Pt. Ravishankar Shukla University,
Raipur (C.G.), India 492010

CURRICULUM & Syllabus
(Based on CBCS & LOCF)

M. Pharm.- Pharmacognosy
(Semester System)

Semester: I-IV

Session: 2025-2027

टीपः– सत्र. 2024-2026 के पाठ्यक्रम को सत्र 2025-2027.....के लिए यथावत प्रभावशील किया जाता है।

Approved by	:	
Board of Studies	:	Pharmacy
Dates	:	16-05-2025
Name of Chairman	:	Dr. S. J. Daharwal
Name of Member's	:	Dr. Preeti K. Suresh
		Dr. Manju Singh
		Dr. Amber Vyas
		Dr. Deependra Singh

M. Pharm in Pharmacognosy

Program Outcomes (POs)

PO-1: Knowledge
Acquire in-depth knowledge of natural products, phytochemistry, traditional systems of medicine, herbal drug standardization, pharmacognostic evaluation, and plant-based drug development.

PO-2: Critical Thinking and Reasoning
Develop critical reasoning to evaluate the quality, efficacy, and safety of herbal drugs and to apply modern scientific principles to traditional knowledge systems.

PO-3: Problem Solving
Identify and address challenges related to raw material authentication, adulteration, and variability in herbal drugs through scientific and analytical approaches.

PO-4: Advanced Analytical and Computational Skills
Employ advanced chromatographic and spectroscopic techniques (TLC, HPTLC, HPLC, GC, UV-Vis, FTIR) and chemometric tools for standardization, quality control, and phytochemical analysis.

PO-5: Effective Communication
Effectively communicate scientific findings, herbal research data, and traditional medicinal knowledge with clarity in both academic and industrial settings.

PO-6: Social/Interdisciplinary Interaction
Collaborate with botanists, chemists, and health professionals to integrate ethnopharmacological knowledge with modern drug discovery and healthcare practices.

PO-7: Self-directed and Life-long Learning
Develop an attitude of lifelong learning and stay updated with advances in herbal medicine research, regulation, and global traditional medicine practices.

PO-8: Effective Citizenship: Leadership and Innovation
Take initiative in sustainable sourcing, conservation of medicinal plants, and innovation in herbal drug formulations with leadership and ethical responsibility.

PO-9: Ethics
Adhere to ethical practices in the use of traditional knowledge, protection of biodiversity, and fair benefit-sharing under applicable legal frameworks like the Nagoya Protocol.

PO-10: Further Education or Employment
Prepare for advanced academic research (Ph.D.), industry roles in herbal drug manufacturing, quality control, regulatory affairs, and academia.

PO-11: Global Perspective
Recognize the global relevance of pharmacognosy and the role of herbal medicines in integrative healthcare systems across cultures and regulatory landscapes.

Program Specific Outcomes (PSOs)

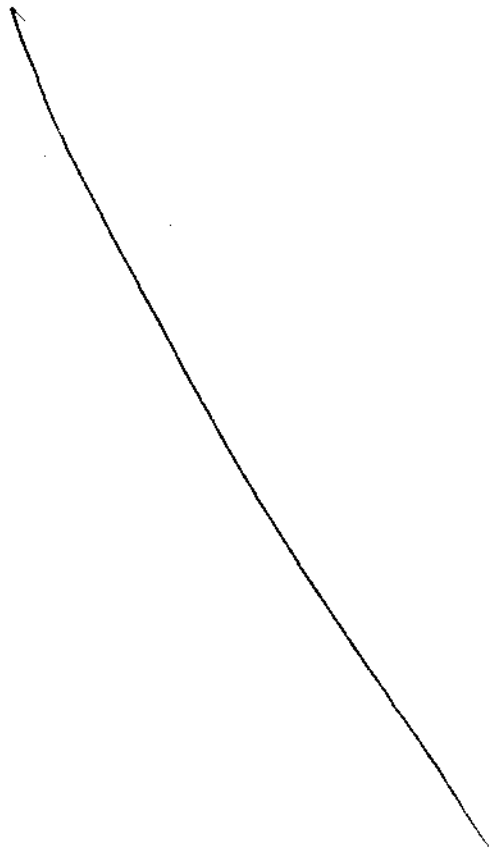
PSO-1: Herbal Drug Standardization and Quality Control
Demonstrate proficiency in identifying, authenticating, and standardizing plant-based materials using macroscopic, microscopic, and chromatographic techniques.

PSO-2: Phytochemical and Pharmacological Research
Apply knowledge in isolating, characterizing, and evaluating bioactive compounds for therapeutic potential and drug discovery.

PSO-3: Traditional Knowledge Integration
Integrate Ayurvedic, Siddha, and Unani principles with modern scientific methodologies to explore new drug leads from traditional knowledge.

PSO-4: Conservation and Sustainability
Promote sustainable harvesting, cultivation, and conservation of medicinal plants, contributing to biodiversity and ethnomedicinal heritage.

PSO-5: Industry and Regulatory Readiness
Equip with skills needed in herbal product formulation, documentation, licensing, and compliance with WHO, AYUSH, and international regulations.



M. Pharm. Pharmacognosy

Semester-I

Program	Subject	Year	Semester
M. Pharm.	Pharmacognosy	I	I
Course Code	Course Title		Course Type
MPG 101T	MODERN PHARMACEUTICAL ANALYTICAL TECHNIQUES		Core
Credit	Hours Per Week (L-T-P)		
	L	T	P
4	4	-	--

Maximum Marks	CIA	ESE
100	25	75

Learning Objective (LO):

After completion of course student is able to know about,

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

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to :	CL
1	Understand the significance of pharmacognosy in the herbal drug industry and explain the principles and practices of cultivation, collection, and conservation of medicinal plants, including regulatory and ethical guidelines.	Ap
2	Describe the techniques for isolation and purification of marine natural products, identify marine toxins, discuss recent advances, and analyze challenges and solutions in marine drug research.	Ap
3	Explain the classification, formulation, standardization, and regulatory guidelines of nutraceuticals; and evaluate the sources, chemical nature, and health benefits of commonly used nutraceutical ingredients.	U
4	Identify and classify important phytopharmaceuticals based on chemical nature, explain their isolation, and evaluate their pharmacological and health-related applications.	An
5	Understand and apply WHO and AYUSH guidelines for safety monitoring of natural medicines, and analyze biodrug interactions and reporting systems with appropriate examples.	U

CL: Cognitive Levels (**R**-Remember; **U**-Understanding; **Ap**-Apply; **An**-Analyze; **E**-Evaluate; **C**-Create).

