Punjab Technical University, Jalandhar
M.Pharm Pharmacognosy
Scheme of syllabi

Semester I

Course code	Subject	Examination hours	Maximum marks	
			Int.	Ext.
PHCOG 511	Cultivation of Medicinal Plants	3	20	80
PHCOG 513	Modern Analytical Techniques	3	20	80
PHCOG 515	Plant Drug Standardisation	3	20	80
PHCOG 517	Pharmacognosy Laboratory- I	12	20	80
Total			80	320

Semester II

Course code	Subject	Examination hours	Maximum marks	
			Int.	Ext.
PHCOG 512	Phytochemistry and Biogenesis	3	20	80
PHCOG 514	Plant Biotechnology	3	20	80
PHCOG 516	Advances in Pharmacognosy	3	20	80
PHCOG 518	Pharmacognosy Laboratory -II	12	20	80
Total			80	320

3rd and 4th Semester

(Research work for one year)

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

Evaluation of written thesis — Maximum Marks: 200
Presentation of seminar on thesis work And viva vocel examination — Maximum Marks: 100

Total Marks: 300

PHCOG 511 Cultivation of Medicinal Plants

External Marks: 80 **4 Hrs/Week**
Internal Marks: 20
Total Marks: 100

1. **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.
2. **Cultivation of medicinal plants:**
   Definition, Eco-friendly farming, Organic farming, Biological farming, Nature farming, Alternate agriculture, Ecological agriculture, Objective of ecological farming.
3. **Biodynamic Agriculture:**
   Basic standards and general principles for organic agriculture. Important tips for cultivation of medicinal plants.
4. **Diseases of medicinal plants** with special reference to *Belladonna, Cinchona, Digitalis, Dioscorea, Datura, Ginseng, Glycyrrhiza, Periwinkle, Plantago, Podophyllum, Rauwolfia, Senna and Withania*
5. **Pest and Pest management in medicinal plants with emphasis on Biopesticides.**
6. **Good agricultural and harvesting practice.**
7. **Cultivation methods developed in India for the following plants and commercial significance:** *Ginseng, Podophyllum, Withania, Senna, Andrographis, Periwinkle, Glycyrrhiza* and *Mentha.*

Books Recommended:

1. W.C.Evans, Trease and Evans Pharmacognosy, 15th edition, W.B. Sounders & 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

PHCOG 513 Modern Analytical Techniques

External Marks: 80 **4 Hrs/Week**
Internal Marks: 20
Total Marks: 100
Spectral Analysis

1. 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 λmax. Methodology; spectral correlation with structure, conjugated dienes and polyenes, α, β- unsaturated carbonyl compounds; benzene, substituted benzenes and polynuclear aromatic hydrocarbons.

2. 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.

3. Nuclear magnetic Resonance Spectroscopy

3.1 ^{1}H 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 ^{1}H NMR with examples.

3.2 ^{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.

4 **Chromatography:**

General principle, separation mechanisms and applications of chromatographic techniques such as gas chromatography, HPLC, HPTLC, MPLC, OPLC, Flash, counter- current chromatography and super critical fluid chromatography

5 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 gropus: aliphatic, aromatic and aralkyl hydrocarbons, alcohols, phenols, ethers; aldehydes, ketones, carboxylic acids and esters; amines and amides, alkyhalides and aralkylhalides. Heteroaromatic compound.

6 Hyphenated techniques:

Principle and applications of GC -MS, LC -MS and LC- NMR techniques

Books 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.

PHCOG 515 Plant Drug Standardization

External Marks: 80 **4 Hrs/Week**
Internal Marks: 20
Total Marks: 100

1. **Concept of standardization of plant drugs**.

1.1 **Organoleptic evaluation** of drugs including Gross morphology, sampling, Preliminary examination and foreign matter.

1.2 **Microscopic evaluation of plant drugs:** Quantitative microscopy, vein islet number, vein termination number, stomatal number, stomatal index, palisade ratio and number of sclerenchyma. Micrometry, measurement of fibers, trichomes, starch grains and calcium oxalate crystals. Lycopodium spore analysis. Fluorescence analysis

1.3 **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.

1.4 Phytochemical evaluation of plant drug: General methods of assays for alkaloids, steroids, terpenoids, flavonoids, glycosides, tannins and coumarins.
Fingerprint profiling of crude drugs and single and multicomponent herbal preparation.
Stability testing of natural products

Books Recommended:

1. W.C.Evans, Trease and Evans Pharmacognosy, 15th edition, W.B. Sounders & 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.

PHCOG 517 Pharmacognosy Laboratory -I

External Marks: 80 **16 Hrs/Week**
Internal Marks: 20
Total Marks: 100

1. **Qualitative and Quantitative Microscopic Examination**: Microscopic evaluation of powdered drugs and their mixtures with adulterants.

2. **Spectral Workshop**: Workshop involving interpretation of IR, NMR and Mass Spectra of organic compounds to elucidate their chemical structure.

