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Item no. 4.66

UNIVERSITY OF MUMBAI



Syllabus for Sem III & IV

Program: M.Sc.

Course : Herbal Science

(Credit Based Semester and Grading System with
effect from the academic year 2013–2014)

M.Sc.
Herbal Science
SEMESTER III

Course Code	UNIT	TOPIC HEADINGS	Credits	L / Week
PSHS301	Title of the Paper: <u>Human Systems, Endocrinology, and Human Pathogens</u>			
	I	Human Systems -I	4	1
	II	Human Systems -II		1
	III	Endocrinology		1
	IV	Human Pathogens		1

PSHS302	Title of the Paper: <u>Crude Drugs and Nutraceuticals</u>			
	I	Collection and Preservation of Crude Drugs	4	1
	II	Quality Assurance of Crude Drugs		1
	III	Stabilization of Crude Drugs		1
	IV	Nutraceuticals		1

PSHS303	Title of the Paper: <u>Systems of Medicine</u>			
	I	Ayurveda	4	1
	II	Siddha		1
	III	Unani		1
	IV	Standardization of ASU drugs		1

PSHS304	Title of the Paper: <u>Herbal Biotechnology</u>			
	I	Plant Transformation and Production of Edible Vaccines	4	1
	II	<i>In vitro</i> production of secondary metabolites		1
	III	Bioreactors		1
	IV	Nanotechnology		1

PSHSP301	Human Systems, Endocrinology, and Human Pathogens		2	4
PSHSP302	Crude Drugs and Nutraceuticals		2	4
PSHSP303	Systems of Medicine		2	4
PSHSP304	Herbal Biotechnology		2	4

SEMESTER IV

Course Code	UNIT	TOPIC HEADINGS	Credits	L / Week
PSHS401	Title of the Paper: Immunology, Disorders and Diseases and Molecular Biology			
	I	Immunology: I.	4	1
	II	Immunology II		1
	III	Disorders and Diseases		1
	IV	Molecular Biology – Medical Applications		1

PSHS402	Title of the Paper: <u>Commercial Aspects</u>			
	I	Entrepreneurship Development- I	4	1
	II	Entrepreneurship Development- II		1
	III	Patenting -I		1
	IV	Patenting -II		1

PSHS403	Title of the paper : <u>Medicinal Plants, Herbal Tinctures and Formulations & Modern System of Medicine</u>			
	I	Medicinal Plants against Disorders- I	4	1
	II	Medicinal Plants against Disorders- II		1
	III	Herbal Tinctures & Formulations		1
	IV	Modern System of Medicine		1

PSHS404	Title of the paper: <u>Environmental Science</u>			
	I	Conservation Ecology -I	4	1
	II	Conservation Ecology -II		1
	III	Bioremediation and Phytoremediation		1
	IV	Safety regulations in Handling GMOs		1

PSHSP401	Project Work	2	4
PSHSP402	Commercial Aspects	2	4
PSHSP403	Medicinal Plants, Herbal Tinctures and Herbal Formulations	2	4
PSHSP404	Environmental Science	2	4

Semester III

Theory

Course Code	Title	Credits
PSHS301	<u>Human Systems, Endocrinology and Human Pathogens</u>	4
Unit I: <u>Human Systems -I</u>	General Vicera and A broad outline of the following Systems: <ul style="list-style-type: none">• Digestive,• Circulatory,• Respiratory,	1
Unit I: <u>Human Systems -I</u>	A broad outline of the following Systems: <ul style="list-style-type: none">• Nervous• Excretory and• Reproductive Histology of Skin.	1
Unit III: <u>Endocrinology</u>	Organization of mammalian endocrine system, biosynthesis storage, release, transport, physiological functions and degradation of the hormones of <ul style="list-style-type: none">• pituitary,• hypothalamus,• thyroid,• adrenal gland, 1• gonads,• pancreas,• GI track, mode of hormone action, role of secondary messenger.	1
Unit : IV <u>Human Pathogens:</u>	Study of the Human Pathogens with reference to their structure and pathogenesis : <ul style="list-style-type: none">• Mycobacterium,	1

