

IKG PUNJAB TECHNICAL UNIVERSITY, JALANDHAR
M. Pharm. (PHARMACOGNOSY)
Scheme and Syllabus

FIRST SEMESTER

| S. No. | Subject Code | Subject Title | Teaching Load Allocation | | | Marks Distribution | | | Exam. (hr) | Credit |
|--------|--------------|---------------------------------|--------------------------|-----------|-----------|--------------------|------------|------------|------------|-----------|
| | | | L | T | P | Int | Ext | Total | | |
| 01 | PHCOG 131 | Cultivation of Medicinal Plants | 4 | 1 | - | 20 | 80 | 100 | 3 | 5 |
| 02 | PHCOG 133 | Modern Analytical Techniques | 4 | 1 | - | 20 | 80 | 100 | 3 | 5 |
| 03 | PHCOG 135 | Plant Drug Standardization | 4 | 1 | - | 20 | 80 | 100 | 3 | 5 |
| 04 | PHCOG 137 | Pharmacognosy Laboratory -I | - | | 14 | 20 | 80 | 100 | 8 | 7 |
| | | Total | 12 | 03 | 14 | 80 | 320 | 400 | | 22 |

SECOND SEMESTER

| S. No. | Subject Code | Subject Title | Teaching Load Allocation | | | Marks Distribution | | | Exam. (hr) | Credit |
|--------|--------------|-------------------------------|--------------------------|-----------|-----------|--------------------|------------|------------|------------|-----------|
| | | | L | T | P | Int | Ext | Total | | |
| 01 | PHCOG 132 | Phytochemistry and Biogenesis | 4 | 1 | - | 20 | 80 | 100 | 3 | 5 |
| 02 | PHCOG 134 | Plant Biotechnology | 4 | 1 | - | 20 | 80 | 100 | 3 | 5 |
| 03 | PHCOG 136 | Advances in Pharmacognosy | 4 | 1 | - | 20 | 80 | 100 | 3 | 5 |
| 04 | PHCOG 138 | Pharmacognosy Laboratory - II | - | | 14 | 20 | 80 | 100 | 8 | 7 |
| | | Total | 12 | 03 | 14 | 80 | 320 | 400 | | 22 |

THIRD AND FOURTH SEMESTER [Credits 12+12=24]

Research Work for one year

The thesis shall be presented by the candidate at the end of record academic year. The thesis shall be evaluated as under

Evaluation of written thesis : 200

Presentation of seminar on thesis and viva-voce : 100

Total : 300

[Note: L- Lecture – Tutorial, P – Practical]

M. PHARM. SEMESTER-I

| S. No | Subject Code | Subject Title | Teaching Load Allocation | | | Marks Distribution | | | Credit |
|-------|--------------|---------------------------------|--------------------------|---|---|--------------------|-----|-------|--------|
| | | | L | T | P | Int | Ext | Total | |
| 01 | PHCOG 131 | Cultivation of Medicinal Plants | 4 | 1 | - | 20 | 80 | 100 | 5 |

Module 01

Production and management of medicinal plants at farms: Preparation of soil for sowing, Depth of sowing, Method of Digging, Preparation of Beds, Type of Beds, Seeds and sowing (Germination, vigour viability, longevity, Dormancy), Sowing techniques, Planting techniques for field crops.

Module 02

Cultivation of medicinal plants : Definition, Eco-friendly farming, Organic farming, Biological farming, Nature farming, Alternate agriculture

Module 03

Ecological agriculture, Objective of ecological farming; Good agricultural and harvesting practice. Biodynamic Agriculture: Basic standards and general principles for organic agriculture. Important tips for cultivation of medicinal plants.