CO-PO/PSO Mapping for the course:

PO / CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	2	3	1	2	3	3	2	3	2	2	3	1	2	3	2
CO2	3	3	3	3	1	1	3	1	2	3	2	2	3	2	1	2
CO3	3	3	2	3	2	2	2	2	2	3	3	3	3	2	2	3
CO4	3	2	3	3	2	1	3	2	2	3	2	3	3	3	2	2
CO5	3	3	2	1	3	2	3	1	3	2	3	2	2	2	2	3

"3" – Strong; "2" – Moderate; "1"- Low; "-" No Correlation

Detailed Syllabus:

Unit No.	Topics	No. of Lectures	CO No.
I	a) **UV-Visible spectroscopy:** Introduction, Theory, Laws, Instrumentation associated with UV-Visible spectroscopy, Choice of solvents and solvent effect and Applications of UV-Visible spectroscopy, Difference/ Derivative spectroscopy. b) **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. c) **Spectroflourimetry:** Theory of Fluorescence, Factors affecting fluorescence, Quenchers, Instrumentation and Applications of fluorescence spectrophotometer. d) Flame emission spectroscopy and Atomic absorption spectroscopy: Principle, Instrumentation, Interferences and Applications.	10hrs	1
II	**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 13C NMR. Applications of NMR spectroscopy.	10hrs	2
III	**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.	10hrs	3
IV	**Chromatography**: Principle, apparatus, instrumentation, chromatographic parameters, factors affecting resolution, isolation of drug from excipients, data interpretation and applications of the following: a. Thin Layer chromatography b. Thin Layer Chromatography c. Ion exchange chromatography d. Column chromatography e. Gas chromatography f. High Performance Liquid chromatography g. Affinity chromatography	10hrs	4
V	a. **Electrophoresis**: Principle, Instrumentation, Working conditions, factors affecting separation and applications of the following: a) Paper electrophoresis b) Gel electrophoresis c) Capillary electrophoresis d) Zone electrophoresis e) Moving boundary electrophoresis f) Iso electric focusing	10hrs	

	b. **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 **Immunological assays** : RIA (Radio immuno assay), ELISA,Bioluminescence assays		
VI	**Potentiometry:** Principle, working, Ion selective Electrodes and Application of potentiometry. **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 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.	10hrs	

Books Recommended:

1. Spectrometric Identification of Organic compounds - Robert M Silverstein, Sixth edition, John Wiley & Sons, 2004.
2. Principles of Instrumental Analysis - Doglas A Skoog, F. James Holler, Timothy A. Nieman, 5th 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, 2nd edn., P.S/Kalsi, Wiley estern Ltd., Delhi.
9. Textbook of Pharmaceutical Analysis, KA.Connors, 3rd Edition, John Wiley & Sons, 1982.

Semester-I

Program	Subject	Year	Semester
M. Pharm.	Pharmacognosy	I	I
Course Code	Course Title		Course Type
MPG 102T	ADVANCED PHARMACOGNOSY - I		Core
Credit	Hours Per Week (L-T-P)		
	L	T	P
4	4	1	--

Maximum Marks	CIA	ESE
100	25	75

Learning Objective (LO):

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.

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to :	CL
1	Understand the significance of pharmacognosy in the herbal drug industry and explain the principles and practices of cultivation, collection, and conservation of medicinal plants, including regulatory and ethical guidelines.	Ap
2	Describe the techniques for isolation and purification of marine natural products, identify marine toxins, discuss recent advances, and analyze challenges and solutions in marine drug research.	Ap
3	Explain the classification, formulation, standardization, and regulatory guidelines of nutraceuticals; and evaluate the sources, chemical nature, and health benefits of commonly used nutraceutical ingredients.	U
4	Identify and classify important phytopharmaceuticals based on chemical nature, explain their isolation, and evaluate their pharmacological and health-related applications.	An
5	Understand and apply WHO and AYUSH guidelines for safety monitoring of natural medicines, and analyze biodrug interactions and reporting systems with appropriate examples.	U

CL: Cognitive Levels (**R**-Remember; **U**-Understanding; **Ap**-Apply; **An**-Analyze; **E**-Evaluate; **C**-Create).

CO-PO/PSO Mapping for the course:

PO / CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	2	3	1	2	3	3	2	3	2	2	3	1	2	3	2
CO2	3	3	3	3	1	1	3	1	2	3	2	2	3	2	1	2
CO3	3	3	2	3	2	2	2	2	2	3	3	3	3	2	2	3
CO4	3	2	3	3	2	1	3	2	2	3	2	3	3	3	2	2
CO5	3	3	2	1	3	2	3	1	3	2	3	2	2	2	2	3

"3" – Strong; "2" -- Moderate; "1"- Low; "-" No Correlation

Detailed Syllabus:

Unit No.	Topics	No. of Lectures	CO No.
I	**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	1
II	**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	2
III	**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 neutraceuticals, Regulatory aspects, FSSAI guidelines, Sources, name of marker compounds and their chemical nature, medicinal uses and health benefits of following: i) Spirulina ii) Soya bean iii) Ginseng iv) Garlic v) Broccoli vi) Green and Herbal Tea vii) Flax seeds viii) Black cohosh ix) Turmeric.	12	3
IV	**Phytopharmaceuticals:** Occurrence, isolation and characteristic features (Chemical nature, uses in pharmacy, medicinal and health benefits) of following. a)Carotenoids – i) α and β - Carotene ii) Xanthophyll (Lutein) b)Limonoids – i) d-Limonene ii) α – 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	12	4
V	**Pharmacovigilance of drugs of natural origin:** WHO and AYUSH guidelines for safety monitoring of natural medicine, Spontaneous reporting schemes for biodrug adverse reactions, bio drug-drug and bio drug-food interactions with suitable examples.	12	5

Books Recommended:

1. Pharmacognosy - G. E. Trease and W.C. Evans. Saunders Edinburgh, New York.
2. Pharmacognosy-Tyler, Brady, Robbers
3. Modem Methods of Plant Analysis- Peach and M.V. Tracey, Vol. IandII
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 and Research Institute, 1995.
8. Medicinal natural products (a biosynthetic approach), Paul M. Dewick, John Wiley and 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 and B.M. Kapoor.
12. Cultivation and Utilization of Aromatic Plants, C.K. Atal and B.M. Kapoor
13. Cultivation of medicinal and aromatic crops, AA Farooqui and B.S. Sreeramu. University Press, 2001.
14. Natural Products from Plants, 1st edition, by Peter B. Kaufman, CRC Press, New York, 1998
15. Recent Advances in Phytochemistry- Vol. 1and4: 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.

