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Item No. 4.18

UNIVERSITY OF MUMBAI



Syllabus for M.Sc. Semester I &II

Program: M.Sc.

Course : Botany

(Credit Based Semester and Grading System with
effect from the academic year 2012–2013)

M.Sc. Semester I and II Botany Syllabus
Credit Based and Grading System
To be implemented from the Academic year 2012-2013

SEMESTER I

Course Code	UNIT	TOPIC HEADINGS	Credits	L / Week
PSBO101	Paper Title: <u>Plant Diversity :CryptogamsI (Algae and Fungi)</u>			
	I	Algae	4	1
	II	Applied Phycology		1
	III	Fungi		1
	IV	Applied Mycology		1
PSBO102	Paper Title: <u>Plant Diversity – Spermatophyta I (Gymnosperms and Angiosperms)</u>			
	I	Gymnosperms I	4	1
	II	Origin of Angiosperms		1
	III	Angiosperms I		1
	IV	Angiosperms II		1
PSBO103	Paper Title: <u>Plant Physiology</u>			
	I	Photosynthesis I (Eukaryotes)	4	1
	II	Photosynthesis II (Prokaryotes)		1
	III	Proteins		1
	IV	Plant Hormones		1
PSBO104	Paper Title: <u>Cytogenetics, Molecular Biology and Biotechnology</u>			
	I	Cytogenetics	4	1
	II	Molecular Biology		1
	III	Recombinant DNA technology		1
	IV	Applications of R-DNA technology		1
PSBOP101	Plant Diversity :Cryptogams I (Algae and Fungi)		2	4
PSBOP102	Plant Diversity – Spermatophyta I (Gymnosperms and Angiosperms)		2	4
PSBOP103	Plant Physiology		2	4
PSBOTP104	Cytogenetics, Molecular Biology &Biotechnology		2	4

SEMESTER II

Course Code	UNIT	TOPIC HEADINGS	Credits	L / Week
PSBO201	Title of the Paper: <u>Plant Diversity : Cryptogams II</u> (<u>Bryophyta and Pteridophyta</u>)			
	I	Bryophyta I	4	1
	II	Bryophyta II		1
	III	Pteridophyta I		1
	IV	Pteridophyta II		1

PSBO202	Title of the Paper: <u>Plant Diversity: Spermatophyta II</u> (<u>Anatomy, Developmental Botany and Palynology</u>)			
	I	Anatomy I	4	1
	II	Anatomy II		1
	III	Developmental Botany		1
	IV	Palynology		1

PSBO203	Title of the Paper: <u>Plant Physiology and Environmental Botany</u>			
	I	Seed Physiology	4	1
	II	Stress Physiology		1
	III	Environmental Botany I		1
	IV	Environmental Botany II		1

PSBO204	Title of the Paper: <u>Medicinal Botany and Dietetics</u>			
	I	Medicinal Botany I	4	1
	II	Medicinal Botany II		1
	III	Dietetics I		1
	IV	Dietetics II		1

PSBOP201	Plant Diversity : Cryptogams II (Bryophyta and Pteridophyta)		2	4
PSBOP202	Plant Diversity: Spermatophyta II (Anatomy, Developmental Botany and Palynology)		2	4
PSBOP203	Plant Physiology and Environmental Botany		2	4
PSBOP204	Medicinal Botany and Dietetics		2	4

Semester I Detailed Syllabus

Theory

Course Code	Title	Credits
PSBO101	<u>Plant Diversity-Cryptogams I (Algae and Fungi)</u>	4
<u>Unit I: Algae</u> Classification of Algae up to orders, according to the system proposed by G.M Smith.		1
<u>Unit II: Applied Phycology</u> 1. Techniques of culturing Algae 2. Algae as biofuel		1
<u>Unit : III Fungi</u> 1. Classification of fungi , upto orders, according to the system proposed by Alexopoulos. 2. General account of spore bearing organs and their arrangements in various groups of fungi; spore release and dispersal.		1
<u>Unit : IV Applied Mycology</u> 1. Mycorrhiza; type, distribution and significance with reference to agriculture and forestry. 2. Study of the following diseases with reference to symptoms, causal organism and disease cycle : a. Late blight of potato b. Covered smut of jowar		1