Module 04 and 05

Diseases of medicinal plants with special reference to *Belladonna*, *Cinchona*, *Digitalis*, *Dioscorea*, *Datura*, *Ginseng*, *Glycyrrhiza*, *Periwinkle*, *Plantago*, *Podophyllum*, *Rauwolfia*, *Senna* and *Withania*

Module 06

Pest and Pest management in medicinal plants with emphasis on Biopesticides. Cultivation methods developed in India for the following plants and commercial significance: *Ginseng*, *Podophyllum*, *Withania*, *Senna*, *Andrographis*, *Periwinkle*, *Glycyrrhiza* and *Mentha*.

Reading Material Recommended

1. W.C.Evans, Trease and Evans Pharmacognosy, 15th edition, W.B. Saunders & Co., London, 2002.
2. Tyler, V.E., Brady, L.R. and Robbers, J.E., Pharmacognosy, 9th Edn., Lea and Febiger, Philadelphia, 1988.
3. J. Reinert and Y.P.S Bajaj, Applied and Fundamental Aspects of Plant Cell, Tissue and Organ Culture, Narora Publishing House, New Delhi, 1998.
4. S. S. Purohit and S. B. Vyas, Medicinal plant cultivation (A Scientific approach), Agrobios, Jodhpur, 2004
5. N.J.Walton and D.E.Brown, Chemicals from Plants, Imperial College Press, London

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| 02 | PHCOG 133 | Modern Analytical Techniques | 4 | 1 | - | 20 | 80 | 100 | 5 |

Module 01

Ultraviolet and Visible Spectroscopy: Introduction, Energy levels and selection rules, Woodward-Fieser, Fieser-Kuhn and Nelson rules; Influence of substituents, ring size, solvent and conjugation on max. Methodology; spectral correlation with structure, conjugated dienes and polyenes, unsaturated carbonyl compounds; benzene, substituted benzenes and polynuclear aromatic hydrocarbons.

Module 02

Infrared Spectroscopy: Introduction, Types of vibrations, Characteristic regions of the spectrum; influence of substituents, ring size, hydrogen bonding, vibrational coupling and field effect on frequency; Methodology; Spectral interpretation with examples.

Module 03

Nuclear magnetic Resonance Spectroscopy : ^1H NMR spectroscopy: Introduction, magnetic nuclei, chemical shifts, shielding and deshielding, relaxation process, chemical and magnetic non-equivalence, local diamagnetic shielding and magnetic non-equivalence, spin –spin splitting, Pascal's triangle, coupling constant, mechanism of coupling quadrupole broadening and decoupling; Effect of stereochemistry on the spectrum; Application of ^1H NMR with examples.

Module 04

^{13}C -NMR spectroscopy: Natural abundance of ^{13}C , resolution and multiplicity. The FT mode and RF pulse. Use of proton coupled, proton decoupled and off resonance decoupling techniques.

Module 05

Chromatography: General principle, separation mechanisms and applications of chromatographic techniques such as gas chromatography, HPLC, HPTLC.

Chromatography: MPLC, OPLC, Flash, counter- current chromatography and super critical fluid chromatography.

Module 06

Mass Spectrometry : Introduction, mass spectrum and metastable ion peak, Determination of molecular formula. Recognition of molecular ion peak and the nitrogen rule. General rules of fragmentation, retro Diels –Alder reaction and the McLafferty re-arrangement. Fragmentations associated with functional groups: aliphatic, aromatic and aralkyl hydrocarbons, alcohols, phenols, ethers; aldehydes, ketones, carboxylic acids and esters; amines and amides, alkylhalides and aralkylhalides. Heteroaromatic compound. Hyphenated techniques: Principle and applications of

