

UNIVERSITY OF MUMBAI



Syllabus for M.Sc. Semester I &II
Program: M.Sc.
Course : Herbal Science

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

M.Sc. Semester I and II - Herbal Science 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
PSHS101	Title of the Paper: <u>Plant Sciences I</u>			
	I	Introduction to Herbal Sciences	4	1
	II	Introduction to Pharmacopoeia		1
	III	Cryptogams I (Algae and Fungi)		1
	IV	Cryptogams II (Bryophytes & Pteridophytes)		1
PSHS102	Title of the Paper: <u>Modern Plant Authentication Techniques</u>			
	I	Techniques in Chromatography - I	4	1
	II	Techniques in Chromatography - II		1
	III	Electrophoresis		1
	IV	Spectroscopy		1
PSHS103	Title of the Paper: <u>Cultivation Practices I</u>			
	I	Vegetative Propagation Techniques	4	1
	II	Sexual Reproduction in Angiosperms		1
	III	Hydroponics		1
	IV	Polyhouse Technology		1
PSHS104	Title of the Paper: <u>Phytoconstituents I</u>			
	I	Primary Metabolites I	4	1
	II	Primary Metabolites II		1
	III	Secondary Metabolites I		1
	IV	Secondary Metabolites II		1
PSHSP101	Plant Sciences I		2	4
PSHSP102	Modern Plant Authentication Techniques		2	4
PSHSP103	Cultivation Practices I		2	4
PSHSP104	Phytoconstituents I		2	4

SEMESTER II

Course Code	UNIT	TOPIC HEADINGS	Credits	L / Week
PSHS201	Title of the Paper: <u>Plant Sciences II</u>			
	I	Gymnosperms	4	1
	II	Angiosperms I		1
	III	Angiosperms II		1
	IV	Taxonomic Evidence		1

PSHS202	Title of the Paper: <u>Genomics, Proteomics, Bioinformatics and Biostatistics</u>			
	I	Genomics and Proteomics	4	1
	II	Bioinformatics I		1
	III	Bioinformatics II		1
	IV	Biostatistics		1

PSHS203	Title of the paper : <u>Cultivation Practices II</u>			
	I	<i>In vitro</i> Techniques in Plant Propagation I	4	1
	II	<i>In vitro</i> Techniques in Plant Propagation II		1
	III	Transgenic Plants		1
	IV	Alternative Methods of Secondary Metabolite Production		1

PSHS204	Title of the paper: <u>Phytoconstituents II</u>			
	I	Pharmacopeial Drugs of Plant Origin I	4	1
	II	Pharmacopeial Drugs of Plant Origin II		1
	III	Enzymology I		1
	IV	Enzymology II		1

PSHSP201	Plant Sciences II	2	4
PSHSP202	Genomics, Proteomics, Bioinformatics and Biostatistics	2	4
PSHSP203	Cultivation Practices II	2	4
PSHSP204	Phytoconstituents II	2	4

Semester I Detailed Syllabus

Theory

Course Code	Title	Credits
PSHS101	<u>Plant Sciences</u>	4
Unit I: <u>Introduction to Herbal Science:</u> Historical Background, Present Status and Scope of the following with special reference to literature: Medicinal Botany, Pharmacognosy, Aroma Therapy, Cosmetology.		1
Unit II: <u>Pharmacopoea :</u> Indian Pharmacopoeia US Pharmacopoeia and British Pharmacopoeia WHO's Pharmacopoeia		1
Unit : III <u>Cryptogams – Algae and Fungi:</u> Taxonomic structure, Classification of plants-General outline. major taxonomic groups. Algae- General Characters of the Divisions as Proposed by Smith Fungi- General characters of Phycomycetae, Ascomycetae, Basidiomycetae, Deuteromycetae. Economic Importance of the above groups of plants with reference to Food and Medicine.		1
Unit : IV <u>Cryptogams – Bryophytes and Pteridophytes:</u> Taxonomic structure, Classification of plants-General outline. major taxonomic groups. Bryophytes – General Characters of Hepaticae, Anthocerotae, Musci Pteridophytes – General Characters of Psilophyta, Lepidophyta, Calamophyta and Pterophyta Economic Importance of the above groups of plants with reference to Food and Medicine.		1