Semester-I

Program	Subject	Year	Semester
M. Pharm.	Pharmacognosy	I	I
Course Code	Course Title		Course Type
MPG 103T	PHYTOCHEMISTRY		Core
Credit	Hours Per Week (L-T-P)		
	L	T	P
4	3	1	--

Maximum Marks	CIA	ESE
100	25	75

Learning Objective (LO):

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

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to :	CL
1	Explain biosynthetic pathways and apply radio tracing techniques for the study of important phyto-pharmaceutical classes like alkaloids, glycosides, steroids, coumarins, and terpenoids with relevance to herbal industries.	Ap
2	Understand the process of drug discovery and development from herbal sources including lead identification, structure optimization, clinical trial design and regulatory steps using examples like artemisinin and andrographolide.	Ap
3	Compare and apply modern extraction and fractionation techniques such as MAE, CCCET, SCFE, and preparative chromatography for isolation of phytoconstituents.	U
4	Utilize advanced instrumental techniques such as HPTLC, LC-MS, and GC-MS for phytochemical fingerprinting and characterization of herbal extracts.	An
5	Interpret spectroscopic data (UV, IR, MS, 1H and 13C NMR) for structural elucidation of natural compounds such as carvone, citral, menthol, luteolin, kaempferol, caffeine, and glycyrrhizin.	U

CL: Cognitive Levels (**R**-Remember; **U**-Understanding; **Ap**-Apply; **An**-Analyze; **E**-Evaluate; **C**-Create).

CO-PO/PSO Mapping for the course:

PO / CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	3	3	2	2	1	3	2	2	3	2	3	3	2	1	2
CO2	3	3	3	2	2	2	3	2	3	3	3	3	3	2	2	3
CO3	3	2	3	3	1	1	3	1	2	3	2	3	3	2	1	2
CO4	3	2	3	3	2	1	3	2	2	3	3	3	3	2	2	2
CO5	3	2	2	3	2	1	3	1	1	3	2	3	3	2	1	3

"3" – Strong; "2" – Moderate; "1"- Low; "-" No Correlation

Detailed Syllabus:

Unit No.	Topics	No. of Lectures	CO No.
I	**Biosynthetic pathways and Radio tracing techniques:** Constituents and 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, Strychynine, Piperine, Berberine, Taxol, Vinca alkoloids. b)Glycosides: Digitoxin,Glycyrrhizin, Sennosides, Bacosides, Quercitin. c)Steroids: Hecogenin, guggulosterone and withanolides d)Coumarin: Umbelliferone. e)Terpenoids: Cucurbitacins	12	1
II	**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	2
III	**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 assisted extraction, Methods of fractionation. Separation of phytoconstituents by latest CCCET, SCFE techniques including preparative HPLC and Flash column chromatography.	12	3
IV	**Phytochemical finger printing:** HPTLC and LCMS/GCMS applications in the characterization of herbal extracts. Structure elucidation of phytoconstituents.	12	4
V	Structure elucidation of the following compounds by spectroscopic techniques like UV, IR, MS, NMR (1H, 13C) a.Carvone, Citral, Menthol b.Luteolin, Kaempferol c.Nicotine, Caffeine iv) Glycyrrhizin	12	5

Books Recommended:

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 and 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. 1and2. Gurdeep R Chatwal.
11. Chemistry of Natural Products- Vol. 1 onwards IWPAC.
12. Modem Methods of Plant Analysis- Peach and M.V. Tracey, Vol. IandII
13. Medicinal Natural products – a biosynthetic approach, Dewick PM, John Wiley and Sons, Toronto, 1998.
14. Chemistry of Natural Products, Bhat SV, Nagasampagi BA, Meenakshi S, Narosa Publishing House, New Delhi.
15. Pharmacognosy and Phytochemistry of Medicinal Plants, 2nd edition, Bruneton J, Interceptt Ltd., New York, 1999.

Semester-I

Program	Subject	Year	Semester
M. Pharm.	Pharmacognosy	I	I
Course Code	Course Title		Course Type
MPG 104T	INDUSTRIAL PHARMACOGNOSTICAL TECHNOLOGY		Core
Credit	Hours Per Week (L-T-P)		
	L	T	P
4	3	I	--

Maximum Marks	CIA	ESE
100	25	75

Learning Objective (LO):

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.

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to	CL
1	Explain the infrastructure, production processes, and challenges in herbal drug formulation, and analyze entrepreneurship strategies including project planning, plant design, and scale-up techniques in herbal manufacturing.	Ap
2	Understand global regulatory requirements for herbal drug industries including patent laws, EXIM policy, TRIPS, and quality assurance standards like GMP, GLP, ISO, and TQM.	Ap
3	Compare the structure and quality parameters of monographs from various pharmacopoeias (IP, USP, Ayurvedic, Siddha, Unani, WHO) used in standardizing herbal drugs.	U
4	Demonstrate knowledge of clinical laboratory and stability testing protocols for herbal medicines and apply them for quality evaluation of natural drug products.	An
5	Understand the Indian and international patent processes applicable to herbal products including GI, copyright, novelty, patent filing, and rights, and analyze real-world patent cases and opposition procedures.	U

CL: Cognitive Levels (**R**-Remember; **U**-Understanding; **Ap**-Apply; **An**-Analyze; **E**-Evaluate; **C**-Create).

CO-PO/PSO Mapping for the course:

PO / CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	2	3	2	2	3	3	3	2	3	2	3	2	2	2	3
CO2	3	3	3	2	2	2	3	2	3	3	3	3	2	2	2	3
CO3	3	2	3	3	2	1	3	1	2	3	2	3	3	3	2	3
CO4	3	2	3	3	2	1	3	1	2	3	2	3	3	2	2	2
CO5	3	2	3	3	2	1	3	1	2	3	2	3	3	3	2	3

"3" – Strong; "2" – Moderate; "1"- Low; "-" No Correlation

Detailed Syllabus:

Unit No.	Topics	No. of Lectures	CO No.
I	**Herbal drug industry:** Infrastructure of herbal drug industry 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.	12	1
II	**Regulatory requirements for setting herbal drug industry:** 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.	12	2
III	**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.	12	3
IV	**Testing of natural products and drugs:** Herbal medicines - clinical laboratory testing. Stability testing of natural products, protocols.	12	4
V	**Patents:** Indian and international patent laws, proposed amendments as applicable to herbal/natural products and process. Geographical indication, Copyright, Patentable subject maters, 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.	12	5

Books Recommended:

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), Ist 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 and 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), IInd Edition, Taylor and Francis Ltd, UK.
11. Herbal Medicine. Expanded Commission E Monographs by M.Blumenthal, (2004), IST Edition,
12. Drug Formulation Manual by D.P.S.Kohli and D.H.Shah (1998), Eastern Publisher, New Delhi.