GC -MS, LC -MS and LC- NMR techniques

Reading Material Recommended

1. William Kemp, Organic Spectroscopy, 3rd edition, ELBS, Mac Millan, Hampshire, U.K., 1991.
2. D.H. Williams and I. Fleming, Spectroscopic Methods in Organic Chemistry, Tata Mc Graw-Hill Publishing Company Ltd., New Delhi, India, 1993.
3. R.M. Silverstein, G.C. Bassler and T.C. Morrill, Spectrometric Identification of Organic Compounds, 5th edition, John Wiley and Sons Inc., New York, U.S.A., 1991.
4. F.A. Bovey, Nuclear Magnetic Resonance Spectroscopy, 2nd Edition, Academic Press Inc., New York, U.S.A. 1988.
5. Egon Stahl, Thin Layer chromatography -A laboratory handbook, Springer-Verlag, Berlin.
6. I.L.Finar, Organic chemistry, Vol 2, The English language book society and Longman group limited, U.K.
7. P.D. Sethi, High performance liquid chromatography, CBS publishing House, New Delhi.

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| 03 | PHCOG 135 | Plant Drug Standardization | 4 | 1 | - | 20 | 80 | 100 | 5 |

Module 01

Concept of standardization of plant drugs. Organoleptic evaluation of drugs: Including Gross morphology, sampling, Preliminary examination and foreign matter.

Module 02

Microscopic evaluation of plant drugs: Quantitative microscopy, vein islet number, vein termination number, stomatal number, stomatal index, palisade ratio and number of sclerenchyma.

Module 03

Micrometry, measurement of fibers, trichomes, starch grains and calcium oxalate crystals. Lycopodium spore

analysis. Fluorescence analysis

Physical evaluation of plant drug: Determination of moisture content, foreign organic matter, ash values, extractive values and swelling index. Refractive index, optical rotation and their applications in standardization of plant drugs.

Module 04

Phytochemical evaluation of plant drug: General methods of assays for alkaloids, steroids, terpenoids

Module 05

Phytochemical evaluation of plant drug: General methods of assays for flavonoids, glycosides, tannins and coumarins

Module 06

Fingerprint profiling of crude drugs and single and multicomponent herbal preparation. Stability testing of natural products

Reading Material Recommended

1. W.C.Evans, Trease and Evans Pharmacognosy, 15th edition, W.B. Saunders & Co., London, 2002.
2. Guidelines for the Assessment of herbal medicines-WHO Report, Geneva, 1991,
3. Quality Control Methods for Medicinal Plant material, WHO/Pharm/1992, 559/rev, pp. 1-84.
4. Pharmacopoeia of India, Govt. of India, Ministry of Health and family welfare, Delhi, 1996.
5. A.N. Kalia, Textbook of Industrial Pharmacognosy, CBS Publishers, New Delhi, 2005.

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| 04 | PHCOG 137 | Pharmacognosy Laboratory-I | - | | 14 | 20 | 80 | 100 | 7 |

1. Qualitative and Quantitative Microscopic Examination :
2. Microscopic evaluation of powdered drugs and their mixtures with adulterants.
3. Spectral Workshop: Workshop involving interpretation of IR, NMR and Mass Spectra of organic compounds to elucidate their chemical structure.
4. Exercises based on standardization and quality control of plant drugs.
5. Quantitative Estimation of Phytoconstituents :
6. Determination of phytoconstituents in crude drugs and commercial herbal formulations. Pharmacopoeial evaluation of natural products.
7. Determination of ash values, extractive values, swelling index and foaming index of crude drugs as per WHO Geneva Guidelines.
8. Quantitative estimation of phytoconstituents based on theory by chemical and spectrophotometric method.
9. Preparation of detailed monograph of at least one medicinal plant covering Taxonomy, Phytochemistry and Pharmacological investigation with its use in traditional system of medicine.
10. Some basic experiments on plant tissue culture.

M. PHARM. SEMESTER-II

| S. No | Subject Code | Subject Title | Teaching Load Allocation | | | Marks Distribution | | | Credit |
|-------|--------------|-------------------------------|--------------------------|---|---|--------------------|-----|-------|--------|
| | | | L | T | P | Int | Ext | Total | |
| 01 | PHCOG 132 | Phytochemistry and Biogenesis | 4 | 1 | - | 20 | 80 | 100 | 5 |

Module 01

Biogenetic pathways for the production of Phytopharmaceuticals: such as alkaloids (*Ephedrine, Atropine, Quinine, Morphine, Papavarine, Vincristine*),

Module 02

Biogenetic pathways for the production of Phytopharmaceuticals: such as *Glycoside, Anthraquinones, Coumarins, Flavonoids, Terpenoids and Carotenoids*.