Course Code	Title	Credits
PSBO102	<u>Plant Diversity – Spermatophyta I (Gymnosperms and Angiosperms)</u>	4
<u>Unit I: Gymnosperms I</u>		
1. Classification of gymnosperms upto orders according to the system proposed by C. J. Chamberlain. 2. General characters; affinities and interrelationships of Cycadofilicales, Bennettitales and Cordaitales.		1
<u>Unit II: Origin of Angiosperms</u>		
Origin and evolution of angiosperms; the primitive angiospermic flower; primitive and advanced character in angiosperms.		1
<u>Unit : III Angiosperms I</u>		
1. International Code of Botanical Nomenclature (I.C.B.N.) History and basic Principles. 2. Principles for assessment of relationships, delimitation of taxa and attribution of rank: a. criteria b. guidelines c. practical considerations, d. use of categories.		1
<u>Unit : IV Angiosperms II</u>		
1. Evolution, variation and speciation, Biosystematic categories, Biotypes and Ecotypes. 2. Concept of characters: - Introduction, type function values of taxonomic characters- numerical taxonomy, chemotaxonomy, Molecular systematics.		1

Course Code	Title	Credits
PSBO103	<u>Plant Physiology</u>	4
<p><u>Unit I: Photosynthesis I (Eukaryotes)</u></p> <p>1. Regulation of C₃, C₄ and CAM pathways of photosynthesis: Role of light in the activation of dark phase enzymes, regulation of RUBISCO, PEPcase, light effect, modulators and coordination of light , dark phase. C₄ Photosynthesis: inter and intra-cellular transport of metabolites, carbonic anhydrase, PEPcase, NADP-MDH and PPK. Regulation of CAM through transport of metabolites.</p> <p>2. Pentose Phosphate Pathway and its importance.</p>		1
<p><u>Unit II: PhotosynthesisII (Prokaryotes)</u></p> <p>Photosynthesis of prokaryotes: Pigment systems in bacteria and Cyanobacteria, light harvesting mechanisms, reductive TCA cycle.</p>		1
<p><u>Unit : III Proteins</u></p> <p>Proteins: Primary, secondary, tertiary and quaternary structural features and their analysis – Theoretical and experimental; protein folding – biophysical and cellular aspects.</p>		1
<p><u>Unit : IV Plant Hormones</u></p> <p>Plant hormones: Biosynthesis, storage, breakdown and transport.</p>		1

Course Code	Title	Credits
PSBO104	<u>Cytogenetics, Molecular Biology and Biotechnology</u>	4
<u>Unit I: Cytogenetics</u>		
Cell division and cell cycle: Steps in cell cycle and control of cell cycle.		1
<u>Unit II: Molecular Biology</u>		
Microbial Genetics: Molecular basis of transformation, transduction, Conjugation; fine structure of the gene, T4 Phage, complementation analysis, deletion mapping, cis-trans tests.		1
<u>Unit : III Recombinant DNA Technology</u>		
Vectors in gene cloning: pUC19, phage, cosmid, BAC and YAC vectors. High and low copy number plasmids and its regulation.		1
<u>Unit : IV Applications of Recombinant DNA technology</u>		
Application of recombinant DNA technology for production of herbicide resistant plants, insect resistant plants, improving seed storage proteins and golden rice.		1