Semester-I

Program	Subject	Year	Semester
M. Pharm.	Pharmacognosy	I	I
Course Code	Course Title		Course Type
MPG 105P	PHARMACOGNOSY PRACTICAL - I		Core
Credit	Hours Per Week (L-T-P)		
	L	T	P
06	-	-	12

Maximum Marks	CIA	ESE
150	50	100

Learning Objective (LO):

By the end of this practical course, students will be able to:

- Understand and perform qualitative and quantitative analysis of phytoconstituents using advanced analytical tools.
- Apply various chromatographic and spectroscopic techniques for fingerprinting and standardization of herbal drugs.
- Carry out phytochemical screening, monograph analysis, and estimation of essential constituents from plant extracts.
- Develop formulations of herbal dosage forms and evaluate their quality.
- Demonstrate competence in extraction techniques and structural interpretation of natural products.

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to :	CL
1	Spectral and Chromatographic Analysis: Perform analysis of phytoconstituents using UV-Vis spectroscopy, interpret spectra of simple plant compounds, and demonstrate fingerprint development through TLC/HPTLC techniques.	Ap
2	Instrumental Techniques in Phytochemical Estimation: Operate and apply advanced techniques such as gas chromatography, flame photometry, and HPLC for the identification and estimation of bioactive constituents in herbal drugs.	Ap
3	Extraction and Phytochemical Screening: Demonstrate proficiency in extraction methods and perform systematic phytochemical screening to identify major groups of phytoconstituents.	U
4	Monograph Analysis and Quality Evaluation: Carry out monograph-based analysis of natural products such as clove oil and castor oil and understand their standardization parameters.	An
5	Herbal Formulation and Standardization: Formulate herbal dosage forms and perform standardization and identification of bioactive constituents from plant extracts.	U

CL: Cognitive Levels (**R**-Remember; **U**-Understanding; **Ap**-Apply; **An**-Analyze; **E**-Evaluate; **C**-Create).

CO-PO/PSO Mapping for the course:

PO / CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	2	3	2	2	3	3	3	2	3	2	3	2	2	2	3
CO2	3	3	3	2	2	2	3	2	3	3	3	3	2	2	2	3
CO3	3	2	3	3	2	1	3	1	2	3	2	3	3	3	2	3
CO4	3	2	3	3	2	1	3	1	2	3	2	3	3	2	2	2
CO5	3	2	3	3	2	1	3	1	2	3	2	3	3	3	2	3

"3" – Strong; "2" – Moderate; "1"- Low; "-" No Correlation

Detailed Syllabus:

LIST OF PRACTICALS

1. Analysis of pharmacopoeial compounds and their formulations by UV Vis spectrophotometer
2. Simultaneous estimation of multi component containing formulations by UV spectrophotometry
3. Experiments based on HPLC
4. Experiments based on Gas Chromatography
5. Estimation of riboflavin/quinine sulphate by fluorimetry
6. Estimation of sodium/potassium by flame photometry
7. 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.
8. Methods of extraction
9. Phytochemical screening
10. Demonstration of HPLC- estimation of glycerrhizin
11. Monograph analysis of clove oil
12. Monograph analysis of castor oil.
13. Identification of bioactive constituents from plant extracts
14. Formulation of different dosage forms and their standardisation.

Semester-II

Program	Subject	Year	Semester
M. Pharm.	Pharmacognosy	1	I
Course Code	**Course Title**		**Course Type**
MPG 201T	MEDICINAL PLANT BIOTECHNOLOGY		Core
Credit	**Hours Per Week (L-T-P)**		
	L	**T**	**P**
4	3	1	--

Maximum Marks	CIA	ESE
100	25	75

Learning Objective (LO):
To explore the knowledge of Biotechnology and its application in the improvement of quality of medicinal plants

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to :	CL
1	Explain the historical evolution, basic concepts, and applications of plant biotechnology in pharmaceutical and allied fields.	Ap
2	Demonstrate various plant tissue culture techniques such as organogenesis, micropropagation, protoplast fusion, and evaluate their significance in propagation and secondary metabolite production.	Ap
3	Analyze plant cell immobilization, cloning methods, and secondary metabolism for the production of medicinal compounds.	U
4	Illustrate biotransformation processes, transgenic plant development, and assess the use of molecular tools like PCR and gene sequencing in plant biotechnology.	An
5	Summarize the role of fermentation technology in the production of pharmacologically important compounds like ergot alkaloids, enzymes, and SCPs.	U

CL: Cognitive Levels (**R**-Remember; **U**-Understanding; **Ap**-Apply; **An**-Analyze; **E**-Evaluate; **C**-Create).

CO-PO/PSO Mapping for the course:

PO / CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	3	2	3	2	1	3	1	2	3	2	3	3	3	2	2
CO2	3	3	3	3	2	2	3	2	2	3	2	3	3	3	3	3
CO3	3	2	3	3	2	2	3	1	1	3	2	3	3	3	2	3
CO4	3	3	3	3	2	1	3	2	2	3	3	3	3	3	2	3
CO5	3	2	3	3	1	1	3	2	2	3	2	3	3	2	1	3

"3" – Strong; "2" – Moderate; "1"- Low; "-" No Correlation

Detailed Syllabus:

Unit No.	Topics	No. of Lectures	CO No.
I	**Introduction to Plant biotechnology:** Historical perspectives, 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.	12	1
II	**Different tissue culture techniques:** Organogenesis and 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.	12	2
III	**Immobilisation techniques and Secondary Metabolite 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.	12	3
IV	**Biotransformation and Transgenesis:** Biotransformation, bioreactors for pilot and large scale cultures of plant cells and retention of biosynthetic potential in cell culture. Transgenic plants, methods used in gene identification, localization and sequencing of genes. Application of PCR in plant genome analysis.	12	4
V	**Fermentation technology:** Application of Fermentation technology, Production of ergot alkaloids, single cell proteins, enzymes of pharmaceutical interest.	12	5

Books Recommended:

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, 3rd revised edition.
12. Biotechnological applications to tissue culture by Shargool, Peter D, Shargoal, CKC Press.
13. Pharmacognosy by Varo E. Tyler, Lynn R. Brady and James E. Robbenrt, That Tjen, NGO.
14. Plant Biotechnology, Ciddi Veerasham.

