

# SHRI GURU RAM RAI UNIVERSITY

[Estd. by Govt. of Uttarakhand, vide Shri Guru Ram Rai University Act no. 03 of 2017 & recognized by UGC u/s (2f) of UGC Act 1956]



## **SCHOOL OF PHARMACEUTICAL SCIENCES** **PROGRAM: M. PHARM (PHARMACOGNOSY)**

### **OUTCOME BASED EDUCATION**

### **COURSE OUTCOMES, PROGRAM OUTCOMES, PROGRAM SPECIFIC OUTCOMES**

**&**

### **ARTICULATION MATRIX**


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**SHRI GURU RAM RAI UNIVERSITY**  
(Estd. by Govt. of Uttarakhand, vide Shri Guru Ram Rai University Act no. 03 of 2017)  
PATEL NAGAR, DEHRADUN-248001, UTTARAKHAND

(School of Pharmaceutical Sciences)

**COs, POs, PSOs &  
ARTICULATION MATRIX  
OF  
M. PHARM.  
(PHARMACOGNOSY)**

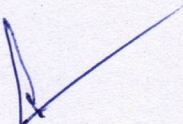
  
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School of Pharmaceutical Sciences  
SRRI University, Dehradun (Uttarakhand)

### Program Outcomes- M. Pharm. (Pharmacognosy)

P01	<b>Advanced Knowledge:</b> Possess advanced scientific knowledge of the pharmacy profession so as to apply the learning's in providing solutions for complex issues of the Pharmaceutical field.
P02	<b>Scientific and Technical Skills:</b> Develop analytical skills for effective scientific writing/presentation, data compilation & interpretation. Obtain erudite technical skills for applying in research and development for improvement of Pharmaceutical process and products.
P03	<b>Multidisciplinary Collaborative Research:</b> Develop interdisciplinary research with other health care communities to provide innovative solutions.
P04	<b>Regulatory Professional Skills</b> Comply and work on rules and regulations involved in the drug discovery & development, manufacture and other allied area of the field.
P05	<b>Critical Thinking:</b> Apply critical thinking skills, including investigation, application, analysis, and creativity, evaluation of information, data and documents related to research.
P06	<b>Problem based learning:</b> Develop problem-based learning approach and analytical thinking in his/her academic and Professional life.
P07	<b>Professional Identity:</b> Demonstrate the ability to plan and implement Professional activities.
P08	<b>Leadership Skills:</b> Leadership qualities of motivation, team building, time management, organizational skills so as to take lead and responsibilities in order to face the challenges of Pharmaceutical sector.
P09	<b>Ethical practice and societal concern:</b> Exercise ethical practices and moral values in personal and Professional endeavours.
P010	<b>Innovations Leading Skills:</b> Development of novel analytical techniques for identification, characterization and quantification of drugs, formulation, Pharmacological, Pharmacognostical, and Regulatory aspects of Drugs and Biomolecules.
P011	<b>Lifelong learning:</b> Tackle professional challenges through lifelong learning attitude.
PO-12	<b>Expertise on Medications:</b> The student should be able to provide an expert opinion on medications to health care professionals on safe and effective medication-use, relevant policies and procedures based on available evidences

**Program Specific Outcomes- M.Pharm. (Pharmacognosy)**

PSO1	<b>Pharmacognosy Knowledge:</b> -Acquire in-depth knowledge of Pharmacognosy, a discipline of pharmacy that deals with all facets of the process of turning a new chemical entity (NCE) from natural origin into a medication able to be safely and effectively used by patients in the community. Pharmacognosy knowledge is an important discipline in the Pharmacy Curriculum and deals with the study of crude drugs from Natural sources.
PSO2	<b>Research Analysis:</b> -Empower the understanding on concept that Pharmacognosy is the bridge between Ayurveda and Allopathic system of medicines and science of evaluation, standardization & design of different Ayurvedic dosage form.
PSO3	<b>Design &amp; Development of dosage forms:</b> - Sharpen the analytical method development skills to deals with the formulation and standardization of a pure drug substance into a dosage form. Divisions of Pharmacognosy include: Industrial Pharmacognostical Technology, Herbal Cosmetics, Medicinal Plant Biotechnology Pharmacokinetics & Pharmacodynamics, Pharmaco-epidemiology, Pharmacogenomics, Pharmacovigilance, Pharmaceutical formulation of herbal remedies etc. All divisions play a diverse role in the Discovery, Characterization, Production, evaluation and Standardization of crude drugs.
PSO4	<b>Modern Methods usage:</b> -Develop strong skills through tremendous renewal of interest in natural products in the area of drug discovery, Cosmeceuticals, Nutraceuticals, Ethnobotany, Marine biology, Microbiology, Alternative medicines, Pharmachemistry, Pharmacology, Phytochemistry, Pharmaceutics, Clinical Pharmacy and Molecular biology.

  
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## Course Outcomes – M. Pharm. (Pharmacognosy)

Semester-I	
<b>COURSE NAME: Modern Pharmaceutical Analytical techniques (MPAT)</b>	
<b>COURSE CODE: MPG101T</b>	
<b>CO 1</b>	Understand the fundamentals of advanced pharmaceutical analytical techniques.
<b>CO 2</b>	Learn about the general principle, theory and instrumentation of advanced pharmaceutical analytical techniques.
<b>CO 3</b>	Explain about the advanced instruments its techniques and applications in drug analysis.
<b>CO 4</b>	Develop in depth knowledge of instruments in modern pharmaceutical analytical techniques.
<b>CO 5</b>	Appraise various applications of Modern Pharmaceutical Instruments.
<b>CO 6</b>	Attain skills in problem solving, critical thinking & analytical reasoning as applied in pharmaceutical analysis.

## Articulation Matrix:

Semester –I																
<b>COURSE NAME: Modern Pharmaceutical Analytical techniques (MPAT)</b>																
<b>COURSE CODE: MPG 101T</b>																
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO 1	3	3	2	2	2	1	0	0	1	0	3	0	1	2	2	1
CO 2	3	2	3	3	3	2	1	0	1	0	3	0	1	2	3	2
CO 3	2	3	3	3	2	1	0	1	1	0	3	0	2	3	2	3
CO 4	2	2	2	2	3	1	0	0	1	0	3	0	1	2	3	1
CO 5	3	3	3	3	2	1	1	1	1	0	3	0	1	3	2	2
CO 6	3	2	3	3	3	1	0	0	1	0	3	0	2	1	2	3

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Semester-I	
<b>COURSE NAME: Advanced Pharmacognosy-I (AP-I)</b>	
<b>COURSE CODE: MPG102T</b>	
<b>CO 1</b>	Understand the Advanced basic description and knowledge about Plant drug cultivation, Nutraceuticals, Phytopharmaceuticals and Pharmacovigilance of natural origin drugs.
<b>CO 2</b>	Elaborative study and explanation regarding Advanced Pharmacognosy i.e. Phyto pharmaceuticals and Nutraceuticals, Marine Natural products.
<b>CO 3</b>	Detailed discussion regarding Phyto pharmaceuticals, GAP and GACP guidelines.
<b>CO 4</b>	Explanation of Application part of Cultivation, Nutraceuticals and Phytopharmaceuticals.
<b>CO 5</b>	Learn utilization and importance of advanced pharmacognosy concepts.
<b>CO 6</b>	Understand Role of Phyto pharmaceuticals for Herbal drug Research.