<ul style="list-style-type: none"> • <i>E.coli</i>, • Retrovirus, • Herpis, • Candida, • Tricophyton, • Entamoeba, • Ascaris, • Guinea worm, • Tape worm, • Scabies 	
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Course Code	Title	Credits
PSHS302	<u>Crude Drugs and Neutraceuticals</u>	4
Unit I: <u>Collection and Preservation of Crude Drugs :</u> Collection , stabilization, drying and preservation of crude drugs.		1
Unit II: <u>Quality Assurance of Crude Drugs:</u> Quality assurance in herbal technology, types of adultration or substitution, detection of adultrents on anatomical and phytochemical basis.		1
Unit : III <u>Stabilization of Crude Drugs:</u> <ul style="list-style-type: none"> • Stabilization and Stability • Methods of Stabilization 		1
Unit : IV <u>Neutraceuticals:</u> <ul style="list-style-type: none"> • Introduction, classification and sources of Nutraceuticals, • Functional Foods : Definition, Relation of functional foods and Nutraceuticals to food and drugs, Application of herbs as functional foods, • Concept of free radicals and antioxidants, • Nutritive and Non-nutritive food components with potential health effects 		1

Course Code	Title	Credits
PSHS303	<u>Systems of Medicine</u>	4
<p>Unit I: Ayurveda</p> <ul style="list-style-type: none"> • History and Philosophy of Ayurveda • The Panchmahabhuta and Their Attributes • The Basic Attributes of Tridosha—Vjta, Pitta, Kapha and their subtypes • The Doshas and Their Subtypes • Prakruti: Your Unique Body Type and their characteristics • Agni, Dhatu, updhatu and Mala. Description of basics of Srotas. The Six tastes and their significance. • Four types of methods for examination in Ayurveda (Chaturvidha-Parikshavidhi), Pramana in Ayurveda. • Knowledge of common Ayurvedic formulations and preparations used in treatment: <ul style="list-style-type: none"> ○ Churna- Triphala, Sitopaladi, Hingvashtaka, Avipattikara ○ Kashaya- Dashamula, Rasnasaptaka, Asanadi, Pathyadi, ○ Asavas-Arista- Amritarishta, Chitrakasava, Saraswatarishta, Ashwagandharishta . ○ Vati- Sanjivani, Chandraprabha, Chitrakadi, Khadiradi, Shankha Vati. ○ Guggula-Kalpana-Triphalaguggula, Trayodashangaguggula, Simhanadaguggula, Yogarajaguggula ○ Rasaushadhi- Tribhuvanakirti Rasa, Arogyavardhini Rasa, Rasamanikya Rasa, Lakshmivilasa Rasa, Sutshekhara Rasa ○ Taila- Mahanarayana Taila, Pindataila, Prasarinyadi Taila, Amritadi Taila. ○ Ghrita- Mahatriphaladi Ghrita, Brahmi Ghrita, Panchtikta Guggulu Ghrita, Kantakari Ghrita. ○ Lehya- Chyavanaprasha Avaleha, Kushmanda Avaleha, Ashwagandha Avaleha, Agastya Hareetaki Rasayana. • Introduction to and activities of the following Organizations :- 		1