Semester-II

Program	Subject	Year	Semester
M. Pharm.	Pharmacognosy	I	I
Course Code	Course Title		Course Type
MPG 202T	ADVANCED PHARMACOGNOSY - II		Core
Credit	Hours Per Week (L-T-P)		
	L	T	P
4	3	1	--

Maximum Marks	CIA	ESE
100	25	75

Learning Objective (LO):

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

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to :	CL
1	Differentiate herbal remedies from conventional drugs and evaluate pharmacodynamic, pharmacokinetic, and regulatory aspects of herbal medicines.	Ap
2	Identify different types and causes of adulteration in herbal drugs and apply modern techniques such as DNA fingerprinting and contamination analysis for quality control.	Ap
3	Interpret the role of ethnobotany and ethnopharmacology in herbal drug development, and assess the impact of reverse pharmacology and bioprospecting in drug discovery.	U
4	Describe the analytical profiles of selected herbal drugs and recognize their pharmacognostic and phytochemical characteristics.	An
5	Demonstrate in vitro and in vivo screening methods for evaluating pharmacological activities of herbal drugs and interpret toxicity testing protocols as per OECD guidelines.	U

CL: Cognitive Levels (**R**-Remember; **U**-Understanding; **Ap**-Apply; **An**-Analyze; **E**-Evaluate; **C**-Create).

CO-PO/PSO Mapping for the course:

PO / CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	3	2	3	2	1	3	1	3	3	3	3	3	2	2	3
CO2	3	3	3	3	2	2	3	2	3	3	2	3	3	2	3	3
CO3	3	3	2	2	2	3	3	2	2	3	3	2	3	3	3	2
CO4	3	2	2	3	1	1	3	1	2	3	2	3	3	2	2	3
CO5	3	3	3	3	2	1	3	1	2	3	2	3	3	2	2	3

"3" – Strong; "2" – Moderate; "1"- Low; "-" No Correlation

Detailed Syllabus:

Unit No.	Topics	No. of Lectures	CO No.
I	**Herbal remedies – Toxicity and Regulations:** Herbals vs Conventional drugs, Efficacy of Herbal medicine products, Validation of herbal therapies, Pharmacodynamic and Pharmacokinetic issues	12	1
II	**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	2
III	**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	3
IV	**Analytical Profiles of herbal drugs:** Andrographis paniculata, Boswellia serata, Coleus forskholii, Curcuma longa, Embelica officinalis, Psoralea corylifolia.	12	4
V	**Biological screening of herbal drugs:** Introduction and Need for Phyto-Pharmacological Screening, New Strategies for evaluating 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.	12	5

Books Recommended:

1. Glimpses of Indian Ethano Pharmacology by P. Pushpangadam. Ulf Nyman. V.George Tropical Botanic Garden and 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 and Fetiger.
5. Modern Methods of Plant Analysis- Peach and M.V. Tracey, Vol. I and 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 and 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. Rangari, Part I and 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.

Semester-II

Program	Subject	Year	Semester
M. Pharm.	Pharmacognosy	1	I
Course Code	Course Title		Course Type
MPG 203T	INDIAN SYSTEMS OF MEDICINE		Core
Credit	Hours Per Week (L-T-P)		
	L	T	P
4	3	1	--

Maximum Marks	CIA	ESE
100	25	75

Learning Objective (LO):

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.

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to :	CL
1	Explain the fundamental concepts, principles, and different dosage forms of Ayurveda, Siddha, Unani, and Homeopathy systems of medicine along with their pharmacopoeial standards.	Ap
2	Describe the basic principles and practices of Naturopathy, Yoga, and Aromatherapy, and their therapeutic applications.	Ap
3	Demonstrate the formulation development techniques and standardization protocols for ISM formulations, including shelf life and stability studies.	U
4	Outline the components and objectives of Schedule T (GMP) for ISM, and evaluate quality assurance practices including GAP, GMP, and GLP in the ISM industry.	An
5	Summarize the regulatory framework for ISM including TKDL, Geographical Indication Bill, and key government bodies like CCRAS, CCRH, CCRU, and their role in safeguarding and promoting AYUSH systems.	U

CL: Cognitive Levels (**R**-Remember; **U**-Understanding; **Ap**-Apply; **An**-Analyze; **E**-Evaluate; **C**-Create).

CO-PO/PSO Mapping for the course:

PO / CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	2	2	2	2	3	2	1	3	3	3	3	2	3	2	2
CO2	2	2	2	1	3	3	3	2	2	2	3	2	2	2	3	2
CO3	3	3	3	3	2	2	3	2	2	3	3	3	3	3	3	3
CO4	3	3	3	3	2	2	3	2	3	3	2	3	3	2	2	3
CO5	3	2	2	2	2	3	2	3	3	3	3	2	2	3	3	3

"3" – Strong; "2" – Moderate; "1"- Low; "-" No Correlation

Detailed Syllabus:

Unit No.	Topics	No. of Lectures	CO No.
I	Fundamental concepts of Ayurveda, Siddha, Unani and Homoeopathy systems of medicine 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).	12	1
II	**Naturopathy, Yoga and Aromatherapy practices** 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 oil	12	2
III	**Formulation development of various systems of medicine** 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.	12	3
IV	**Schedule T** – Good Manufacturing Practice of Indian systems of medicine 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.	12	4
V	TKDL, Geographical indication Bill, Government bills in AYUSH, ISM, CCRAS, CCRS, CCRH, CCRU	12	5

Books Recommended:

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 and 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, Pulok 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.

Semester-II

Program	Subject	Year	Semester
M. Pharm.	Pharmacognosy	1	I
Course Code	Course Title		Course Type
MPG 204T	HERBAL COSMETICS		Core
Credit	Hours Per Week (L-T-P)		
	L	T	P
4	3	1	--

Maximum Marks	CIA	ESE
100	25	75

Learning Objective (LO):

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.

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to :	CL
1	Understand the fundamentals of herbal and natural cosmetics, including their classification, economic importance, and regulatory frameworks related to manufacturing, licensing, GMP, import-export, and penalties.	Ap
2	Identify and analyze commonly used herbal cosmetic raw materials such as preservatives, surfactants, humectants, oils, colors, and functional herbs; apply preformulation and compatibility studies to design effective herbal cosmetic formulations.	Ap
3	Explain the physiology and chemistry of skin, hair, scalp, lips, and nails, and demonstrate the preparation and standardization of various herbal cosmetic products including creams, lotions, powders, lipsticks, soaps, and baby products.	U
4	Develop and evaluate herbal and natural cosmeceuticals such as hair growth formulations, shampoos, conditioners, colorants, fairness creams, sunscreen preparations, moisturizers, and deodorants.	An
5	Perform quality control, analysis, and toxicity screening of herbal cosmetic products in accordance with the Drug and Cosmetics Act to ensure safety and efficacy.	U

CL: Cognitive Levels (**R**-Remember; **U**-Understanding; **Ap**-Apply; **An**-Analyze; **E**-Evaluate; **C**-Create).