**Articulation Matrix:**

Semester -I																
COURSE NAME: Advanced Pharmacognosy-I (AP-I)																
COURSE CODE: MPG 102T																
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
<b>CO 1</b>	3	3	2	3	2	1	0	1	1	0	3	0	1	2	3	1
<b>CO 2</b>	3	2	3	2	1	2	1	1	1	0	3	0	1	3	3	1
<b>CO 3</b>	3	3	2	2	1	1	0	1	1	0	3	0	2	3	2	2
<b>CO 4</b>	3	3	3	3	2	2	0	0	0	0	2	0	1	2	2	2
<b>CO 5</b>	2	3	3	2	2	2	0	0	1	1	2	0	2	2	3	3
<b>CO 6</b>	3	2	2	1	1	1	1	0	0	1	3	0	2	1	2	3

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## Semester-I

COURSE NAME: Phytochemistry

COURSE CODE: MPG103T

CO 1	The basic description and concepts of Phytochemistry, extraction, metabolic pathways, drug discovery protocol with clinical trials and Phytochemical fingerprinting.
CO 2	Understand the explanatory study of Biosynthetic pathways of some important Phytoconstituents of syllabus, Modern techniques of extraction and Phytochemical fingerprinting.
CO 3	Detailed discussion regarding drug discovery process, interpretation of spectral study of Phytoconstituents covered in syllabus and chromatography types.
CO 4	Learn to Analyze application part of drug discovery process, modern extraction techniques and interpretation of Spectral study.
CO 5	Understand the assessment & estimation of Phytochemical fingerprinting and interpretation part of syllabus.
CO 6	Creative study of biosynthetic pathways of some important phytoconstituents of syllabus, modern techniques of extraction, LC MS, GC MS concepts and Phytochemical fingerprinting.

## Articulation Matrix:

## Semester -I

COURSE NAME: Phytochemistry

COURSE CODE: MPG 103T

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO 1	3	3	2	2	2	1	0	0	1	0	3	0	1	2	2	1
CO 2	3	2	3	3	2	2	1	0	1	0	2	1	2	2	2	1
CO 3	3	2	2	2	3	1	0	0	2	0	3	0	2	3	1	3
CO 4	3	3	3	3	2	2	0	1	2	1	2	0	1	2	2	1
CO 5	3	3	3	3	2	2	1	0	1	0	3	1	1	3	2	2
CO 6	3	2	1	2	2	1	0	1	2	1	3	0	3	2	2	2

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**Semester-I****COURSE NAME: Industrial Pharmacognostical Technology (IPT)****COURSE CODE: MPG104T**

<b>CO 1</b>	Basic description of herbal drug industry infrastructure and current challenges in modernization of herbal formulations, Regulatory requirements, TQM, GLP, GMP, ISO-9000, Monograph of herbal drugs, Stability testing of herbals protocol and patents, copyrights.
<b>CO 2</b>	Understand the explanatory study about entrepreneurship, Pilot scale up techniques, TRIPS, Quality assurance in herbal drugs and products, Monographs and WHO guidelines in quality assessment, testing of natural products and geographical indications patents.
<b>CO 3</b>	Learn to Apply the knowledge part of Production management of herbals, Global marketing management, Indian and international patents, WHO guidelines in assessment of herbals, testing of natural products and procedure of Indian patent filing.
<b>CO 4</b>	Learn to Analyze the Plant design and layout , Case study of herbal extracts, Concepts of TQM, GMP, GLP, ISO 9000, Comparative study of monographs in various pharmacopoeias and cases of patents.
<b>CO 5</b>	Evaluative study about herbal drugs industry infrastructure , Regulatory requirements, Monographs of herbal drugs, testing and patents.
<b>CO 6</b>	Creative study about various emerging topics of the syllabus including Regulatory aspects, Infrastructure of plant design, testing of natural drugs etc.

**Articulation Matrix:****Semester -I****COURSE NAME: Industrial Pharmacognostical technology (IPT)****COURSE CODE: MPG 104T**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
<b>CO 1</b>	3	3	2	3	2	1	0	0	1	0	3	0	1	2	2	1
<b>CO 2</b>	3	2	2	3	2	2	0	0	1	0	3	0	1	2	2	1
<b>CO 3</b>	3	2	2	3	2	1	0	0	1	0	3	0	2	2	2	3
<b>CO 4</b>	3	3	2	3	2	1	0	0	1	0	3	0	1	2	2	1
<b>CO 5</b>	3	3	3	3	2	1	0	0	1	0	3	0	1	2	2	3
<b>CO 6</b>	3	2	2	3	2	1	0	0	1	0	3	0	2	2	2	3

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Semester-I	
<b>COURSE NAME: Pharmacognosy - I Lab / Practical</b>	
<b>COURSE CODE: MPG105P</b>	
<b>CO 1</b>	Analysis of Pharmacopoeial compounds of natural origin & their formulations by spectroscopic techniques.
<b>CO 2</b>	In process & finished product evaluation and quality control tests for crude drugs, their Phytoconstituents and dosage forms
<b>CO 3</b>	Isolation of Phytoconstituents & Estimation of extracts by Chromatographic techniques as Phyto chemical fingerprinting.
<b>CO 4</b>	Assay of Raw materials as per official monograph.

**Articulation Matrix:**

Semester-I																
<b>COURSE NAME: Pharmacognosy - I Lab / Practical</b>																
<b>COURSE CODE: MPG105P</b>																
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
<b>CO 1</b>	3	3	1	3	2	1	0	0	1	0	3	1	1	2	3	1
<b>CO 2</b>	3	2	2	2	1	2	0	0	2	0	2	0	2	2	2	2
<b>CO 3</b>	3	2	3	2	2	2	1	0	1	0	3	0	2	3	2	3
<b>CO 4</b>	3	3	2	3	3	2	0	1	1	0	3	1	1	2	1	1

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Semester-II	
<b>COURSE NAME: Medicinal Plant Biotechnology (MPB)</b>	
<b>COURSE CODE: MPG201T</b>	
<b>CO 1</b>	Acquire basic knowledge about main concepts of Medicinal plant biotechnology, DNA Recombinant technology, Plant tissue culture techniques with applications, immobilization techniques, Gene Cloning, Biotransformation and Fermentation process.
<b>CO 2</b>	Understand detailed description about Genetic and Molecular biology, DNA Recombinant technology, Plant tissue culture, Micropropagation, Protoplast fusion, Gene cloning, Immobilisation applications, Transgenic plants, synthetic seeds and different types of fermentors.
<b>CO 3</b>	Learn to apply knowledge part of Plant tissue cultures techniques, Gene expression, immobilization techniques, biotransformation and fermentation.
<b>CO 4</b>	Learn to analyze DNA Recombinant technology, Immobilization concepts, Plant tissue culture techniques, Biotransformation and fermentation process.
<b>CO 5</b>	Evaluative study about biotechnology, DNA, RNA Protein replication, PTC techniques, Synthetic seeds, Cloning of plant cells, Biotransformation and fermentation process.
<b>CO 6</b>	Creative study about Basic concepts of Medicinal plant biotechnology, Plant tissue culture applications, Immobilization of plant cells and Fermentation.