	Practical	
Code	Title	Credits
PSBOP101	Plant Diversity :Cryptogams I (Algae and Fungi)	2
<p>1 Study of following type with reference to their systematic position, thallus and reproductive structures: <i>Scytonema, Lyngbya, Anabaena, Volvox, Scenedesmus, Ulothrix, Enteromorpha, Pithophora, Closterium, Nitella, Padina</i> and <i>Gracilaria</i>.</p> <p>2 Extraction of algal pigments and their separation by paper chromatography.</p> <p>3 Preparation of algal herbaria.</p> <p>4 Study of the following type with reference to their systematic position, thallus and reproductive structures: <i>Stemonitis, Saprolegnia, Phytophthora, Xylaria, Peziza, Daedalea, Claviceps, Fusarium</i> and <i>Trichoderma</i>.</p> <p>5 Study of the disease mentioned in the syllabus (theory) with reference to the symptoms. Causal organisms and disease cycle.</p>		
PSBOP102	Plant Diversity – Spermatophyta I (Gymnosperms and Angiosperms)	2
<p>Gymnosperms: A study of following types</p> <p><i>Cordaites</i> (Fossil) <i>Araucaria, Cupressus, Podocarpus</i> and <i>Juniperus</i>.</p> <p>Angiosperms: A study of the following plant families their morphological peculiarities and economic importance :</p> <p>Menispermaceae, Portulacaceae, Guttiferae, Passifloraceae, Rhamnaceae, Sapindaceae, Lythraceae, Boraginaceae, Chenopodiaceae, Liliaceae, Scitaminae, Cyperaceae.</p> <p>Identification of genus and species with the help of flora volumes. (In addition to the above mentioned families, all families studied in undergraduate classes are included).</p>		
PSBOP103	Plant Physiology	2
<p>Major experiments</p> <p>1 Enzyme kinetics : Determination of Km and Vmax of the enzyme amylase purified (amylase)</p> <p>2 Extraction of cellulase from a suitable fungal culture and study of enzyme activity by DNSA method.</p> <p>3 Immobilisation of yeast cells and study of invertase activity.</p> <p>4 Quantitative study of diurnal fluctuation in titratable acid number (TAN) in a CAM plant.</p> <p>5 Extraction and estimation of GOT and GPT from suitable plant material.</p> <p>6 Estimation of the total nitrogen content of a plant using Kjeldahl's method.</p> <p>Minor experiment</p>		

- 1 Separation of organic acids by paper chromatography.
- 2 Separation of sugars by paper chromatography.
- 3 A study of the enzyme polyphenol oxidase, from potato peels.
- 4 Solvent extraction of chlorophyll a/b, xanthophylls and study of absorption pattern.

PSBOP104

Cytogenetics, Molecular Biology and Biotechnology

2

1. Preparation of cytological stains, fixatives and pretreatment agents.
2. Squash preparation from pre-treated root tips (colchicines/ Paradichlorobenzene/ Aesculin).
3. Squash preparation from mutagen treated root tips for study of aberrations.
4. Smear preparation from any suitable plant material.
5. Problems based on:
 - Restriction map analysis and construction of restriction maps,
 - Tetrad analysis in *Neurospora* – two genes and centromere.
 - Deletion mapping in Bacteriophage.

Semester II Detail Syllabus

Theory

Course Code	Title	Credits
PSBO201	<u>Plant Diversity- Cryptogams II (Bryophyta and Pteridophyta)</u>	4
<p style="text-align: center;"><u>Unit I: Bryophyta I</u></p> <p>1. Classification of Bryophyta, upto orders, according to the system proposed by G.M.Smith.</p> <p>2. Alternation of generation in Bryophyta.</p>		1
<p style="text-align: center;"><u>Unit II: Bryophyta II</u></p> <p>1. Origin and evolution of Bryophyta with reference to habitat and form</p> <p>2. Evolution of the Sporophyte in Bryophyta</p>		1
<p style="text-align: center;"><u>Unit : III: Pteridophyta I</u></p> <p>Classification of Pteridophyta, upto orders, according to the system proposed by G.M.Smith.</p>		1
<p style="text-align: center;"><u>Unit : IV Pteridophyta II</u></p> <p>1. The geological time scale and a study of fossil Pteridophytes (<i>Rhinia</i>, <i>Horneophyton</i>, <i>Lepidodendron</i>, <i>Calamites</i>, <i>Cladoxylon</i>, <i>Sphenophyllales</i>, <i>Coenopteridales</i>)</p> <p>2. Economic importance of Pteridophytes;</p> <p>3. Cultivation and maintenance of ornamental Ferns.</p>		1