CO-PO/PSO Mapping for the course:

PO / CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	2	2	2	2	3	2	3	3	3	3	2	2	2	2	3
CO2	3	3	3	3	2	2	2	2	2	3	2	3	3	2	2	3
CO3	3	3	3	3	3	2	2	2	2	3	3	3	3	2	2	3
CO4	3	2	3	3	3	2	2	2	2	3	3	3	3	2	2	3
CO5	3	3	3	3	2	2	2	2	3	3	3	3	3	2	2	3

"3" – Strong; "2" – Moderate; "1"- Low; "-" No Correlation

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Detailed Syllabus:

Unit No.	Topics	No. of Lectures	CO No.
I	**Introduction:** Herbal/natural cosmetics, Classification and Economic aspects. Regulatory Provisions relation to manufacture of cosmetics: - License, GMP, offences and Penalties, Import and Export of Herbal/natural cosmetics, Industries involved in the production of Herbal/natural cosmetics.	12	1
II	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	2
III	**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 : Tonic, Bleaches, Dentifrices and Mouth washes and Tooth Pastes, Cosmetics for Nails.	12	3
IV	**Cosmeceuticals of herbal and natural origin:** Hair growth formulations, Shampoos, Conditioners, Colorants and hair oils. Fairness formulations, vanishing and foundation creams, anti-sun burn preparations, moisturizing creams, deodorants.	12	4
V	Analysis of Cosmetics, Toxicity screening and test methods: Quality control and toxicity studies as per Drug and Cosmetics Act.	12	5

Books Recommended:

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 and 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. Aromatheraphy (A Complete Guide to the Healing Art), Sri Satguru Publications, New Delhi.
7. Chattopadhyay PK. Herbal Cosmetics and Ayurvedic Medicines (EOU), National Institute of Industrial Research, Delhi.
8. Balsam MS and Edward Sagarin. Cosmetics Science and Technology, Wiley Interscience, New York.

Semester-II

Program	Subject	Year	Semester
M. Pharm.	Pharmacognosy	1	I
Course Code	Course Title		Course Type
MPG 205P	HERBAL COSMETICS PRACTICALS		Core
Credit	Hours Per Week (L-T-P)		
	L	T	P
06	-	–	12

Maximum Marks	CIA	ESE
150	50	100

Learning Objective (LO):

- Develop hands-on skills in the isolation and quantitative estimation of nucleic acids and phytochemicals from herbal raw materials.
- Acquire practical knowledge in plant tissue culture techniques like callus and suspension culture establishment.
- Prepare, standardize, and evaluate various herbal cosmetic and pharmaceutical formulations using traditional and modern methods.
- Gain expertise in analytical techniques for phytochemical content estimation such as phenolics, alkaloids, flavonoids, and volatile oils.
- Understand quality control, standardization, and safety evaluation methods relevant to herbal cosmetics and formulations.**Course Outcomes (CO):**

CO No.	Expected Course Outcomes **At the end of the course, the students will be able to :**	CL
1	Perform isolation and quantitative estimation of nucleic acids, phenolics, alkaloids, flavonoids, and other phytochemicals from herbal materials.	Ap
2	Apply plant tissue culture techniques such as callus and suspension culture for the propagation and study of medicinal plants.	Ap
3	Prepare, standardize, and evaluate various herbal cosmetic formulations including lip balm, lipstick, creams, sunscreens, and hair care products.	U
4	Develop proficiency in preparing and standardizing dosage forms from Ayurvedic, Siddha, Homeopathy, and Unani formularies.	An
5	Conduct evaluation and quality control tests on herbal tablets, capsules, syrups, and cosmetic products to ensure safety and efficacy.	U

CL: Cognitive Levels (**R**-Remember; **U**-Understanding; **Ap**-Apply; **An**-Analyze; **E**-Evaluate; **C**-Create).

CO-PO/PSO Mapping for the course:

PO / CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	3	3	4	2	1	3	1	1	2	1	5	4	2	1	2
CO2	2	3	3	3	1	3	2	3	2	1	1	4	3	3	4	2
CO3	3	3	3	4	3	2	3	3	1	3	2	5	4	2	3	5
CO4	3	3	2	3	2	2	3	2	1	3	1	4	3	3	2	5
CO5	3	4	3	4	3	2	3	3	2	3	2	5	4	2	3	5

"3" – Strong; "2" – Moderate; "1"- Low; "-" No Correlation

Detailed Syllabus:

LIST OF PRACTICALS
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 and standardization of herbal cough syrup.

Semester-II

Program	Subject	Year	Semester
M. Pharm.	Pharmacognosy	I	II
Course Code	Course Title		Course Type
--	Seminar /Assignment		Core
Credit	Hours Per Week (L-T-P)		
	L	T	P
4	--	--	--

Maximum Marks	CIA	ESE
100	--	100

Learning Objective (LO):

The subject is designed to create an environment where teachers provide the students a critical eye and openness to fortify the presentation and academic writing skills of students in the field of Pharmaceutics and industrial pharmacy.

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to :	CL
1	Develop skills to gather, organize, deliver information, and defend a given topic in Pharmaceutics and industrial pharmacy.	Ap
2	Learn to organize complex concepts using audio-visual aids.	Ap
3	Acquire communication and presentation skills.	U
4	Effectively respond to questions raised by peers and stand scientific scrutiny.	An
5	Develop a write-up on the subject of seminar presentation and cultivate continuous learning.	U

CL: Cognitive Levels (**R**-Remember; **U**-Understanding; **Ap**-Apply; **An**-Analyze; **E**-Evaluate; **C**-Create).

CO-PO/PSO Mapping for the course:

PO-CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	3	2	2	2	2	3	3	2	2	2	3	2	2	2	2
CO2	3	3	3	2	2	2	2	3	2	2	2	2	2	2	2	2
CO3	3	3	3	3	2	2	2	3	3	3	3	3	2	2	2	2
CO4	3	3	3	3	2	3	3	3	3	3	3	3	3	2	2	2
CO5	3	3	3	2	3	3	2	2	2	2	3	3	3	3	3	2

"3" – Strong; "2" – Moderate; "1"- Low; "-" No Correlation

Semester-III

Program	Subject	Year	Semester
M. Pharm.	Pharmacognosy	I	I
Course Code	Course Title		Course Type
MRM 301T	Research Methodology and Biostatistics		Core
Credit	Hours Per Week (L-T-P)		
	L	T	P
4	4	-	--

Maximum Marks	CIA	ESE
100	25	75

Learning Objective (LO):

- Understand the fundamentals of research methodology including study designs, bias elimination, controls, and randomization techniques.
- Apply biostatistical methods for analyzing data, interpreting statistical tests, and understanding the role of sample size in research.
- Comprehend the ethical principles and dilemmas in medical research, including patient autonomy, informed consent, confidentiality, and conflicts of interest.
- Learn the CPCSEA guidelines for proper laboratory animal care and management in compliance with ethical and regulatory standards.
- Recognize the significance of the Declaration of Helsinki in framing ethical standards for medical research involving human subjects.