**Articulation Matrix:**

Semester-II																
<b>COURSE NAME: Medicinal Plant Biotechnology (MPB)</b>																
<b>COURSE CODE: MPG201T</b>																
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
<b>CO 1</b>	3	3	3	2	1	1	0	0	1	0	3	0	2	3	3	2
<b>CO 2</b>	3	3	3	3	1	2	0	0	2	0	2	1	1	3	3	2
<b>CO 3</b>	3	2	2	3	2	1	0	0	2	1	3	1	2	2	2	3
<b>CO 4</b>	3	3	3	2	2	1	0	0	2	1	2	2	3	3	3	2
<b>CO 5</b>	3	2	3	2	3	2	1	0	2	0	3	0	3	3	2	3
<b>CO 6</b>	3	3	2	3	3	2	1	0	1	0	2	0	2	3	2	3

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Semester-II	
COURSE NAME: Advanced Pharmacognosy-II (AP-II)	
COURSE CODE: MPG202T	
CO 1	Acquire basic knowledge about herbal and conventional drugs, validation of herbal therapies, adulteration, DNA fingerprinting, Ethnobotany and Ethnopharmacology, Phytopharmacological screening of herbal drugs.
CO 2	Understand detailed description about herbal remedies, Adulteration & Deterioration, Role of Ethnopharmacology in drug discovery, Bioprospecting tools, Analytical profiles of herbal drugs in syllabus and biological screening of herbals.
CO 3	Learn to Apply knowledge part of herbal v/s conventional drugs, causes & measures of adulteration, detection of heavy metals, pesticide residues, Role of Ethnobotany impact on traditional medicine, Analytical profile of important herbal drugs and biological screening in vivo evaluation and OECD guidelines.
CO 4	Learn to Analyze herbal therapies for validation, Efficacy of herbal medicines, causes and measures of adulteration, sampling procedures, Role of ethno pharmacology, Analytical profiles of herbal drugs including their biological screening.
CO 5	Evaluative study about herbal remedies, adulteration and substitution of drugs, impact of ethnobotany on traditional medicines, Analytical study about some herbal drugs of syllabus and Phyto pharmacological screening.
CO 6	Creative study about various herbal remedies v/s conventional drugs, detection of Phytotoxins and Microbial contamination, heavy metals, Reverse Pharmacology, Analytical profiles of herbal drugs covered in syllabus and screening of drugs.

**Articulation Matrix:**

Semester-II																
COURSE NAME: Advanced Pharmacognosy-II (AP-II)																
COURSE CODE: MPG202T																
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO 1	3	3	2	3	2	1	0	1	2	0	2	0	2	3	2	1
CO 2	2	3	3	3	1	2	1	0	2	0	2	0	2	3	3	2
CO 3	3	2	3	3	1	2	0	0	2	0	3	0	2	3	3	3
CO 4	2	3	2	3	3	2	1	0	1	0	2	1	1	2	3	1
CO 5	3	2	3	3	2	1	0	0	1	0	3	1	3	3	3	2
CO 6	3	2	1	3	2	1	0	0	1	1	3	0	2	2	2	3

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Semester-II	
COURSE NAME: Indian System of Medicine (ISM)	
COURSE CODE: MPG203T	
CO 1	Acquire basic knowledge about fundamental concepts of Indian system of medicine (ISM) i.e. Ayurveda, Siddha, Unani & Homoeopathy, Naturopathy, Aromatherapy, Yoga, Formulation development of ISM drugs, GMP for ISM drugs, GLP, GAP, TKDL etc.
CO 2	Understand detailed description about fundamental concepts of Indian system of medicines, Gunapadam, Suddhi process, Yoga streams and Naturopathy, formulation development, Schedule T provisions, TKDL and Govt. bills in AYUSH etc.
CO 3	Learn to Apply knowledge part of basic concepts of Ayurveda, Siddha, Unani & Homoeopathy System of medicine, Yoga and Naturopathy basic principles, GAP, GMP for ISM drugs, TKDL, CCRAS, CCRS, CCRU, CCRH and AYUSH govt. bills. Documents for NDA etc.
CO 4	Learn to Analyze the Principles of ISM Medicines, formulation development and their standardization, types of various Asanas, Pranayam, streams of Yoga, Shelf life and Stability studies of ISM drugs, Schedule T, Current challenges in monitoring of safety of herbals and TKDL.
CO 5	Evaluative study about various Indian system of medicine principles and formulation development, Naturopathy, Yoga, Aromatherapy, Salient features of GMP for ISM formulations along with GAP, GLP, TKDL and Govt. bills.
CO 6	Creative study about Salient features of techniques of preparation of important formulations of ISM along with their evaluative part, types of Streams of Yoga, Schedule T and TKDL, CCRAS, CCRU, CCRH etc.

## Articulation Matrix:

Semester-II																
COURSE NAME: Indian System of Medicine (ISM)																
COURSE CODE: MPG203T																
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO 1	3	3	2	3	2	1	0	0	1	0	3	1	2	3	3	1
CO 2	3	3	1	2	3	2	0	1	2	0	2	1	2	3	3	3
CO 3	3	2	1	3	2	2	1	0	2	0	2	0	2	3	3	3
CO 4	2	3	2	3	2	2	1	0	1	0	2	0	2	3	2	2
CO 5	3	2	2	3	3	1	0	0	1	0	3	0	1	2	3	2
CO 6	2	2	2	2	2	2	0	1	2	0	3	1	2	2	2	3

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Semester-II	
COURSE NAME: Herbal Cosmetics (HC)	
COURSE CODE: MPG204T	
CO 1	Understand the Basic description and Concepts of commonly used herbal cosmetics, Regulatory provisions, Physiology of skin and hair, Cosmeceuticals and its Analysis.
CO 2	Learn explanatory study about herbal cosmetics, their Regulatory provisions, Licence, GMP and import export policies, hair growth formulations and their analysis.
CO 3	Understand to Apply the knowledge of various herbal cosmetics of natural origin, their regulatory provisions along with analysis and toxicity screening methods.
CO 4	Learn to Analyze the herbal Cosmeceuticals, design of herbal cosmetics, analysis and toxicity screening techniques of herbal origin cosmetics for skin and hair care.
CO 5	Evaluative study about various types of herbal cosmetics and their Regulatory provisions, analysis etc.
CO 6	Creative study about design of various herbal skin and hair care formulations, their standardization and Quality control, toxicity studies.

## Articulation Matrix:

Semester-II																
COURSE NAME: Herbal Cosmetics (HC)																
COURSE CODE: MPG204T																
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO 1	3	2	1	2	2	0	0	0	1	1	3	1	3	1	3	2
CO 2	3	1	1	2	2	0	0	0	1	1	3	1	3	1	3	3
CO 3	3	3	1	2	2	0	0	0	1	1	3	1	3	2	3	3
CO 4	3	2	1	2	2	1	0	0	1	2	3	1	3	1	3	3
CO 5	3	3	1	2	2	1	0	0	1	1	3	1	3	1	3	3
CO 6	3	3	1	2	1	0	0	0	1	2	3	1	3	2	3	3

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Semester-II	
<b>COURSE NAME: Pharmacognosy-II (Herbal Cosmetics) Lab / Practical</b>	
<b>COURSE CODE: MPG205P</b>	
<b>CO 1</b>	Analysis, isolation, characterization, identification, biosynthesis and activity profile of biologically active natural products and study of immobilization techniques.
<b>CO 2</b>	Isolation and estimation of Plant genetic material and molecular biology product.
<b>CO 3</b>	Preparation and Standardization of Herbal Cosmetics.
<b>CO 4</b>	Assay of Raw materials and ISM formulations as per official monograph.

**Articulation Matrix:**

Semester-II																
<b>COURSE NAME: Pharmacognosy-II (Herbal Cosmetics) Lab / Practical</b>																
<b>COURSE CODE: MPG205P</b>																
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
<b>CO 1</b>	3	3	2	2	2	1	0	0	1	0	3	0	1	2	3	2
<b>CO 2</b>	2	2	2	3	2	2	0	0	2	0	2	1	2	3	3	2
<b>CO 3</b>	3	2	1	3	3	2	0	0	2	1	2	1	2	3	3	3
<b>CO 4</b>	3	3	1	2	3	1	1	0	1	0	2	1	2	3	2	2

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**Semester-III**

**COURSE NAME: Research Methodology & Biostatistics**

**COURSE CODE: MPG301T**

<b>CO 1</b>	Understand the various aspects of research methodology and the use of biostatistics in research.
<b>CO 2</b>	Compare the various statistical techniques and their applications.
<b>CO 3</b>	Select and perform the appropriate parametric / nonparametric tests as per the data, manually as well as using statistical software.
<b>CO 4</b>	Elaborate with examples the ethics involved in Medical Research.
<b>CO 5</b>	Comprehend the guidelines for the experimentation on animals.
<b>CO 6</b>	Know about the genesis of bioethics with special Reference to Helsinki declaration.