Course Code	Title	Credits
PSHS102	<u>Modern Plant Authentication Techniques I</u>	4
Unit I: <u>Techniques in Chromatography I :</u> Principles, Instrumentation, processes, applications of -Adsorption Chromatography, Partition Chromatography, HPLC, Counter-current extraction,		1
Unit II: <u>Techniques in Chromatography II:</u> Principles, Instrumentation, processes, applications of - TLC, HPTLC, Gas- liquid chromatography, GC , Affinity Chromatography.		1
Unit : III <u>Spectroscopy:</u> Introductory principles: Principles and Instrumentation of UV and Visible spectrophotometer, Turbidometry, IR, AAS, NMR, ICI, and X-ray diffraction.		1
Unit : IV <u>Electrophoresis:</u> Principles of Electrophoresis, Agarose Gel Electrophoresis, Polyacralamide Gel Electrophoresis Basic protein chemistry, principles of separation, equipment and process, standardisation of technique Electrofocussing, Southern, Northern and Western Northern Blotting		1

Course Code	Title	Credits
PSHS103	<u>Cultivation Practices I</u>	4
1. Unit I: <u>Vegetative Propagation Techniques</u> A) Natural Methods by Specialised vegetative structures: Tuberous roots, stem tubers, rhizome, bulb, corm, runner, offset, stolon, sucker, bulbils B) Artificial methods: Cutting (stem and leaf), Grafting, Budding, Layering.		1
Unit II: <u>Sexual Reproduction in Angiosperms:</u> A) Microsporogenesis and Microgametogenesis B) Megasporogenesis and Megagametogenesis C) Fertilization D) Embryo and Endosperm development E) Seed Germination, Seed dormancy – types and Methods of overcoming seed dormancy		1
<u>Unit : III Hydroponics</u> History and Origin Soil less Culture, its advantages and Disadvantages Techniques in Hydroponics – static solution culture, Continuous –flow solution culture, Aeroponics, Passive sub-irrigation, Ebb and flow or flood and drain irrigation, Run to waste, Deep water culture, Bubbleponics. Media used for Hydroponics: Ex-clay, Rock wool, Coir, Perlite, Pumice, Vermiculite, Sand, Gravel, Brick shards, Polystyrene packing peanuts, wood fibre. Nutrient Solutions – Major and Minor nutrients, role of nutrients. Commercial Aspects, Advancements		1
Unit : IV <u>Polyhouse Technology:</u> Selection of site and type of polyhouses, construction, additional facilities in polyhouses , maintaining temperature and humidity ; Irrigation, soil mangement, pest management.		1

Course Code	Title	Credits
PSHS104	<u>Phytoconstituents</u>	4
Unit I: <u>Primary Metabolites I</u> Biosynthesis and Biodegradation of Carbohydrates – Sucrose, Starch, Fructans, Cellulose. Lipid Metabolism - Biosynthesis and Degradation of fatty acids and glycerol, Respiratory metabolism in germinating seeds, β -oxidation & energetics of β -oxidation, Types of lipids.		1
Unit II: <u>Primary Metabolites II</u> Nitrogen Metabolism: Nitrogen Nutrition, Asymbiotic and Symbiotic N fixation, Synthesis of Amino acids and Amides, Proteins.		1
Unit : III <u>Secondary Metabolites I :</u> History, Classification, Properties, Distribution in Nature, Extraction, Biosynthesis, Biological role and applications of Alkaloids and Glycosides.		1
Unit : IV <u>Secondary Metabolites II :</u> History, Classification, Properties, Distribution in Nature, Extraction, Biosynthesis, Biological role and applications of Tannins and other Phenolic Compounds. Volatile oils and resins		1