<p>Department of AYUSH, Central Council of Indian Medicine, Central Council for Research in Ayurvedic Sciences, Ayurvedic Pharmacopeia Commission, National Medicinal Plants Board, Traditional Knowledge Digital Library (TKDL)</p>	
<p>Unit II : Siddha</p> <ul style="list-style-type: none"> • Principles and practice- basis of siddha system, concept of disease, siddha diagnosis, treatment. • Classification of treatment according to Siddha system of medicine- purgative therapy, emetic therapy, fasting therapy, steam therapy, oleation therapy, solar therapy, blood-letting therapy and yoga therapy • Types of drug formulations- herbal, inorganic and animal products, internal and external medicines with examples. • Methods of manufacturing siddha medicines – raw material to finished product— <ul style="list-style-type: none"> ○ Solid preparations- with two examples ○ Liquid preparations- with two examples ○ Gaseous preparations- with two examples 	<p>1</p>
<p>Unit : III Unani:</p> <ul style="list-style-type: none"> • Principles and practice- history, objectives, basic principles, maintenance of health, concept of disease, concept of sabab, marz and arz, diagnosis and treatment • Sources of drugs- plants, animals and minerals • Types of drug formulations- <ul style="list-style-type: none"> ○ Solid preparations ○ Semisolid preparations ○ Liquid preparations ○ Gaseous preparations • Methods of manufacture- raw material to finished product- manufacturing of Hab, Qurs, Sufoof and Majoon. • Study of a disease and its treatment with Unani system of medicine- example Asthama. 	<p>1</p>
<p>Unit : IV Standardization of <u>ASU Drugs</u></p>	<p>1</p>

<ul style="list-style-type: none"> • Steps involved in standardization, • Approaches to standardization; • Raw materials, In-process materials, • Finished products, • Developing standardized QC methods, Shelf life studies on finished products. 	
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Course Code	Title	Credits
PSHS304	<u>Herbal Biotechnology</u>	4
Unit I: Plant Transformation and Production of Edible Vaccines <ul style="list-style-type: none"> • Studies on <i>Agrobacterium</i> mediated transformed root cultures. • Biotransformation using cell cultures with any two suitable examples. • Edible Vaccines 		1
Unit II: <i>In vitro</i> production of secondary metabolites. <ul style="list-style-type: none"> • Plant cell cultures as chemical factories: • Cell suspension cultures, • Enhancement of product formation using biotic and abiotic elicitors, immobilization, • Permeabilization and product recovery. 		1
Unit III: Bioreactors <ul style="list-style-type: none"> • The quest for commercial production from plant cell scaling up of cell cultures, • Important factors for bioreactor design, pneumatically agitated bioreactors, comparison of bioreactors, operating mode, batch, fed-batch, semicontinuous, two stage operation, continuous cultivation. • Example: Shikonin production by <i>Lithospemumerythrorhizon</i> cell cultures. 		1
Unit : IV Nanotechnology: <ul style="list-style-type: none"> • Introduction, • Synthesis of nanomaterials, <ul style="list-style-type: none"> ○ Various methods for Green synthesis of nanoparticles : a) 		1

<p>Polysaccharide method , b) Tollens method, c) Irradiation method d) biological methods and e) Polyoxometalates method.</p> <p>○ Biosynthesis of nanoparticles using biological agents like bacteria, fungi, actinomycetes, yeast, algae and plants.</p> <ul style="list-style-type: none"> • Application of nanomaterials in food, cosmetics and medicine. 	
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Practical

PSHSP301	<u>Human Systems, Endocrinology and Human Pathogens</u>	2	4
<ul style="list-style-type: none"> • Study of the histological organization of various organs of the systems and endocrine glands prescribed in theory with help of permanent slides. • Simple and different staining , Gram's staining. Endospore staining, acid fast staining. • Growth curve of E.coli • Maintenance of fungal cultures • MIC of sugar and NaCl. • Preparation of antigen.slide and tube agglutination using antigen and antibody • ELISA test • Detection of liver disorders by means of SGOT,SGPT,bilirubin 			
PSHSP302	<u>Crude Drugs and Neutraceuticals</u>	2	4
<ul style="list-style-type: none"> • Identification and monitoring of microbial contamination in the herbal products-visual and microbiological methods. • Study of different storage methods suitable for the herbal products. • Estimation of vitamin C from Citrus/amla fruits • Separation of plant pigments Chlorophylls and carotenes by TLC • Absorption spectrum of chlorophyll, athocyanins and carotenes • Preparation of Soymilk • Preparation of a functional food rich in Vitamins/Antioxidants. 			
PSHSP303	<u>Systems of Medicine</u>	2	4
<ul style="list-style-type: none"> • Properties and Methods of preparation of any two examples of the following drugs : 			

