993, Inorganic, Organic and Biological Chemistry, WMC Brown, USA.

Sem. III  
14PBO3114  

Hours/Week: 3  
Credits: 3  

Laboratory Course-VI:  

BIOCHEMISTRY

1. Estimation of glycogen / total polysaccharides
2. Estimation of hexosamine
3. Determination of total proteins [Bradford’s / Lowry’s]
4. Study of Enzyme Kinetics (experiments with acid phosphatase)
5. Effect of temperature on enzyme activity.
6. Effect of pH on enzyme activity.
8. Effect of [S] on enzyme activity; measurement of Vmax and Km.
9. Estimation of Ascorbic acid [Calorimetric / volumetric]
10. Estimation of Riboflavin
11. Estimation of Phenolics [Folin - Ciocalteau]
12. Estimation of Tannins [Folin - Denis / Vanillin hydrochloride]
13. Estimation of total lipids and cholesterol.
Core Elective-3: 
GENETICS

Objectives
1. To understand the principle and the hereditary mechanisms.
2. To study the structure and functions of genetic materials.

Unit I

Unit II
Linkage and crossing over, Multiple alleles, Sex linked inheritance, Sex determination in plants, theories of sex determination and chromosome basis of heredity. Modified Mendelian ratios. DNA is the genetic material: proof: Griffith’s, Avery et al., and Hershey and Chase. RNA as genetic material.

Unit III
Organization of eukaryotic chromosome and bacterial genome. Special chromosome types - polypene & lamp brush. Chloroplast and Mitochondrial genomes. Watson and Crick model of DNA. Replication of DNA: types and mechanism. DNA repair mechanisms - mismatch and proof reading, photoactivation, excision, recombination and SOS mechanisms in E. coli.

Unit IV

Unit V

Book

Reference

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Core Elective-3: 
PHARMACOGNOSY

Objectives
1. To study the different systems of Indian medicines and the bioactive principles.
2. To know the ethnopharmacological importance of medicinal plants.

Unit I
Traditional and alternative system of medicine - Principle, practice, short history and merits of herbal medicine- naturopathy, traditional chinese, folk medicine, Ayurveda, Siddha, Unani, Homeopathy, Aromatherapy and acupuncture. Global trend in herbal market. Status of Indian medicinal plant trade, medicinal plants prohibited from export, leading companies in India in trade of medicinal plants. WHO regulation of herbal medicine.

Unit II
Classification of crude drugs - alphabetical, taxonomical, morphological, chemical, pharmacological (therapeutical). Cultivation-sexual and asexual method of propagation, fertilizer and manure, pest and its control, collection, processing of herbal drugs - harvesting, drying, dressing, packing and storage.
Unit III
Medicinal useful plant parts - Root - Hemidesmus indicus, Withania somnifera, Rauvolfia serpentina; Rhizome - Zingiber officinalis, Acorus calamus, Curcuma longa; Stem - Tinospora cordifolia, Santalum album, Cinchona officinalis; Bark - Terminalia arjuna, Cinnamomum verum, Saraca asoca; Leaf - Adhatoda vasica, Ocimum sanctum, Cynodon dactylon; Flowers - Crocus sativus, Syzygium aromaticum, Leucus aspera; Fruits - Phyllanthus emblica, Piper longum, Terminalia chebula; Seeds - Azadirachta indica, Vernonia anthelmintica, Ricinus communis.

Unit IV
Herbal preparation methods and herbs - bolus, capsules, compresses, creams, decoctions, extracts, infusions, herbal tea, ointments, massage oils, medicinal vinegar, poultice & plasters, powders, salves, syrups, tinctures, tonic, maceration and baths and bathing remedies teas and dry extract (pills or capsules). Method of administration.

Unit V

Books

Online Resources
- http://shawnacohen.tripod.com/thetribaltraditions/id51.html
Books

Sem. III Hours/Week: 4
14PBO3403 Credits: 4

HORTICULTURE AND LANDSCAPING

Objectives
1. To understand the methods of plant propagation
2. To know the state of art in landscape designing and its aesthetic values.

Unit I
Importance and scope of horticulture; divisions of horticulture; climate, soil and nutritional needs. Water irrigation; plant propagation methods - cutting, layering, grafting, and budding. Stock - scion relationship, micropropagation by root induction.

Unit II

Unit III
Fruit crops - induction of flowering, flower thinning, fruit setting, fruit development. Cultivation of important fruit crops - mango, grapes and guava.

Unit IV
Landscaping principles - planning designs for house gardens, institutional and industrial gardens - bioaesthetic planning for rural gardens, recreational grounds, avenue planting, highway planting, railway planting - trees, shrubs, climbers, herbs and ground covers suited for different situations their culture, training and pruning - tree transplantation.

Unit V
Lawns: different grasses, maintenance of lawns and turf in play grounds, gardens and golf courses; special types of gardens: traffic islands, vertical garden, roof/terrace garden, bog garden, water garden, planning parks and public garden; beautification of urban areas.