**Articulation Matrix:**

**Semester-III**

**COURSE NAME: Research Methodology & Biostatistics**

**COURSE CODE: MPG301T**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
<b>CO 1</b>	3	3	2	3	1	1	0	1	1	0	3	0	2	3	2	2
<b>CO 2</b>	3	3	3	2	1	2	1	0	2	1	2	1	3	3	3	2
<b>CO 3</b>	3	2	3	2	2	2	1	1	2	1	2	1	2	3	3	3
<b>CO 4</b>	3	2	2	2	3	1	0	1	2	1	3	2	2	2	3	1
<b>CO 5</b>	3	2	3	3	3	2	0	2	2	0	2	1	1	3	3	3
<b>CO 6</b>	3	2	2	3	2	1	0	0	1	0	3	0	2	2	2	3

  
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## Semester-III

COURSE NAME: Research Work

COURSE CODE:

CO 1	Gain an understanding to identify the Research questions.
CO 2	Developing skills to define & determine the Research problem with the peers to achieve the desired outcome.
CO 3	Gain understanding to establish the Research objectives.
CO 4	Developing skills for establishing a Suitable methodology to answer the Research problems.
CO 5	Gain an understanding to develop a Protocol & Plan of work to answer the Research problems.
CO 6	Demonstration of the Plan of work & Critically appraised Research problems in appropriate forum.


## Articulation Matrix:

## Semester-III

COURSE NAME: Research Work

COURSE CODE:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO 1	3	3	2	3	3	1	0	0	2	0	3	0	2	3	2	2
CO 2	3	3	2	3	3	2	0	0	2	1	2	1	1	3	3	3
CO 3	3	3	3	2	3	2	0	1	2	1	2	2	2	2	3	3
CO 4	3	3	3	2	2	2	1	1	1	2	3	2	2	3	3	2
CO 5	3	3	3	2	2	1	1	0	1	2	2	2	1	3	3	3
CO 6	3	2	2	3	2	2	1	0	1	0	3	0	3	2	2	3

  
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Semester-III *IV*

COURSE NAME: Journal Club

COURSE CODE:

CO 1	Search Articles from various Scientific databases.
CO 2	Critically appraise Scientific articles and assess the quality
CO 3	Develop a Report on the Critically appraised articles.
CO 4	Prepare a technical presentation for a small audience and deliver presentation & address related queries.

Articulation matrix:

Semester-III *IV*

COURSE NAME: Journal Club

COURSE CODE:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO 1	3	3	2	3	3	1	0	1	1	0	3	0	1	2	3	1
CO 2	3	2	3	3	2	2	1	1	2	0	2	2	2	3	3	2
CO 3	3	2	2	2	2	2	1	0	2	1	3	2	2	2	2	3
CO 4	3	3	2	3	3	1	0	0	1	1	3	0	3	3	2	2

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**Semester-IV****COURSE NAME: Research Work & Colloquium****COURSE CODE:**

<b>CO 1</b>	Ability to Review Scholarly articles critically to collect and formulate the data.
<b>CO 2</b>	Developing skills to conduct Research for achieving Research objectives.
<b>CO 3</b>	Gain understanding to stratify the collected data and formulate into the Research findings.
<b>CO 4</b>	Ability to statistically analyse the critically formulated data and generate the Research outcome.
<b>CO 5</b>	Developing skills to propose new ideas or outcomes for the defined Research question and create Research document of the findings.
<b>CO 6</b>	Appraise and defend the Research findings with evidence-based observations.

**Articulation Matrix:****Semester-IV****COURSE NAME: Research Work & Colloquium****COURSE CODE:**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
<b>CO 1</b>	3	3	2	3	2	1	0	0	3	0	3	0	1	3	3	2
<b>CO 2</b>	3	3	3	2	3	2	0	1	2	0	2	0	2	3	2	2
<b>CO 3</b>	3	2	3	3	2	1	1	0	2	0	3	0	2	3	3	3
<b>CO 4</b>	3	3	2	3	3	2	2	0	2	0	2	2	3	2	2	2
<b>CO 5</b>	3	2	3	2	2	1	0	0	2	2	2	2	1	2	3	3
<b>CO 6</b>	3	2	3	3	3	1	0	0	2	2	3	2	2	2	2	3

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**Dr. Chandra Shekhar Tailor**  
(M. Pharm., Ph.D.)  
Associate Professor  
Dept. of Pharmacognosy  
SPS, SGRRU, Dehradun.

PHARMACOGNOSY (MPG)

MODERN PHARMACEUTICAL ANALYTICAL TECHNIQUES  
(MPG 101T)

Scope

This subject deals with various advanced analytical instrumental techniques for identification, characterization and quantification of drugs. Instruments dealt are NMR, Mass spectrometer, IR, HPLC, GC etc.

Objectives

After completion of course student is able to know,

- The analysis of various drugs in single and combination dosage forms
- Theoretical and practical skills of the instruments

THEORY

60 Hrs

1. UV-Visible spectroscopy: Introduction, Theory, Laws, Instrumentation associated with UV-Visible spectroscopy, Choice of solvents and solvent effect and Applications of UV-Visible spectroscopy. 12 Hrs  
IR spectroscopy: Theory, Modes of Molecular vibrations, Sample handling, Instrumentation of Dispersive and Fourier - Transform IR Spectrometer, Factors affecting vibrational frequencies and Applications of IR spectroscopy  
Spectrofluorimetry: Theory of Fluorescence, Factors affecting fluorescence, Quenchers, Instrumentation and Applications of fluorescence spectrophotometer.  
Flame emission spectroscopy and Atomic absorption spectroscopy: Principle, Instrumentation, Interferences and Applications.
- 2 NMR spectroscopy: Quantum numbers and their role in NMR, Principle, Instrumentation, Solvent requirement in NMR, Relaxation process, NMR signals in various compounds, Chemical shift, Factors influencing chemical shift, Spin-Spin coupling, Coupling constant, Nuclear magnetic double resonance, Brief outline of principles of FT-NMR and <sup>13</sup>C NMR. Applications of NMR spectroscopy. 12 Hrs

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3 Mass Spectroscopy: Principle, Theory, Instrumentation of Mass Spectroscopy, Different types of ionization like electron impact, chemical, field, FAB and MALDI, APCI, ESI, APPI Analyzers of Quadrupole and Time of Flight, Mass fragmentation and its rules, Meta stable ions, Isotopic peaks and Applications of Mass spectroscopy. 10 Hrs

4 Chromatography: Principle, apparatus, instrumentation, chromatographic parameters, factors affecting resolution, isolation of drug from excipients, data interpretation and applications of the following: 10 Hrs

- a) Thin Layer chromatography
- b) High Performance Thin Layer Chromatography
- c) Ion exchange chromatography
- d) Column chromatography
- e) Gas chromatography
- f) High Performance Liquid chromatography
- g) Ultra High Performance Liquid chromatography
- h) Affinity chromatography
- i) Gel Chromatography

5 Electrophoresis: Principle, Instrumentation, Working conditions, factors affecting separation and applications of the following: 10 Hrs

- a) Paper electrophoresis
- b) Gel electrophoresis
- c) Capillary electrophoresis
- d) Zone electrophoresis
- e) Moving boundary electrophoresis
- f) Iso electric focusing

X ray Crystallography: Production of X rays, Different X ray methods, Bragg's law, Rotating crystal technique, X ray powder technique, Types of crystals and applications of X-ray diffraction.