Practical

PSHSP101	<u>Plant Sciences I</u>	2	4
<ol style="list-style-type: none"> 1. Identification of the following plants based on exomorphic and endomorphic features and chemical tests for their active constituents: <ol style="list-style-type: none"> a. Medicinal Plants: <i>Datura</i>(tropane alkaloids), <i>Andrographis</i>(diterpene lactose), <i>Curcuma</i>(curcuminoids), <i>Boerhaavia</i>(glycosides), <i>Ricinus</i>(fatty acids), <i>Terminalia belerica</i>(tannins), <i>Allium sativum</i> (sulphur compounds). b. Cosmetics and Aromatherapy: <i>Vetiveria zizanoidis</i>, <i>Rosa sinensis</i>, <i>Jasminum spp.</i>, <i>Pogostemon patcholi</i>. c. Food additives: <i>Bixa orellana</i>, <i>Beta vulgaris</i>, <i>Cinamomum tamala</i>, <i>Zingiber officinalis</i>, <i>Allium sativum</i>, <i>Curcuma longa</i>. 2. Identification of Algae used as food and in medicine(5 plants) 3. Identification of Fungi used as food and in medicine(5 plants) 4. Identification of Bryophytes and Pteridophytes used in medicine(5 plants) 5. Cultivation of Mushrooms. 			
PSHSP102	<u>Modern Plant Authentication Techniques</u>	2	4
<ol style="list-style-type: none"> 1. Separation of Phytochemicals using different methods of Chromatography (Paper, TLC, HPTLC, GC, Column). 2. Extraction and separation of Proteins from the given raw material/products using PAGE. 3. Extraction and separation Nucleic acid by Gel electrophoresis. 4. Principles, applications- UV and Visible and IR Spectroscopy. 			
PSHSP103	<u>Cultivation Practices I</u>	2	4
<ol style="list-style-type: none"> 1. Study of growth pattern in stem and leaf cuttings, 2. Effect of PGR in stem cutting 3. Study of seed viability 4. Breaking of seed dormancy by Physical and chemical methods 5. Effect of pH, Temperature, PGR and substratum on seed germination. 6. Study of Hydroponics 7. Preparation of a report on Polyhouse Technology Based on visits to Polyhouses with respect to the following:Types of Polyhouses and their uses, Determination of quantity of water needed for pot cultivation in polyhouse, Control of temperature and humidity in polyhouses, Pest management in polyhouse cultivation 			
PSHSP104	<u>Phytoconstituents I</u>	2	4
<ol style="list-style-type: none"> 1. Estimation of proteins by Biuret method and Folin-Lowry method. 2. Estimation of reducing sugars 3. Estimation of fatty acids 4. Determination of Fatty acids 5. Estimation of Alkaloids 			

Semester II Detailed Syllabus

Theory

Course Code	Title	Credits
PSHS201	<u>Plant Science</u>	4
Unit I: <u>Gymnosperms:</u> Classification of Gymnosperms upto orders as proposed by Chamberlain General characters of Cycadophyta General characters of Coniferophyta Importance of Gymnosperms in Health and Medicine		1
Unit II: <u>Angiosperms I:</u> Bentham and Hooker's system of classification up to orders (family) with respect to the following prescribed families with at least two plants of medicinal importance from each: Annonaceae, Malvaceae, Anacardiaceae, Myrtaceae, Leguminosae and Apiaceae.		1
Unit : III <u>Angiosperms II:</u> Bentham and Hooker's system of classification up to orders (family) with respect to the following prescribed families with at least two plants of medicinal importance from each: Rubiaceae, Apocyanaceae, Solanaceae, Lamiaceae, Euphorbiaceae, Liliaceae, Scitaminae.		1
Unit : IV <u>Taxonomic evidence</u> Application of information from interrelated subjects. Exomorphic characters. Endomorphic characters: Anatomical, Cytological, Palynological and Embryological. Physico-chemical characters: Ash content, extractive values, qualitative chemical values, quantitative chemical analysis.		1

Course Code	Title	Credits
PSHS202	<u>Genomics, Proteomics, Bioinformatics and Biostatistics</u>	4
Unit I: <u>Genomics and Proteomics</u> DNA finger printing, molecular markers, Different analytical techniques for purification and determining molecular size, shape, diffusion and sedimentation, Gel filtration, viscosity, light scattering small angle scattering method, capillary isoelectric focussing, electro spray, ionisation, mass spectroscopy (CIEF-ESI-MS), 2-d PAGE, ELECTOSPRAYMS/MS(NANOSPRAY and LC/MS/MS) MALDI-TOF-MS, BioChips(DNA CHIPS, PROTEIN CHIPS and SENSOR CHIPS).		1
Unit II: <u>Bioinformatics I</u> Data base -Organisation of biological data, data bases, Exploration of data bases, retrieval of desired data. Sequence alignment –Introduction to sequence alignment, significance Sequence similarity search with single query sequence, FASTA,BLAST, multiple sequence analysis and applications, Phylogenetic analysis - tree –building methods		1
Unit III: <u>Bioinformatics II</u> Predictive methods -predictive methods using protein sequences. Protein structure prediction and modelling, Homology modelling, prediction of protein function Proteomics and genomics -DNA microarray, Human genome project Drug discovery and development -Insilico Drug design- Theory of drug design, Use of computers in drug design, Molecular modelling in drug discovery, Docking.		1
Unit IV: <u>Biostatistics</u> Statistical Hypothesis testing: Student t-test (paired and Unpaired), The chi-square test, ANOVA. Correlation and regression.		1