<ul style="list-style-type: none"> ○ Churna- ○ Asavas-Arishta- ○ Vati ○ Avaleha ○ Satva ○ Churna ○ Bhasma <ul style="list-style-type: none"> ● Preparation of a Siddha formulation ● Preparation of a Unani formulation 			
PSHSP304	<u>Herbal Biotechnology</u>	2	4
<ul style="list-style-type: none"> ● Establishment of suspension culture ● Enhancement of product formation using Elicitation. ● Synthesis of nanoparticles and its characterisation using UV-visible absorption spectrometry ● Antimicrobial activity of the fabricated nanoparticles. ● Industry visit to study Bioreactors. 			

Semester IV

Theory

Course Code	Title	Credits
PSHS401	<u>Immunology, Disorders and Diseases and Molecular Diagnostics</u>	4
Unit I: Immunology I. <ul style="list-style-type: none"> • Introduction- phylogeny of immune system, innate and acquired immunity , local and herd immunity. • Humoral and cellular immunity. • Bclonal nature of immune responses. Organization and structure of lymphoid organs. Antibody structure and functions. Antigen strctre, Antigen antibody interaction. 		1
Unit II: Immunology II <ul style="list-style-type: none"> • Regulation of immune response. • Antigen processing and presentation. • Generation of humoral and cell mediated immune response. • Activation of B and T lymphocytes. Cytokines and their role in immune regulation. T cell regulation. MHC restriction. • Immunological tolerance. Hypersensitivity, autoimmunity, immunity to infectious agents (intracellular parasites, helminthes and viruses) AIDS and immunodeficiencies. Determinant of antigenicity, biological classes • Structure, immunoglobulin classes 		1
Unit : III Disorders an d Diseases A study of the disorders and diseases of the following systems <ul style="list-style-type: none"> • Digestive • Respiratory • Circulatory • Reproductive and • Excretory 		1
Unit : IV Molecular Diagnostics <ul style="list-style-type: none"> • Diagnostics- Introduction, medical and diagnostic products: • Diagnostic kits, DNA probe and Monoclonal antibodies as 		1

<ul style="list-style-type: none"> • Diagnostic tools and application. • Preventive-Vaccines-Introduction, types and application 	
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Course Code	Title	Credits
PSHS402	<u>Commercial Aspects</u>	4
Unit : I Entrepreneurship Development- I: Definition, characteristics and qualities of an entrepreneur, concept of entrepreneurship, sources of finance and technical assistance to an entrepreneur.		
Unit : II Entrepreneurship Development- II: Marketing and advertising, legal formalities and provision, export and import policies with reference to herbal drugs. Success stories of entrepreneurs in Herbal Industry		
Unit III: Patenting -I <ul style="list-style-type: none"> • IPR, Patenting and Registration of new drugs: • WTO and its implication(for drugs), patents act with emphasis on Indian patents act, US and European patent registration, requirements for filling patent, patent protection and patent servicing. Issues in registering herbal drugs. 		
Unit IV: Patenting II <ul style="list-style-type: none"> •Protection of traditional knowledge – objective, concept of traditional knowledge, holders, issue concerning, bio-prospecting and bio-piracy. 		