6 Potentiometry: Principle, working, Ion selective Electrodes and Application of potentiometry. 10 Hrs

Thermal Techniques: Principle, thermal transitions and Instrumentation (Heat flux and power-compensation and designs), Modulated DSC, Hyper DSC, experimental parameters (sample preparation, experimental conditions, calibration, heating and

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cooling rates, resolution, source of errors) and their influence, advantage and disadvantages, pharmaceutical applications. Differential Thermal Analysis (DTA): Principle, instrumentation and advantage and disadvantages, pharmaceutical applications, derivative differential thermal analysis (DDTA). TGA: Principle, instrumentation, factors affecting results, advantage and disadvantages, pharmaceutical applications.

#### REFERENCES

1. Spectrometric Identification of Organic compounds - Robert M Silverstein, Sixth edition, John Wiley & Sons, 2004.
2. Principles of Instrumental Analysis - Douglas A Skoog, F. James Holler, Timothy A. Nieman, 5<sup>th</sup> edition, Eastern press, Bangalore, 1998.
3. Instrumental methods of analysis - Willards, 7th edition, CBS publishers.
4. Practical Pharmaceutical Chemistry - Beckett and Stenlake, Vol II, 4th edition, CBS Publishers, New Delhi, 1997.
5. Organic Spectroscopy - William Kemp, 3rd edition, ELBS, 1991.
6. Quantitative Analysis of Drugs in Pharmaceutical formulation - P D Sethi, 3rd Edition, CBS Publishers, New Delhi, 1997.
7. Pharmaceutical Analysis - Modern Methods - Part B - J W Munson, Vol 11, Marcel. Dekker Series
8. Spectroscopy of Organic Compounds, 2<sup>nd</sup> edn., P.S/Kalsi, Wiley estern Ltd., Delhi.

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ADVANCED PHARMACOGNOSY - I  
(MPG 102T)

SCOPE

To learn and understand the advances in the field of cultivation and isolation of drugs of natural origin, various phytopharmaceuticals, nutraceuticals and their medicinal use and health benefits.

OBJECTIVES

Upon completion of the course, the student shall be able to know the,

- advances in the cultivation and production of drugs
- various phyto-pharmaceuticals and their source, its utilization and medicinal value.
- various nutraceuticals/herbs and their health benefits
- Drugs of marine origin
- Pharmacovigilance of drugs of natural origin

THEORY

60 Hrs

1. Plant drug cultivation: General introduction to the importance of Pharmacognosy in herbal drug industry, Indian Council of Agricultural Research, Current Good Agricultural Practices, Current Good Cultivation Practices, Current Good Collection Practices, Conservation of medicinal plants- Ex-situ and In-situ conservation of medicinal plants. 12 Hrs
2. Marine natural products: General methods of isolation and purification, Study of Marine toxins, Recent advances in research in marine drugs, Problems faced in research on marine drugs such as taxonomical identification, chemical screening and their solution. 12 Hrs
3. Nutraceuticals: Current trends and future scope, Inorganic mineral supplements, Vitamin supplements, Digestive enzymes, Dietary fibres, Cereals and grains, Health drinks of natural origin, Antioxidants, Polyunsaturated fatty acids, Herbs as functional foods, Formulation and standardization of nutraceuticals, Regulatory aspects, FSSAI guidelines, Sources, name of marker compounds and their chemical nature, medicinal uses and health benefits of following 12 Hrs
  - i) Spirulina
  - ii) Soya bean
  - iii) Ginseng
  - iv) Garlic
  - v) Broccoli
  - vi) Green and Herbal Tea
  - vii) Flax seeds
  - viii) Black cohosh
  - ix) Turmeric.

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- 4 Phytopharmaceuticals: Occurrence, isolation and characteristic 12 features (Chemical nature, uses in pharmacy, medicinal and Hrs health benefits) of following.
- a) Carotenoids - i)  $\alpha$  and  $\beta$  - Carotene ii) Xanthophyll (Lutein)
  - b) Limonoids - i) d-Limonene ii)  $\alpha$  - Terpineol
  - c) Saponins - i) Shatavarins
  - d) Flavonoids - i) Resveratrol ii) Rutin iii) Hesperidin iv) Naringin v) Quercetin
  - e) Phenolic acids- Ellagic acid
  - f) Vitamins
  - g) Tocotrienols and Tocopherols
  - h) Andrographolide, Glycolipids, Gugulipids, Withanolides, Vascine, Taxol
  - i) Miscellaneous
- 5 Pharmacovigilance of drugs of natural origin: WHO and 12 AYUSH guidelines for safety monitoring of natural medicine, Hrs Spontaneous reporting schemes for biodrug adverse reactions, bio drug-drug and bio drug-food interactions with suitable examples.

REFERENCES (Latest Editions of)

1. Pharmacognosy - G. E. Trease and W.C. Evans. Saunders Edinburgh, New York.
2. Pharmacognosy-Tyler, Brady, Robbers
3. Modern Methods of Plant Analysis- Peach & M.V. Tracey, Vol. I&II
4. Text Book of Pharmacognosy by T.E. Wallis
5. Marine Natural Products-Vol.I to IV.
6. Natural products: A lab guide by Raphael Ikan , Academic Press 1991.
7. Glimpses of Indian Ethano Pharmacology, P. Pushpangadam. Ulf Nyman. V.George Tropical Botanic Garden & Research Institute, 1995.
8. Medicinal natural products (a biosynthetic approach), Paul M. Dewick, John Wiley & Sons Ltd., England, 1998.
9. Chemistry of Marine Natural Products- Paul J. Schewer 1973.
10. Herbal Drug Industry by RD. Choudhary, Eastern Publisher, New Delhi, 1996.
11. Cultivation of Medicinal Plants by C.K. Atal & B.M. Kapoor.
12. Cultivation and Utilization of Aromatic Plants, C.K. Atal & B.M. Kapoor
13. Cultivation of medicinal and aromatic crops, AA Farooqui and B.S. Sreeramu. University Press, 2001.

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14. Natural Products from Plants, 1st edition, by Peter B. Kaufman, CRC Press, New York, 1998
15. Recent Advances in Phytochemistry- Vol. 1&4: Scikel Runeckles- Appleton Century crofts.
16. Text book of Pharmacognosy, C.K.Kokate, Purohit, Ghokhale, Nirali Prakasshan, 1996.
17. Pharmacognosy and Pharmacobiotechnology, Ashutoshkar, New Age Publications, New Delhi.

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PHYTOCHEMISTRY  
(MPG 103T)

SCOPE

Students shall be equipped with the knowledge of natural product drug discovery and will be able to isolate, identify and extract and the phyto-constituents

OBJECTIVES

- Upon completion of the course, the student shall be able to know the,
- different classes of phytoconstituents, their biosynthetic pathways, their properties, extraction and general process of natural product drug discovery
  - phytochemical fingerprinting and structure elucidation of phytoconstituents.

THEORY

60 Hrs

1. Biosynthetic pathways and Radio tracing techniques: 12 Hrs  
Constituents & their Biosynthesis, Isolation, Characterization and purification with a special reference to their importance in herbal industries of following phyto-pharmaceuticals containing drugs:
  - a) Alkaloids: Ephedrine, Quinine, Strychnine, Piperine, Berberine, Taxol, Vinca alkaloids.
  - b) Glycosides: Digitoxin, Glycyrrhizin, Sennosides, Bacosides, Quercetin.
  - c) Steroids: Hecogenin, guggulosterone and withanolides
  - d) Coumarin: Umbelliferone.
  - e) Terpenoids: Cucurbitacins
- 2 Drug discovery and development: History of herbs as source of drugs and drug discovery, the lead structure selection process, structure development, product discovery process and drug registration, Selection and optimization of lead compounds with suitable examples from the following source : artemesin, andrographolides. Clinical studies emphasising on phases of clinical trials, protocol design for lead molecules. 12 Hrs
- 3 Extraction and Phytochemical studies: Recent advances in extractions with emphasis on selection of method and choice of solvent for extraction, successive and exhaustive extraction and other methods of extraction commonly used like microwave 12 Hrs

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assisted extraction, Methods of fractionation. Separation of phytoconstituents by latest CCCET, SCFE techniques including preparative HPLC and Flash column chromatography.