3. **Exercises based on standardization and quality control of plant drugs.**

4. **Quantitative Estimation of Phytoconstituents** : Determination of phytoconstituents in crude drugs and commercial herbal formulations. Pharmacopoeial evaluation of natural products.

5. Determination of ash values, extractive values, swelling index and foaming index of crude drugs as per WHO Geneva Guidelines.

6. Quantitative estimation of phytoconstituents based on theory by chemical and spectrophotometric method.

7. Preparation of detailed monograph of atleast one medicinal plant covering Taxonomy, Phytochemistry and Pharmacological investigation with its use in traditional system of medicine.

8. Some basic experiments on plant tissue culture.

PHCOG 512 Phytochemistry and Biogenesis

External Marks: 80 **4 Hrs/Week**
Internal Marks: 20
Total Marks: 100

1. Biogenetic pathways for the production of Phytopharmaceuticals such as Alkaloids (*Ephedrine, Tropane Alkaloids, Quinine, Morphine, Papavarine Vincristine), Glycosides (Cardiac, anthraquinone, Saponin, Coumarin and Flavone) Terpenoids and Carotenoids.*

2. General methods of phytochemical screening, isolation and purification of plant constituents.

3. Brief concept on biological screening of natural products with special reference to anti-inflammatory, hepatoprotective, antidiabetic, antilipidemic and anticancer agents.

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

5. **Phytopharmaceticals:** Isolation, purification and potentials of Artemisinin, Taxol, Podophyllotoxins, Gingkolides, Ginsenosides.

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

Books Recommended:

1. W.C. Evans, Trease and Evans Pharmacognosy, 15th edition, W.B. Sounders & 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.

PHCOG 514 Plant Biotechnology

External Marks: 80 **4 Hrs/Week**
Internal Marks: 20
Total Marks: 100

1. **Plant Biotechnology**
   i. Introduction and brief history
   ii. Tools of Biotechnology
   iii. Impact of Biotechnology on pharmaceutical industry.
   iv. Biotechnology in drug discovery.
2. **Pharmacognostic aspects of tissue culture**
   Brief introduction to types, techniques, nutritional requirements and growth of plant tissue culture. Micropropogation of medicinal plants.
3. **Secondary metabolites in tissue culture:** Production of medicinal agents in tissue culture, screening and selection of high yielding cell lines. Effect of environmental factors, precursors and elicitors on production of biomedicinals
4. **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. Immobilized plant cell culture systems, immobilization techniques, Effect of immobilization on secondary metabolism and realization of chemosynthetic potential in immobilsed cells. Hairy root and multiple shoot cultures and their applications in industrially potential cell systems of different types.
5. **Plant regeneration:** Morphogenesis and its biotechnological utilization

Books Recommended:

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

PHCOG 516 Advances in Pharmacognosy

External Marks: 80 **4 Hrs/Week**
Internal Marks: 20
Total Marks: 100

1. Drug discovery and development from natural products with special emphasis on drugs derived from the following Plants: *Digitalis, Artemesia, Atropa belladonna, Catharanthus roseus, Podophyllum* and *Taxus species.*
2. Comparative study of British herbal pharmacopeia Ayurvedic pharmacopeia of India, Chinese, Japanese herbal pharmacopoeias, European pharmacopoeia, US Formulary, W.H.O guidelines for herbal medicinal products.
3. Pharmacognostic characterstics, chemical constituents and pharmacological basis of therapeutic uses of the following plants

3.1 **Hepatoprotective plants:** *Andrographis paniculata, Glycyrrhiza glabra, Picrorrhiza, Silybum marianum* and *Swertia chirata.*

3.2 **Anti inflammatory plants:** *Aesculus hippocastanum, Boswellia serrata, Commiphora mukul, Curcuma longa, Pluchea lanceolata and Vitex negundo.*

3.3 **Antidiabitic plants:** *Allium cepa,Azadirachta indica, Cyamopsis tetragonolobus, Gymnema sylvestris, Momordica charantia, Pterocarpus marsupium, Syzygium cuminii and Trigonella foenum graecum*.

3.4 **Plants used in cardiovascular disorders***: Digitalis*, *Coleus forskohli, Garcinia cambogia, Terminalia arjuna, Thevetia nerrifolia, Viscum album and Veratrum.*

3.4 **Antiviral plants:** *Echinaceae purpurea, Sambucus nigra, Saponaria officinalis, Rhizophora species and Thuja occidentalis*.

3.5 **Plants used as adaptogens and immunomodulators:** *Allium sativum, Asparagus racemosus, Ganoderma species, Ocimum sanctum, Panax ginseng, Phyllanthus emblica, Tinospora cordifolia and Withania somnifera.*

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

Books Recommended:

1. W.C. Evans, Trease and Evans Pharmacognosy, 15th edition, W.B. Sounders & 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.

PHCOG 518 Pharmacognosy Laboratory II

External Marks: 80 **16 Hrs/Week**
Internal Marks: 20
Total Marks: 100

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)