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to :	CL
1	Explain general research methodology, including study designs, bias elimination, controls, randomization, and blinding techniques.	Ap
2	Apply biostatistical concepts including sample size determination, parametric and non-parametric tests, and interpretation of results.	Ap
3	Discuss medical ethics principles, including autonomy, beneficence, informed consent, confidentiality, and ethical dilemmas.	U
4	Understand and implement CPCSEA guidelines for ethical treatment and management of laboratory animals in research facilities.	An
5	Describe the history, principles, and applications of the Declaration of Helsinki for ethical medical research.	U

CL: Cognitive Levels (**R**-Remember; **U**-Understanding; **Ap**-Apply; **An**-Analyze; **E**-Evaluate; **C**-Create).

CO-PO/PSO Mapping for the course:

PO / CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	4	4	3	3	2	1	3	1	1	2	1	2	2	2	1	2
CO2	4	4	4	5	2	1	4	1	1	2	1	3	4	2	1	3
CO3	3	4	4	2	4	3	3	2	4	3	3	2	2	3	1	2
CO4	3	3	3	2	2	2	2	2	4	2	1	4	2	3	5	3
CO5	3	3	3	2	2	2	3	2	5	2	2	3	3	3	2	3

"3" – Strong; "2" – Moderate; "1"- Low; "-" No Correlation

Detailed Syllabus:

Unit No.	Topics	No. of Lectures	CO No.
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.	4	1
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 (wilcoxan rank tests, analysis of variance, correlation, chi square test), null hypothesis, P values, degree of freedom, interpretation of P values.	4	2
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.	4	3
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.	4	4
V	**Declaration of Helsinki:** History, introduction, basic principles for all medical research, and additional principles for medical research combined with medical care.	4	5

Books Recommended:

1. Research Methodology: Methods and Techniques by C.R. Kothari
2. Biostatistics: A Foundation for Analysis in the Health Sciences by Wayne W. Daniel and Chad L. Cross
3. Statistical Methods for Practice and Research by Ajai S. Gaur and Sanjaya S. Gaur
4. Principles of Biomedical Ethics by Tom L. Beauchamp and James F. Childress
5. Medical Ethics: Accounts of Ground-Breaking Cases by Gregory Pence
6. Ethics and the Practice of Psychology by Gerald P. Koocher and Patricia Keith-Spiegel
7. Guide for the Care and Use of Laboratory Animals by Institute for Laboratory Animal Research (ILAR)
8. CPCSEA Guidelines on Laboratory Animal Facilities and Ethics
9. Declaration of Helsinki: Ethical Principles for Medical Research Involving Human Subjects

Semester-III

Program	Subject	Year	Semester
M. Pharm.	Pharmacognosy	2	III
Course Code	Course Title		Course Type
	JOURNAL CLUB		Core
Credit	Hours Per Week (L-T-P)		
	L	T	P
1	1	-	--

Maximum Marks	CIA	ESE
75	25	-

Learning Objective (LO):

The subject is designed to create an environment where students present a published research paper, and critically analyse it, that would enhance the communication, presentation and analytical skills of the students. This subject is designed to understand the advanced knowledge for research methodology, ethics in research, medical research, design, conduct and interpretation of results. This subject deals with principles of statistics and their applications in biostatistics involving parametric tests, non-parametric tests, correlation, regression, probability theory and statistical hypotheses.

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to :	CL
1	Organize and present complex research concepts effectively using audio-visual aids.	Ap
2	Develop strong communication and presentation skills in the context of scientific research.	Ap
3	Critically analyze published research papers and respond effectively to scientific queries and scrutiny	U
4	Understand and apply principles of research methodology, ethics, and biostatistics in research analysis.	An
5	Foster continuous self-learning and knowledge upgradation in advanced research techniques.	U

CL: Cognitive Levels (**R**-Remember; **U**-Understanding; **Ap**-Apply; **An**-Analyze; **E**-Evaluate; **C**-Create).

CO-PO/PSO Mapping for the course:

PO / CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	3	2	2	2	2	3	3	2	2	2	3	2	2	2	2
CO2	3	3	3	2	2	2	2	3	2	2	2	3	2	2	2	2
CO3	3	3	3	3	2	3	3	3	3	3	3	3	3	2	2	2
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	2	3	3	2	2	2	2	3	3	3	3	3	2

"3" – Strong; "2" – Moderate; "1"- Low; "-" No Correlation

Semester-III

Program	Subject	Year	Semester
M. Pharm.	Pharmacognosy	2	III
Course Code	Course Title		Course Type
	DISCUSSION / PRESENTATION (PROPOSAL PRESENTATION)		Core
Credit	Hours Per Week (L-T-P)		
	L	T	P
2	2	--	--

Maximum Marks	CIA	ESE
50	50	--

Learning Objective (LO):

The subject is designed to create an environment where students present a published research paper, and critically analyse it, that would enhance the communication, presentation and analytical skills of the students. This subject is designed to understand the advanced knowledge for research methodology, ethics in research, medical research, design, conduct and interpretation of results. This subject deals with principles of statistics and their applications in biostatistics involving parametric tests, non-parametric tests, correlation, regression, probability theory and statistical hypotheses.

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to :	CL
1	Understand the significance of clear vision and well-defined objectives in pharmaceutical research	Ap
2	Identify and analyze the key components of vision and objectives statements in research proposals.	Ap
3	Develop a comprehensive and coherent vision and objectives statement for pharmaceutical research projects.	U
4	Enhance scientific communication and presentation skills through proposal and final presentations.	An
5	Critically evaluate peer presentations and provide constructive feedback to improve research quality.	U

CL: Cognitive Levels (**R**-Remember; **U**-Understanding; **Ap**-Apply; **An**-Analyze; **E**-Evaluate; **C**-Create).