- |   |  |           |
|---|--|-----------|
| 4 | Phytochemical finger printing: HPTLC and LCMS/GCMS applications in the characterization of herbal extracts. Structure elucidation of phytoconstituents.  | 12<br>Hrs |
| 5 | Structure elucidation of the following compounds by spectroscopic techniques like UV, IR, MS, NMR (1H, 13C)<br>a. Carvone, Citral, Menthol<br>b. Luteolin, Kaempferol<br>c. Nicotine, Caffeine iv) Glycyrrhizin. | 12<br>Hrs |

REFERENCES (Latest Editions of)

1. Organic chemistry by I.L. Finar Vol.II
2. Pharmacognosy by Trease and Evans, ELBS.
3. Pharmacognosy by Tylor and Brady.
4. Text book of Pharmacognosy by Wallis.
5. Clark's isolation and Identification of drugs by A.C. Mottal.
6. Plant Drug Analysis by Wagner & Bladt.
7. Wilson and Gisvolds text book of Organic Medicinnal and Pharmaceutical Chemistry by Deorge. R.F.
8. The Chemistry of Natural Products, Edited by R.H. Thomson, Springer International Edn. 1994.
9. Natural Products Chemistry Practical Manual by Anees A Siddiqui and SeemiSiddiqui
10. Organic Chemistry of Natural Products, Vol. 1&2. Gurdeep R Chatwal.
11. Chemistry of Natural Products- Vol. 1 onwards IWPAC.
12. Modem Methods of Plant Analysis- Peach & M.V. Tracey, Vol. I&II
13. Medicinal Natural products - a biosynthetic approach, Dewick PM, John Wiley & Sons, Toronto, 1998.
14. Chemistry of Natural Products, Bhat SV, Nagasampagi BA, Meenakshi S, Narosa Publishing House, New Delhi.
15. Pharmacognosy & Phytochemistry of Medicinal Plants, 2<sup>nd</sup> edition, Bruneton J, Interceptt Ltd., New York, 1999.

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INDUSTRIAL PHARMACOGNOSTICAL TECHNOLOGY  
(MPG 104T)

SCOPE

To understand the Industrial and commercial potential of drugs of natural origin, integrate traditional Indian systems of medicine with modern medicine and also to know regulatory and quality policy for the trade of herbals and drugs of natural origin.

OBJECTIVES

By the end of the course the student shall be able to know,

- the requirements for setting up the herbal/natural drug industry.
- the guidelines for quality of herbal/natural medicines and regulatory issues.
- the patenting/IPR of herbals/natural drugs and trade of raw and finished materials.

THEORY

60 Hrs

1. Herbal drug industry: Infrastructure of herbal drug industry 12 Hrs  
involved in production of standardized extracts and various dosage forms. Current challenges in upgrading and modernization of herbal formulations. Entrepreneurship Development, Project selection, project report, technical knowledge, Capital venture, plant design, layout and construction. Pilot plant scale -up techniques, case studies of herbal extracts. Formulation and production management of herbals.
2. Regulatory requirements for setting herbal drug industry: 12 Hrs  
Global marketing management. Indian and international patent law as applicable herbal drugs and natural products. Export - Import (EXIM) policy, TRIPS.  
Quality assurance in herbal/natural drug products.  
Concepts of TQM, GMP, GLP, ISO-9000.
3. Monographs of herbal drugs: General parameters of monographs of herbal drugs and comparative study in IP, USP, Ayurvedic Pharmacopoeia, Siddha and Unani Pharmacopoeia, American herbal pharmacopoeia, British herbal pharmacopoeia, WHO guidelines in quality assessment of herbal drugs.

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- 4 Testing of natural products and drugs: Herbal medicines - 12  
clinical laboratory testing. Stability testing of natural products, Hrs  
protocols.
- 5 Patents: Indian and international patent laws, proposed 12  
amendments as applicable to herbal/natural products and Hrs  
process. Geographical indication, Copyright, Patentable subject  
matters, novelty, non obviousness, utility, enablement and best  
mode, procedure for Indian patent filing, patent processing, grant  
of patents, rights of patents, cases of patents, opposition and  
revocation of patents, patent search and literature, Controllers of  
patents.

REFERENCES (Latest Editions of)

1. Herbal drug industry by R.D. Choudhary (1996), Eastern Publisher, New Delhi.
2. GMP for Botanicals - Regulatory and Quality issues on Phytomedicine by Pulok K Mukharjee (2003), 1st Edition, Business horizons Robert Verpoorte, New Delhi.
3. Quality control of herbal drugs by Pulok K Mukarjee (2002), Business Horizons Pharmaceutical Publisher, New Delhi.
4. PDR for Herbal Medicines (2000), Medicinal Economic Company, New Jersey.
5. Indian Herbal Pharmacopoeia (2002), IDMA, Mumbai.
6. Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae (1996), Nirali Prakashan, New Delhi.
7. Text book of Pharmacognosy and Phytochemistry by Vinod D. Rangarl (2002), Part I & II, Career Publication, Nasik, India.
8. Plant drug analysis by H.Wagner and S.Bladt, Springer, Berlin.
9. Standardization of Botanicals. Testing and extraction methods of medicinal herbs by V. Rajpal (2004), Vol.I, Eastern Publisher, New Delhi.
10. Phytochemical Dictionary. Handbook of Bioactive Compounds from Plants by J.B.Harborne, (1999), 11nd Edition, Taylor and Francis Ltd, UK.
11. Herbal Medicine. Expanded Commission E Monographs by M.Blumenthal, (2004), 1ST Edition,
12. Drug Formulation Manual by D.P.S.Kohli and D.H.Shah (1998), Eastern Publisher, New Delhi.

✓  
by Ashu  
Bansal

PHARMACOGNOSY PRACTICAL - I  
(MPG 105P)

1. Analysis of Pharmacopoeial compounds of natural origin and their formulations by UV Vis spectrophotometer
2. Analysis of recorded spectra of simple phytoconstituents
3. Experiments based on Gas Chromatography
4. Estimation of sodium/potassium by flame photometry
5. Development of fingerprint of selected medicinal plant extracts commonly used in herbal drug industry viz. Ashwagandha, Tulsi, Bael, Amla, Ginger, Aloe, Vidang, Senna, Lawsonia by TLC/HPTLC method.
6. Methods of extraction
7. Phytochemical screening
8. Demonstration of HPLC- estimation of glycerrhizin
9. Monograph analysis of clove oil
10. Monograph analysis of castor oil.
11. Identification of bioactive constituents from plant extracts
12. Formulation of different dosage forms and their standardisation.