Course Code	Title	Credits
PSHS403	<u>Medicinal Plants, Herbal Tinctures and Herbal Formulations</u>	4
Unit I: Medicinal Plants Against Disorders and Diseases- I: Phytoconstituents and mode of action of medicinal plants (any three) used against the following Disorders: <ul style="list-style-type: none"> • Cold, Cough, Asthama • Fever • Gynecological Disorders 		

<ul style="list-style-type: none"> • Rheumatism and Arthritis 	
Unit I: Medicinal Plants Against Disorders and Diseases -II: Phytoconstituents and mode of action of medicinal plants (any three) used against the following Disorders: <ul style="list-style-type: none"> • Cardiac • Diabetes • Gastrointestinal disorders • Liver disorders 	
Unit III: Herbal Tinctures and Formulations Commercial production of herbal tinctures and herbal extracts by using Solvents of different polarity. <ul style="list-style-type: none"> • Principles of Extraction, • Selection of solvent, • Solid Phase Extraction (SPE) • Super Critical Fluid Extraction (SCFE) Herbal formulations for : <ul style="list-style-type: none"> • Medicated Powders • Medicated Oils • Toiletries 	
Unit : IV Modern Systems of Medicine <ul style="list-style-type: none"> • Principles and practice, • Evolution of new drug molecule, steps involved in designing a drug molecule, • Drug formulation, • Efficacy testing. 	

Course Code	Title	Credits
PSHS404	<u>Environmental Science</u>	4
Unit I: Conservation Ecology- I Role of national and international organisations in conservation. International Convention, Treatises and Protocols for Biodiversity		

Conservation - Legal Coverage on Biodiversity Conservation in India. Municipal corporation Agenda 21, NGOss, capacity building, GEMS, GEO, WRR, GIS, IBGP, TRIPS, etc, legislation aiming at conservation. Asian Regional Agreement on Biodiversity.	
Unit II: Conservation Ecology II Environmental impact assessment for physical, chemical, biological and socio-economic factors; Legislative implications of EIA, environmental impacts assessment and environmental auditing Endangered medicinal plants and steps being taken in Conservation of Medicinal Plants. Methods of ex-situ and in-situ conservation of Medicinal Plants.	
Unit : III Bioremediation and Phytoremediation Bioremediation and phytoremediation: <ul style="list-style-type: none"> • Detoxification of xenobiotics, • chemical modification, • compartmentation, • superaccumulation. 	
Unit : IV Safety regulations in Handling GMOs <ul style="list-style-type: none"> • Genetically Engineered organisms • Causes of worry • Their safe handling 	

Practical

PSHSP401	<u>Project</u>	2	4
<ul style="list-style-type: none"> • ‘Project Work’ - based on specialization (Paper VII OR VIII), prepare a report and presentation of the same. • Projects should be: • Well planned and executed meticulously. • An attempt should be made towards a multi-disciplinary approach • Consist of references to literature of relevance • In the nature of ‘problem solving’ • Hypothesis should be clearly spelt out, • Objectives should be unambiguous • Material and methods should be precise 			

<ul style="list-style-type: none"> • Collected data must be treated statistically and presented in a graphical manner • Results should highlight the achievements of the project executed and identify the scope for further work in the subject. 			
PSHSP402	<u>Commercial Aspects</u>	2	4
<ul style="list-style-type: none"> • Preapartion of project plan for establishing herbal industry with reference to factors like finance, technical assistance, marketing strategy . • Collection and preview of any Five advertisements printed in print media. • Prepartion of advertisements for any five herbal products. • Preparation of report for field visit to herbal industry w.r.t manufacturing, packaging and forwarding of products. • Filling of application forms for patent registration as per the <ul style="list-style-type: none"> ○ Indian patent act, ○ US and ○ European patent regulation. 			
PSHSP403	<u>Medicinal Plants, Herbal Tinctures and Herbal Formulations</u>	2	4
<ul style="list-style-type: none"> • Preparation of Monographs of Medicinal Plants • Submission of Monograms of any five Medicinal plants studied in theory. • Preparation of any three Herbal Formulations 			
PSHSP404	<u>Environmental Science</u>	2	4
<ul style="list-style-type: none"> • Effects of heavy metals on various plants • Phytoremediation of heavy metals – estimation of uptake of the heavy metals by plant roots or plants. • Ultra rapid detection of organochlorine insecticide by chromogenic paper method / GC/ HPLC. 			