CO-PO/PSO Mapping for the course:

PO / CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	2	2	2	1	2	1	1	1	1	1	3	2	1	2	2
CO2	3	3	2	2	1	2	2	2	1	1	1	3	2	1	2	2
CO3	3	3	3	3	2	3	2	2	2	2	2	3	3	2	3	3
CO4	3	3	3	2	2	2	2	3	2	2	2	3	2	2	2	2
CO5	3	3	3	3	2	3	3	3	3	2	2	3	3	3	3	3

"3" – Strong; "2" – Moderate; "1"- Low; "-" No Correlation

Semester-III

Program	Subject	Year	Semester
M. Pharm.	Pharmacognosy	2	III
Course Code	Course Title		Course Type
	RESEARCH WORK		Core
Credit	Hours Per Week (L-T-P)		
	L	T	P
14	--	–	28

Maximum Marks	CIA	ESE
350	--	350

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to :	CL
1	Design, conduct, and analyze original pharmaceutical research to contribute to the advancement of knowledge in pharmacy	Ap
2	Apply theoretical and practical knowledge to solve real-world pharmaceutical problems, develop research hypotheses, and critically evaluate scientific literature	Ap
3	Develop research skills including study design, data collection, analysis, interpretation, and prepare scientific manuscripts and presentations	U
4	Demonstrate expertise in a specific pharmacy area and innovate new methodologies or technologies to improve pharmaceutical practice and patient care.	An
5	Effectively communicate and present research findings through scientific writing, posters, and oral presentations to prepare for research and academic careers.	U

CL: Cognitive Levels (**R**-Remember; **U**-Understanding; **Ap**-Apply; **An**-Analyze; **E**-Evaluate; **C**-Create).

CO-PO/PSO Mapping for the course:

PO / CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	3	3	3	2	3	2	2	2	2	2	3	3	2	3	3
CO2	3	3	3	2	2	3	2	2	2	2	2	3	3	2	3	2
CO3	3	3	3	3	3	3	3	2	2	2	2	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO6	3	3	3	3	3	3	2	3	3	3	3	3	3	3	3	3

"3" – Strong; "2" – Moderate; "1"- Low; "-" No Correlation

Semester- IV

Program	Subject	Year	Semester
M. Pharm.	Pharmacognosy	2	III
Course Code	Course Title		Course Type
	DISCUSSION / PRESENTATION (PROPOSAL PRESENTATION)		Core
Credit	Hours Per Week (L-T-P)		
	L	T	P
2	2	–	--

Maximum Marks	CIA	ESE
75	75	--

Learning Objective (LO):

The subject is designed to create an environment where students present a published research paper, and critically analyse it, that would enhance the communication, presentation and analytical skills of the students. This subject is designed to understand the advanced knowledge for research methodology, ethics in research, medical research, design, conduct and interpretation of results. This subject deals with principles of statistics and their applications in biostatistics involving parametric tests, non-parametric tests, correlation, regression, probability theory and statistical hypotheses.

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to :	CL
1	Understand the significance of clear vision and well-defined objectives in pharmaceutical research	Ap
2	Identify and analyze the key components of vision and objectives statements in research proposals.	Ap
3	Develop a comprehensive and coherent vision and objectives statement for pharmaceutical research projects.	U
4	Enhance scientific communication and presentation skills through proposal and final presentations.	An
5	Critically evaluate peer presentations and provide constructive feedback to improve research quality.	U

CL: Cognitive Levels (**R**-Remember; **U**-Understanding; **Ap**-Apply; **An**-Analyze; **E**-Evaluate; **C**-Create).

CO-PO/PSO Mapping for the course:

PO / CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	2	2	2	1	2	1	1	1	1	1	3	2	1	2	2
CO2	3	3	2	2	1	2	2	2	1	1	1	3	2	1	2	2
CO3	3	3	3	3	2	3	2	2	2	2	2	3	3	2	3	3
CO4	3	3	3	2	2	2	2	3	2	2	2	3	2	2	2	2
CO5	3	3	3	3	2	3	3	3	3	2	2	3	3	3	3	3

"3" – Strong; "2" – Moderate; "1"- Low; "-" No Correlation

Semester-IV

Program	Subject	Year	Semester
M. Pharm.	Pharmacognosy	2	III
Course Code	Course Title		Course Type
	RESEARCH WORK		Core
Credit	Hours Per Week (L-T-P)		
	L	T	P
31	--	--	16

Maximum Marks	CIA	ESE
400	--	400

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to :	CL
1	Design, conduct, and analyze original pharmaceutical research to contribute to the advancement of knowledge in pharmacy	Ap
2	Apply theoretical and practical knowledge to solve real-world pharmaceutical problems, develop research hypotheses, and critically evaluate scientific literature	Ap
3	Develop research skills including study design, data collection, analysis, interpretation, and prepare scientific manuscripts and presentations	U
4	Demonstrate expertise in a specific pharmacy area and innovate new methodologies or technologies to improve pharmaceutical practice and patient care.	An
5	Effectively communicate and present research findings through scientific writing, posters, and oral presentations to prepare for research and academic careers.	U

CL: Cognitive Levels (**R**-Remember; **U**-Understanding; **Ap**-Apply; **An**-Analyze; **E**-Evaluate; **C**-Create).

CO-PO/PSO Mapping for the course:

PO / CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	3	3	3	2	3	2	2	2	2	2	3	3	2	3	3
CO2	3	3	3	2	2	3	2	2	2	2	2	3	3	2	3	2
CO3	3	3	3	3	3	3	3	2	2	2	2	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	2	3	3	3	3	3	3	3	3	3

"3" – Strong; "2" – Moderate; "1"- Low; "-" No Correlation

Semester wise credits distribution

Semester	Credit Points
I	26
II	26
III	21
IV	20
Co-curricular Activities (Attending Conference, Scientific Presentations andOther Scholarly Activities)	Minimum=02 Maximum=07*
Total Credit Points	Minimum=95 Maximum=100*

*Credit Points for Co-curricular Activities

Guidelines for Awarding Credit Points for Co-curricular Activities

Name of the Activity	Maximum Credit Points Eligible / Activity
Participation in National Level Seminar/Conference/Workshop/Symposium/ Training Programs (related to the specialization of the student)	01
Participation in International Level Seminar/ Conference/Workshop/Symposium/ Training Programs (related to the specialization of the student)	02
Academic Award/Research Award from State Level/National Agencies	01
Academic Award/Research Award from International Agencies	02
Research / Review Publication in National Journals (Indexed in Scopus / Web of Science)	01
Research / Review Publication in International Journals (Indexed in Scopus / Web of Science)	02

Note: International Conference: Held Outside India
International Journal: The Editorial Board Outside India

*The credit points assigned for extracurricular and or co-curricular activities shallbe given by the Principals of the colleges and the same shall be submitted to the University. The criteria to acquire this credit point shall be defined by the colleges from time to time.