Course Code	Title	Credits
PSHS203	<u>Cultivation Practices</u>	4
Unit I: <u>In vitro Plant Propagation techniques -I</u> Setting up of a plant tissue Culture Lab. Aseptic conditions, Micropropagation by Mericlone Node culture Organogenesis Embryo culture Anther and Pollen culture		1
Unit I: <u>In vitro Plant Propagation techniques -II</u> Micropropagation by Somatic Embryogenesis and synthetic seed production Somatic Hybridization Standardisation of cultivation of protocols of any two medicinal plants		1
Unit III: <u>Transgenic Plants</u> Production of Transgenic Plants: Artificial direct DNA uptake by protoplast, electroporation, liposome mediated, and particle gun transformation. Natural method of gene transfer <i>Agrobacterium</i> and viruses. Marker and Reporter genes. Transgenic Plants for improving seed quality, insect and disease resistance, Production of golden rice, edible vaccines.		1
Unit : IV <u>Alternative methods of Secondary Metabolite Production</u> Organ culture, Cell culture. Biotransformation(microbial and plant cells) Scale up: Enhancement of product formation by elicitation, permeabilization of plant cells for product release.		1

Course Code	Title	Credits
PSHS204	<u>Phytoconstituents</u>	4
Unit I: <u>Pharmacopoeial Drugs of Plant origin I</u> Vitamins and Hormones Colouring and Flavouring agents.		1
Unit II: <u>Pharmacopoeial Drugs of Plant origin II</u> Tumour inhibitors Anti- bacterial, anti-viral and antii protozoal		1
Unit : III <u>Enzymology I</u> Classification, IUB/EC nomenclature, Michaelis-Menten Kinetics, L. B. plot, Km definition and significance.		1
Unit : IV <u>Enzymology II</u> Enzyme inhibition-various types, allosteric enzymes, isoenzymes-clinical significance. Immobilization of enzymes and their use in industry.		1

Practical

PSHSP201	<u>Plant Sciences II</u>	2	4
<p>Exomorphic features of two medicinal plants each, from the families prescribed for theory.</p> <p>Physico-chemical studies of <i>Adhathoda</i> leaf w.r.t. ash content and extractive value (Water, Methyl alcohol, Acetone)</p>			
PSHSP202	<u>Genomics, Proteomics, Bioinformatics and Biostatistics</u>	2	4
<ol style="list-style-type: none"> 1. Extraction and separation Nucleic acid by Gel electrophoresis. 2. PCR techniques (RAPD). 3. Use of internet and www. Tools used in Bioinformatics related to Herbal technology-NCBI data model. 4. Student t-test (paired and unpaired) 5. The chi square test. 6. ANOVA <p style="text-align: center;">Coefficient of Correlation and regression analysis</p>			
PSHSP203	<u>Cultivation Practices II</u>	2	4
<ol style="list-style-type: none"> 1. Sterilization of glassware and explants 2. Plant tissue culture:- Callus culture, Organ culture, meristem culture, Cell suspension culture, protoplast culture, somatic embryogenesis and synthetic seed production. 3. Enhancement of phytochemicals in culture system using physical and chemical agents 			
PSHSP204	<u>Phytoconstituents II</u>	2	4
<ol style="list-style-type: none"> 1 Identification of Plants (any five) as sources of Vitamins, Hormones, Colouring and flavouring agents, Tumour inhibitors, Anti-bacterial anti-viral and anti-protozoal compounds. 2 Effect of pH, substrate concentration and temperature on amylase activity. 3 Assay and determination of Km value of the following enzymes from the crude enzyme extract: Amylase from suitable plant material; Cellulase from fungi 4 Immobilization of enzymes and activity of immobilized enzymes. 			