Course Code	Title	Credits
PSBO202	<u>Plant Diversity –Spermatophyta II (Anatomy, Developmental Botany and Palynology)</u>	4
<u>Unit I: Anatomy I</u> 1. Meristems: Definition type of meristems, apical cell theory, histogen theory and Tunica corpus theory 2. Sensory and tactile tissue system: Tactile sense organs, gravitational and optical sense organs		1
<u>Unit II: Anatomy II</u> 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 in <i>Arabidopsis</i> and <i>Antirrhinum</i> .		1
<u>Unit : III Developmental Botany</u> 1. Male gametophyte: Pollen development and gene expression male sterility sperm dimorphism and hybrid seed production; pollen tube growth and guidance; pollen storage; pollen embryos . 2. Female gametophyte; Types of embryo sacs; structure of embryo sac cells. 3. Pollination, pollen-pistil interaction and fertilization: floral characteristics. 4. Mechanism of Pollination and Fertilization: vectors involved in pollination; breeding system; commercial considerations, structure of the pistil; pollen-stigma interactions, sporophytic and gametophytic self-incompatibility (cytological, biochemical and molecular aspects); double fertilization; <i>in vitro</i> fertilization. 5. Seed development and fruit growth; endosperm development during Early, Maturation and Desiccation stages; embryogenesis, ultrastructure and nucellar cytology; cell lineage during late embryo development; storage proteins of endosperm and embryo; apomixis; embryo culture; dynamics of fruit growth; biochemistry and molecular biology of fruit maturation.		1
<u>Unit : IV Palynology</u> 1. Special relationships of pollen grain in pollen tetrads. 2. Pollen wall morphogenesis, ultrastructure, primexin formation. 3. Pollen proteins and allergens.		1

Course Code	Title	Credits
PSBO203	<u>Plant Physiology and Environmental Botany</u>	4
<u>Unit I: Seed physiology:</u> Physiology and biochemistry of seed germination mobilization of food reserves, germination and growth factors, seed dormancy, control and release of dormancy.		1
<u>Unit II: Stress Physiology:</u> Responses of plants to biotic (pathogen and insects) and abiotic (water, temperature and salt) stresses; mechanism of resistance to biotic stress and tolerance to abiotic stress.		1
<u>Unit : III Environmental Botany I</u> 1. The Environment: Physical environment; biotic environment; biotic and abiotic interactions. 2. Habitat and Niche: concept of habitat and niche; niche width and overlap; fundamental and realized niche; resource partitioning; character displacement. 3. Population Ecology: Characteristics of a population; population growth curves; population regulation; life history strategies (r and K selection); concept of metapopulation – demes and dispersal, interdemec extinctions, age structured population.		1
<u>Unit : IV Environmental Botany II</u> 1. Species interactions: types of interactions, interspecific competition, herbivory, carnivory, pollination and symbiosis. 2. Biogeography: Major terrestrial biomes, theory of island biogeography; biogeographical zones of India. 3. Environmental Botany- Present concern: Conservation of genetic resources, gene pools land races, Global warming and costal ecosystems. Depletion of forest cover, threats to mangroves. Urbanization and plant cover.		1

Course Code	Title	Credits
PSBO204	<u>Medicinal Botany and Dietetics</u>	4
<u>Unit I: Medicinal Botany I</u> Biological source, geographical distribution, physicochemical analysis of <i>Tylophora asthmatica</i> (leaf), Fennel and <i>Plantago</i> (fruit/seed), <i>Cinnamon</i> and <i>Holarrhena</i> (bark) and <i>Acorus</i> (rhizome) and <i>Tinospora</i> root.		
<u>Unit II: Medicinal Botany II</u> Essential oils (<i>Cinnamon</i> , <i>Eucalyptus</i> and <i>Citronella</i>) fatty oil (Sesame, Safflower and coconut). Vegetable fat (Cocum butter and Mahua butter) And Medicinal uses of the above		
<u>Unit : III Dietetics I</u> Therapeutic value of Indian plant foods :-a) rice wheat ; b) gram , green gram c) lemon, grapes and bananas; d) ginger, turmeric, coriander, garlic, asafoetida, cumin and clove.		
<u>Unit : IV Dietetics II</u> Plant food in the treatment of diseases - anorexia, arthritis constipation, diarrhoea, diabetes, exhaustion, hypertension, memory and piles.		