Books
Sem. IV  Hours/Week: 6  Credits: 5  
14PBO4115  

MICROBIOLOGY AND IMMUNOLOGY  

Objectives  
1. To study the microorganisms and their activities.  
2. To understand and exploit their potentialities in agriculture, industry and other environmental aspects and to know the basic concepts of the immune system.  

Unit I  
General microbiology; scope, branches and history. Structure and organization of Spirochetes, Rickettsias, Chlamydias, Mycoplasmas, Viruses - Viroids and prions. Culture of microorganisms, synchronous, batch and continuous culture. chemostat and turbidostat, preservation of microbes.  

Unit II  
Food, dairy and environmental microbiology. Microbial contamination of food; food poisoning, food-borne infections and food preservation. Microbial contamination of milk, milk-borne diseases - preservation of milk and dairy products. Aquatic microbiology - fresh water and marine microbes. Treatment and disposal of contaminated waters and sewage. Soil microbes and their role in biogeochemical cycling.  

Unit III  
Industrial microbiology: selection of industrially useful microbes, fermentation processes, recovery of end products; production of alcohol, insulin, lactic acid, vinegar, hydrocarbons, single cell oil and single cell protein. Common immunizations, antibiotics and other chemotherapeutic agents and their mode of action. Drug resistance in microbes.  

Unit IV  

Unit V  
Antigens - types, properties, antigen-antibody interaction. Types of immunity - innate and adaptive - emphasis on cell mediated and humoral immune reactions - Vaccines -Immunization schedule.  

Books  
1. Prescott et al., 2009 7e, Microbiology. Wm. C. Brown Publishers.  

Reference  

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42  43
GENETIC ENGINEERING AND BITECHNOLOGY

Objectives
1. To know the art of recombining genes and traits.
2. To develop the skills in handling genetic material.
3. To apply genetic concepts into manipulating living things for human welfare.
4. Understanding the revolutions that unfold in biotechnology.

Unit I
Crown gall and Agrobacterium; generation of bacterial genes (restriction enzymes) and eukaryotic (cDNA). Joining DNA molecules and the strategies - E. coli and T4 DNA ligases, linkers and homopolymers.

Unit II
Cloning vectors: ideal cloning vehicles; Natural vectors (E. coli and Agrobacterium based), in vitro vectors (pBR), ssrDNA vectors (M13) and shuttle vectors. Expression of cloned genes - problems and solution. Cloning strategies - cDNA libraries and genomic libraries.

Unit III

Unit IV
Technology protection systems (GURT) - the terminator. GMOs and environment - rationale for biosafety of GMOs and GM foods. Principles of biosafety; potential risks; environmental impacts; safety of food and animal feed derived from GM crops; and patterns of gene flow. Issues concerning release of Bt brinjal.

Unit V
Synthetic biology - the art of extreme genetic engineering and creation of new life in lab. Artificial DNA and synthetic genome. The pioneering work of JC Venter et al. Minimal genome, Modular components and expanded gene pool. Creation of synthetic organisms: top-down and bottom-up approaches. Potentials and applications; implications risks and ethical questions. Areas of research and future directions.

Books
2. Watson JD et al., 2005. Recombinant DNA. Blackwell Science Publ. USA.

Reference
1. Adrian Slater et al., 2003, Plant Biotechnology, Oxford University press, U.K.
Laboratory Course-VII: Microbiology, Immunology, Genetic Engineering & Biotechnology

1. Isolation and enumeration (CFU) of microorganisms in soil by serial dilution.
2. Bacterial staining - Simple, Gram’s staining.
3. Isolation of bacteria from skin, mouth and urine.
4. Potability test of water - presumptive, confirmative and completed tests.
6. Testing quality of milk by methylene blue reductase (MBRT) and phosphatase test.
8. Blood grouping
9. WIDAL- test for typhoid
10. RPR- test for syphilis
11. RF- test for rheumatoid arthritis
12. Immuno-electrophoresis
13. Macrophage isolation and observation
14. ELISA - Demo
15. Identification of local crop diseases (sugar cane, paddy, banana, brinjal and citrus).
17. Clonal propagation.
18. Embryo culture
19. Electrophoretic separation of DNA, protein and restriction digestion.
20. Isolation of protoplasts by enzymes and synthetic seeds.

Self Paced Learning: PLANT BREEDING AND EVOLUTION

Objectives
1. To study the importance of plant breeding in food production.
2. To understand the methodology of plant breeding.

Unit I

Unit II

Unit III
Inbreeding depression and heterosis: genetic basis and application in plant breeding. Steps in the production of single cross, double cross, three-way cross and synthetics - induced polyploidy in plant breeding. Role of auto and allopolyploidy. Heteroploids - mutagen and crop improvement. Population genetics: Hardy-Weinberg principle; gene frequencies; and the factors that change it.

Unit IV

Unit V
Mutations (principles of Hugo de' veries). Role of mutations in speciation. Evidences for evolution, adaptive radiation, biological evolution.

**Book**

**Reference**

Sem. IV
14PBO4120

**PROJECT DISSERTATION**

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**VIVA VOCE**