Module 03

General methods of phytochemical screening, isolation and purification.

Module 04

Brief concept on biological screening of natural products: with special reference to anti-inflammatory, hepatoprotective, antidiabetic and antihyperlipidemic.

Module 05

Principles of chemotaxonomy, role of secondary metabolites in chemotaxonomy. Relationship between phytochemistry and taxonomy.

Module 06

Phytopharmaceuticals: Isolation, purification and potentials of Artemisinin, Paclitaxel, Podophyllotoxins and Ginkgolides

Isolation, chemistry and uses of essential oils and related products of plant origin in perfume Industry.

Reading Material Recommended

1. W.C. Evans, Trease and Evans Pharmacognosy, 15th edition, W.B. Saunders & Co., London, 2002.
2. Tyler, V.E., Brady, L.R. and Robbers, J.E., Pharmacognosy, 9th Edn., Lea and Febiger, Philadelphia, 1988.
3. Nakanishi K, Chemistry of Natural Products, Kodansha Book Publishing Company, Osaka, Japan
4. Jonne Bernes, Herbal medicines, Pharmaceutical press, London
5. Kaufmann, Natural Products from Plants, CRC Press, New York.
6. R.J.P. Cannell, Natural Products Isolation, Humana Press, New Jersey.

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| 02 | PHCOG 134 | Plant Biotechnology | 4 | 1 | - | 20 | 80 | 100 | 5 |

Module 01

Plant Biotechnology: Introduction and brief history, Tools of Biotechnology. Plant Biotechnology: Impact of Biotechnology on pharmaceutical industry, Biotechnology in drug discovery.

Module 02 and 03

Pharmacognostic aspects of tissue culture: Brief introduction to types, techniques, nutritional requirements and growth of plant tissue culture. Micropropagation of medicinal plants.

Secondary metabolites in tissue culture: Production of medicinal agents in tissue culture, screening and selection of high yielding cell lines.

Secondary metabolites in tissue culture: Effect of environmental factors, precursors and elicitors on production of biomedicinals.

Module 04 and 05

Plant cell culture systems: Biotransformation, bioreactors for pilot and large scale culture of plant cells, cellular totipotency cryopreservation and retention of biosynthetic potential in cell cultures.

Plant cell culture systems: immobilization techniques, Effect of immobilization on secondary metabolism and realization of chemosynthetic potential in Immobilize cells.

Module 06

Plant cell culture systems: Hairy root and multiple shoot cultures and their applications in industrially potential cell systems of different types; Plant regeneration: Morphogenesis and its biotechnological utilization

Reading Material Recommended

1. W.C. Evans, Trease and Evans, Pharmacognosy, 15th edition, W.B. Saunders & Co., London, 2002.
2. Tyler, V.E., Brady, L.R. and Robbers, J.E., Pharmacognosy, 9th Edn., Lea and Febiger, Philadelphia, 1988.
3. H.E. Street, Plant Tissue and Cell Culture, Blackwell Scientific Publication, London, 1977.
4. A.N. Kalia, Textbook of Industrial Pharmacognosy, CBS Publishers, New Delhi
5. Margaret L, Vickery and Brian Vickery, Secondary Plant Metabolism, The Macmillan Press Ltd, London, 1981.
6. R Endress, Plant cell Biotechnology, Springer-Verlag, Berlin, 1994.