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MEDICINAL PLANT BIOTECHNOLOGY  
(MPG 201T)

SCOPE

To explore the knowledge of Biotechnology and its application in the improvement of quality of medicinal plants

OBJECTIVES

Upon completion of the course, the student shall be able to,

- Know the process like genetic engineering in medicinal plants for higher yield of Phytopharmaceuticals.
- Use the biotechnological techniques for obtaining and improving the quality of natural products/medicinal plants

THEORY

60 Hrs

1. Introduction to Plant biotechnology: Historical perspectives, 12 Hrs  
prospects for development of plant biotechnology as a source of medicinal agents. Applications in pharmacy and allied fields. Genetic and molecular biology as applied to pharmacognosy, study of DNA, RNA and protein replication, genetic code, regulation of gene expression, structure and complicity of genome, cell signaling, DNA recombinant technology.
2. Different tissue culture techniques: Organogenesis and 15 Hrs  
embryogenesis, synthetic seed and monoclonal variation, Protoplast fusion, Hairy root multiple shoot cultures and their applications. Micro propagation of medicinal and aromatic plants. Sterilization methods involved in tissue culture, gene transfer in plants and their applications.
3. Immobilisation techniques & Secondary Metabolite 15 Hrs  
Production: Immobilization techniques of plant cell and its application on secondary metabolite Production. Cloning of plant cell: Different methods of cloning and its applications. Advantages and disadvantages of plant cell cloning. Secondary metabolism in tissue cultures with emphasis on production of medicinal agents. Precursors and elicitors on production of secondary metabolites.
4. Biotransformation and Transgenesis: Biotransformation, 13 Hrs  
bioreactors for pilot and large scale cultures of plant cells and retention of biosynthetic potential in cell culture. Transgenic

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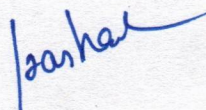
plants, methods used in gene identification, localization and sequencing of genes. Application of PCR in plant genome analysis.

- 5 Fermentation technology: Application of Fermentation 05 technology, Production of ergot alkaloids, single cell proteins, Hrs enzymes of pharmaceutical interest.

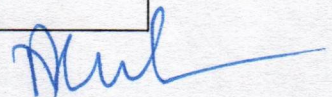
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1. Plant tissue culture, Bhagwani, vol 5, Elsevier Publishers.
2. Plant cell and Tissue Culture (Lab. Manual), JRMM. Yeoman.
3. Elements in biotechnology by PK. Gupta, Rastogi Publications, New Delhi.
4. An introduction to plant tissue culture by MK. Razdan, Science Publishers.
5. Experiments in plant tissue culture by John HD and Lorin WR., Cambridge University Press.
6. Pharmaceutical biotechnology by SP. Vyas and VK. Dixit, CBS Publishers.
7. Plant cell and tissue culture by Jeffrey W. Pollard and John M Walker, Humana press.
8. Plant tissue culture by Dixon, Oxford Press, Washington DC, 1985
9. Plant tissue culture by Street.
10. Pharmacognosy by G. E. Trease and WC. Evans, Elsevier.
11. Biotechnology by Purohit and Mathur, Agro-Bio, 3<sup>rd</sup> revised edition.
12. Biotechnological applications to tissue culture by Shargool, Peter D, Shargool, CKC Press.
13. Pharmacognosy by Varo E. Tyler, Lynn R. Brady and James E. Robbert, That Tjen, NGO.
14. Plant Biotechnology, Ciddi Veerasham.









ADVANCED PHARMACOGNOSY - II  
(MPG 202T)

SCOPE

To know and understand the Adulteration and Deterioration that occurs in herbal/natural drugs and methods of detection of the same. Study of herbal remedies and their validations, including methods of screening

OBJECTIVES

Upon completion of the course, the student shall be able to know the,

- validation of herbal remedies
- methods of detection of adulteration and evaluation techniques for the herbal drugs
- methods of screening of herbals for various biological properties

THEORY

60 Hrs

1. Herbal remedies – Toxicity and Regulations: Herbals vs Conventional drugs, Efficacy of Herbal medicine products, Validation of herbal therapies, Pharmacodynamic and Pharmacokinetic issues. 12 Hrs
2. Adulteration and Deterioration: Introduction, Types of Adulteration/ Substitution of Herbal drugs, Causes and Measures of Adulteration, Sampling Procedures, Determination of Foreign Matter, DNA Finger printing techniques in identification of drugs of natural origin, detection of heavy metals, pesticide residues, phytotoxin, microbial contamination in herbs and their formulations. 12 Hrs
3. Ethnobotany and Ethnopharmacology: Ethnobotany in herbal drug evaluation, Impact of Ethnobotany in traditional medicine, New development in herbals, Bio-prospecting tools for drug discovery, Role of Ethnopharmacology in drug evaluation, Reverse Pharmacology. 12 Hrs
4. Analytical Profiles of herbal drugs: Andrographis paniculata, Boswellia serata, Coleus forskholii, Curcuma longa, Embelica officinalis, Psoralea corylifolia. 12 Hrs
5. Biological screening of herbal drugs: Introduction and Need for Phyto-Pharmacological Screening, New Strategies for evaluating 12 Hrs

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Natural Products, In vitro evaluation techniques for Antioxidants, Antimicrobial and Anticancer drugs. In vivo evaluation techniques for Anti-inflammatory, Antiulcer, Anticancer, Wound healing, Antidiabetic, Hepatoprotective, Cardio protective, Diuretics and Antifertility, Toxicity studies as per OECD guidelines.

REFERENCES (Latest Editions of)

1. Glimpses of Indian Ethano Pharmacology by P. Pushpangadam. Ulf Nyman. V.George Tropical Botanic Garden & Research Institute.
2. Natural products: A lab guide by Raphael Ikan, Academic Press.
3. Pharmacognosy - G. E. Trease and W.C. Evans. WB. Saunders Edinburgh, New York.
4. Pharmacognosy-Tyler, Brady, Robbers, Lee & Fetiger.
5. Modern Methods of Plant Analysis- Peach & M.V. Tracey, Vol. I & II, Springer Publishers.
6. Herbal Drug Industry by RD. Choudhary, Eastern Publishers, New Delhi.
7. Text book of Pharmacognosy by C.K.Kokate, Purohit, Ghokhale, Nirali Prakashan.
8. Text Book of Pharmacognosy by T.E. Wallis, J & A Churchill Ltd., London.
9. Quality control of herbal drugs by Pulok K Mukherjee, Business Horizons Pharmaceutical Publishers, New Delhi.
10. Indian Herbal Pharmacopoeia, IDMA, Mumbai.
11. Text book of Pharmacognosy and Phytochemistry by Vinod D. Rangarl, Part I & II, Career Publication, Nasik, India.
12. Plant drug analysis by H.Wagner and S.Bladt, 2nd edition, Springer, Berlin.
13. Standardization of Botanicals. Testing and extraction methods of medicinal herbs by V. Rajpal (2004), Vol.I, Eastern PublisherS, New Delhi.
14. Herbal Medicine. Expanded Commission E Monographs, M.Blumenthal.

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INDIAN SYSTEMS OF MEDICINE  
(MPG 203T)

SCOPE

To make the students understand thoroughly the principles, preparations of medicines of various Indian systems of medicine like Ayurveda, Siddha, Homeopathy and Unani. Also focusing on clinical research of traditional medicines, quality assurance and challenges in monitoring the safety of herbal medicines.

OBJECTIVES

After completion of the course, student is able to

- To understand the basic principles of various Indian systems of medicine
- To know the clinical research of traditional medicines, Current Good Manufacturing Practice of Indian systems of medicine and their formulations.

THEORY

60 Hrs

1. Fundamental concepts of Ayurveda, Siddha, Unani and Homoeopathy systems of medicine 12 Hrs  
Different dosage forms of the ISM.  
Ayurveda: Ayurvedic Pharmacopoeia, Analysis of formulations and bio crude drugs with references to: Identity, purity and quality.  
Siddha: Gunapadam (Siddha Pharmacology), raw drugs/Dhatu/Jeevam in Siddha system of medicine, Purification process (Suddhi).
2. Naturopathy, Yoga and Aromatherapy practices 12 Hrs  
a) Naturopathy - Introduction, basic principles and treatment modalities.  
b) Yoga - Introduction and Streams of Yoga. Asanas, Pranayama, Meditations and Relaxation techniques.  
c) Aromatherapy - Introduction, aroma oils for common problems, carrier oils.
3. Formulation development of various systems of medicine 12 Hrs  
Salient features of the techniques of preparation of some of the important class of Formulations as per Ayurveda, Siddha, Homeopathy and Unani Pharmacopoeia and texts.  
Standardization,  
Shelf life and Stability studies of ISM formulations.