Practical

Code	Title	Credit
PSBOP201	Plant Diversity : Cryptogams II (Bryophyta and Pteridophyta)	2
<p>1. Study of vegetative and reproductive structures in <i>Targionia Plagiochasma Fimbraria</i>, <i>Pellia</i> and <i>Pgonganatum</i>.</p> <p>2. Study of vegetative and reproductive structures in : <i>Isoetes</i>, <i>Ophioglossum Pteris</i>, <i>Angiopteris</i>, <i>Lygodium</i> and <i>Azolla</i></p> <p>3. Study of fossils : <i>Sigillaria</i>, <i>Calamites</i>, <i>Rhynia</i>, <i>Sphenophyllum</i> and <i>Glossopteris</i>.</p>		
PSBOP202	Plant Diversity: Spermatophyta II (Anatomy, Developmental Botany and Palynology)	2
<p>1. Study of wood elements in <i>Annona</i>, <i>Michelia</i>, <i>Sterculia</i> and <i>Thuja</i>, using the maceration technique.</p> <p>2. Study of the following leaves with respect to leaf surface characters (wax, cuticle, epidermis, stomata, epidermal outgrowth): <i>Pistia</i> , <i>Ficus</i>, <i>Avicennia</i> and <i>Peperomia</i>.</p> <p>3. Photosynthetic system in <i>Pinus</i> (arm palisade): <i>Cyperus</i>, <i>Ficus</i>, and <i>Oxalis</i>.</p> <p>4. A study of Microsporogenesis and megasporogenesis with the help of permanent slides</p> <p>5. <i>In vitro</i> germination of pollen grains, effect of temperature on pollen viability and short term storage.</p> <p>6. Study of the morphology of the pollen (using Chitale's and acetolysis method) from the families; Malvaceae, Asteraceae, Convolvulaceae, Labiatae and Graminae.</p>		
PSBOP203	Plant Physiology and Environmental Botany	2
<p>Practical exercises are planned for better understanding of the state of environment, rather than 5-hour units. Field exercises are expected to be completed during excursion and field diaries maintained for submission during tests. Other practical work can be carried out in the laboratory with help of plant and soil samples collect from the field.</p> <p>Major experiments</p> <ol style="list-style-type: none"> 1 Breaking of seed dormancy by Physical and Chemical methods 2 Assessing seed viability by TTC method 3 Determination of Nygard index of algae in a water body. 4 Determination of dust load on lives of roadside plant. 5 Comparison of two population of a species collected from two areas. 6 Determination of primary production of an area by harvest method. 7 Determination of primary production of an area by chlorophyll method. 8 Determination of primary aquatic production by harvest method. 9 Determination of mechanical composition of soil by international pipette method. 		

Minor experiments

- 1 Effect of water and salinity stress on chlorophyll content of leaves.
- 2 Effect of water and salinity stress on Proline content of leaves.
- 3 Determination of Stomatal Index of leaves
- 4 Determination of epidermal architecture of leaves.
- 5 Determination of LAI of different types of trees.
- 6 Assessment of pollution in ambient air, on the basis of injured leaf area.

Field exercises

- 1 Assessment of erosion status of land along a 'stream' on a slope or on flat land.
- 2 Assessment of status of waste land, on the basis of its appearance and visible plant growth.

Assessment of degradation of a forest on the basis of its canopy cover and height, strata and species diversity.

PSBOP204	Medicinal Botany and Dietetics	2
<ol style="list-style-type: none">1. A study of the macroscopic and microscopic characters and identification of active ingredients of drugs mentioned in the syllabus for theory by means of chemical tests/TLC.2. Identification of medicinally important plants like <i>Tinospora</i>, <i>Holarrhoena</i> and Ginger with respect to their morphological and anatomical characters for authentication.3. Estimation of FW/DW ratio and total ash content from any medicinal plant material as per Indian Pharmacopeia standards.4. A study of the following medicinal plants/plant parts with respect to their morphological, anatomical and biochemical characters for authentication of the drug source: <i>Tinospora cordifolia</i>, <i>Holarrhoena antidysenterica</i>, <i>Ricinus communis</i>, <i>Zingiber officinalis</i>.5. Morphological identification of plants with similar nomenclatures in the Ayurvedic system of medicine.<ol style="list-style-type: none">a. Brahmi – <i>Centella asiatica</i> and <i>Bacopa monieri</i>b. Asoka – <i>Saraca indica</i> and <i>Polyalthia longifolia</i>c. Karanj – <i>Caesalpinia bonducella</i> and <i>Pongamia pinnata</i>		