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| 03 | PHCOG 136 | Advances in Pharmacognosy | 4 | 1 | - | 20 | 80 | 100 | 5 |

Module 01

Drug discovery and development from natural products with special emphasis on drugs derived from atropine, morphine, quinine, cocaine, podophyllotoxin and paclitaxel

Module 02

Pharmacognostic characteristics, chemical constituents and pharmacological basis of therapeutic uses of the Hepatoprotective plants-*Andrographis paniculata*, *Glycyrrhiza glabra*, *Picrorrhiza kurroa*, *Silybum marianum* and *Swertia chirata*.

Pharmacognostic characteristics, chemical constituents and pharmacological basis of therapeutic uses of the Anti inflammatory plants- *Aesculus hippocastanum*, *Boswellia serrata*, *Commiphora mukul*, *Curcuma longa*, *Pluchea lanceolata* and *Vitex negundo*.

Module 03

Pharmacognostic characteristics, chemical constituents and pharmacological basis of therapeutic uses of the Antidiabetic plants- *Allium cepa*, *Azadirachta indica*, *Cyamopsis tetragonolobus*, *Gymnema sylvestris*, *Momordica charantia*, *Pterocarpus marsupium*, *Syzygium cuminii* and *Trigonella foenum graecum*.

Module 04

Pharmacognostic characteristics, chemical constituents and pharmacological basis of therapeutic uses of the Plants used in cardiovascular disorders- *Digitalis*, *Coleus forskohli*, *Garcinia cambogia*, *Terminalia arjuna*, *Thevetia nerrifolia*, *Viscum album*, *Veratrum* and *Allium sp*.

Module 05

Pharmacognostic characteristics, chemical constituents and pharmacological basis of therapeutic uses of the Antiviral plants- *Echinaceae purpurea*, *Sambucus nigra*, *Saponaria officinalis*, *Rhizophora species* and *Thuja occidentalis*

Anticancer drugs-*Camptotheca acuminata*, *Catharanthus roseus*, *Podophyllum species* and *Taxus species*

Module 06

Pharmacognostic characteristics, chemical constituents and pharmacological basis of therapeutic uses of the Plants used as adaptogens and immunomodulators-*Allium sativum* *Asparagus racemosus*, *Ganoderma species*, *Ocimum sanctum*, *Panax ginseng*, *Phyllanthus emblica*, *Tinospora cordifolia* and *Withania somnifera*.

Reading Material Recommended

1. W.C. Evans, Trease and Evans Pharmacognosy, 15th edition, W.B. Saunders &Co., London, 2002.
2. S.S. Handa and M.L. Kaul, Supplement to cultivation and utilization of medicinal plants, R.R.L Jammu, India, 1996.
3. Ram P Rastogi, Compendium of Indian Medicinal Plants Vol. I-V, CSIR, Lucknow & NISCOM, New Delhi, 1998.
4. T. Fleming, PDR for Herbal Medicine, 2nd edition Medical Economics compant, Mountvale, New Jersy, 2000.
5. M.J. Cupp, Toxicology and Clinical Pharmacology of Herbal Products, Humana Press, New Jersy, 2000.

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| 04 | PHCOG 138 | Pharmacognosy Laboratory -II | - | - | 14 | 20 | 80 | 100 | 7 |

1. Isolation and Chemical Evaluation of Phytochemical Constituents : Isolation of various phytoconstituents like curcumin, piperine, caffeine, hesperidin, berberine, vasicine, glycyrrhizin and sennosides.
2. Physico-chemical evaluation and TLC profiles of various isolated phytochemical constituents.
3. Chromatographic Techniques: Exercises based on paper, thin layer, column chromatography and HPLC.
4. Separation of solanaceous alkaloids from Datura/Belladonna by column using Alumina as adsorbent and identification by TLC
5. Formulation of herbal cosmetics (Shampoo and Cream)

M. PHARM. SEMESTER-III and IV [Credits 12+12=24]

Research Work

The thesis shall be presented by the candidate at the end of record academic year. The thesis shall be evaluated as under:

Evaluation of written thesis : MM 200

Presentation of seminar on thesis : MM 100

and viva-voce

Total : 300 marks