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- 4 Schedule T - Good Manufacturing Practice of Indian systems of medicine 12 Hrs  
 Components of GMP (Schedule - T) and its objectives, Infrastructural requirements, working space, storage area, machinery and equipments, standard operating procedures, health and hygiene, documentation and records.  
 Quality assurance in ISM formulation industry - GAP, GMP and GLP. Preparation of documents for new drug application and export registration.  
 Challenges in monitoring the safety of herbal medicines: Regulation, quality assurance and control, National/Regional Pharmacopoeias.
- 5 TKDL, Geographical indication Bill, Government bills in AYUSH, ISM, CCRAS, CCRS, CCRH, CCRU 12 Hrs

REFERENCES (Latest Editions of )

1. Ayurvedic Pharmacopoeia, The Controller of Publications, Civil Lines, Govt. of India, New Delhi.
2. Hand Book on Ayurvedic Medicines, H. Panda, National Institute of Industrial Research, New Delhi.
3. Ayurvedic System of Medicine, Kaviraj Nagendranath Sengupata, Sri Satguru Publications, New Delhi.
4. Ayurvedic Pharmacopoeia. Formulary of Ayurvedic Medicines, IMCOPS, Chennai.
5. Homeopathic Pharmacopoeia. Formulary of Homeopathic Medicines, IMCOPS, Chennai.
6. Homeopathic Pharmacy : An introduction & Hand book, Steven B. Kayne, Churchill Livingstone, New York.
7. Indian Herbal Pharmacopoeia, IDMA, Mumbai.
8. British Herbal Pharmacopoeia, bRITISH Herbal Medicine Association, UK.
9. GMP for Botanicals - Regulatory and Quality issues on Phytomedicine, Pulk K Mukharjee, Business Horizons, New Delhi.
10. Indian System of Medicine and Homeopathy in India, Planning and Evaluation Cell, Govt. of India, New Delhi.
11. Essential of Food and Nutrition, Swaminathan, Bappco, Bangalore.
12. Clinical Dietetics and Nutrition, F.P. Antia, Oxford University Press, Delhi.
13. Yoga - The Science of Holistic Living by V.K.Yoga, Vivekananda Yoga Prakashna Publishing, Bangalore.

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**HERBAL COSMETICS**  
(MPG 204T)

**SCOPE**

This subject deals with the study of preparation and standardization of herbal/natural cosmetics. This subject gives emphasis to various national and international standards prescribed regarding herbal cosmeceuticals.

**OBJECTIVES**

After completion of the course, student shall be able to,

- understand the basic principles of various herbal/natural cosmetic preparations
- current Good Manufacturing Practices of herbal/natural cosmetics as per the regulatory authorities

**THEORY**

60 Hrs

1. Introduction: Herbal/natural cosmetics, Classification & Economic aspects. 12 Hrs  
Regulatory Provisions relation to manufacture of cosmetics: - License, GMP, offences & Penalties, Import & Export of Herbal/natural cosmetics, Industries involved in the production of Herbal/natural cosmetics.
2. Commonly used herbal cosmetics, raw materials, preservatives, surfactants, humectants, oils, colors, and some functional herbs, preformulation studies, compatibility studies, possible interactions between chemicals and herbs, design of herbal cosmetic formulation. 12 Hrs
3. Herbal Cosmetics : Physiology and chemistry of skin and pigmentation, hairs, scalp, lips and nail, Cleansing cream, Lotions, Face powders, Face packs, Lipsticks, Bath products, soaps and baby product, Preparation and standardisation of the following : 12 Hrs  
Tonic, Bleaches, Dentifrices and Mouth washes & Tooth Pastes, Cosmetics for Nails.
4. Cosmeceuticals of herbal and natural origin: Hair growth formulations, Shampoos, Conditioners, Colorants & hair oils, Fairness formulations, vanishing & foundation creams, anti-sun burn preparations, moisturizing creams, deodorants. 12 Hrs

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On the right, there are two more signatures in blue ink, one above the other.

- 5 Analysis of Cosmetics, Toxicity screening and test methods: 12  
Quality control and toxicity studies as per Drug and Cosmetics Hrs  
Act.

REFERENCES (Latest Editions of)

1. Panda H. Herbal Cosmetics (Hand book), Asia Pacific Business Press Inc, New Delhi.
2. Thomson EG. Modern Cosmetics, Universal Publishing Corporation, Mumbai.
3. P.P.Sharma. Cosmetics - Formulation, Manufacturing & Quality Control, Vandana Publications, New Delhi.
4. Supriya K B. Handbook of Aromatic Plants, Pointer Publishers, Jaipur.
5. Skaria P. Aromatic Plants (Horticulture Science Series), New India Publishing Agency, New Delhi.
6. Kathi Keville and Mindy Green. Aromatherapy (A Complete Guide to the Healing Art), Sri Satguru Publications, New Delhi.
7. Chattopadhyay PK. Herbal Cosmetics & Ayurvedic Medicines (EOU), National Institute of Industrial Research, Delhi.
8. Balsam MS & Edward Sagarin. Cosmetics Science and Technology, Wiley Interscience, New York.

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✓  
S. Paul  
Sarkar

HERBAL COSMETICS PRACTICALS  
(MPG 205P)

1. Isolation of nucleic acid from cauliflower heads
2. Isolation of RNA from yeast
3. Quantitative estimation of DNA
4. Immobilization technique
5. Establishment of callus culture
6. Establishment of suspension culture
7. Estimation of aldehyde contents of volatile oils
8. Estimation of total phenolic content in herbal raw materials
9. Estimation of total alkaloid content in herbal raw materials
10. Estimation of total flavonoid content in herbal raw materials
11. Preparation and standardization of various simple dosage forms from Ayurvedic, Siddha, Homoeopathy and Unani formulary
12. Preparation of certain Aromatherapy formulations
13. Preparation of herbal cosmetic formulation such as lip balm, lipstick, facial cream, herbal hair and nail care products
14. Evaluation of herbal tablets and capsules
15. Preparation of sunscreen, UV protection cream, skin care formulations.
16. Formulation & standardization of herbal cough syrup.

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Semester III  
MRM 301T - Research Methodology & Biostatistics

UNIT – I

General Research Methodology: Research, objective, requirements, practical difficulties, review of literature, study design, types of studies, strategies to eliminate errors/bias, controls, randomization, crossover design, placebo, blinding techniques.

UNIT – II

Biostatistics: Definition, application, sample size, importance of sample size, factors influencing sample size, dropouts, statistical tests of significance, type of significance tests, parametric tests (students "t" test, ANOVA, Correlation coefficient, regression), non-parametric tests (wilcoxon rank tests, analysis of variance, correlation, chi square test), null hypothesis, P values, degree of freedom, interpretation of P values.

UNIT – III

Medical Research: History, values in medical ethics, autonomy, beneficence, non-maleficence, double effect, conflicts between autonomy and beneficence/non-maleficence, euthanasia, informed consent, confidentiality, criticisms of orthodox medical ethics, importance of communication, control resolution, guidelines, ethics committees, cultural concerns, truth telling, online business practices, conflicts of interest, referral, vendor relationships, treatment of family members, sexual relationships, fatality.

UNIT – IV

CPCSEA guidelines for laboratory animal facility: Goals, veterinary care, quarantine, surveillance, diagnosis, treatment and control of disease, personal hygiene, location of animal facilities to laboratories, anesthesia, euthanasia, physical facilities, environment, animal husbandry, record keeping, SOPs, personnel and training, transport of lab animals.

UNIT – V

Declaration of Helsinki: History, introduction, basic principles for all medical research, and additional principles for medical research combined with medical care.