

M.PHARM (PHARMACOGNOSY) SYLLABUS

Course Structure, Scheme of Instruction and Evaluation

SEMESTER I (Minimum of 20 weeks)

COURSE NO.	SUBJECTS/ PAPER	TH /PR	INSTRUCTIONS HRS/WEEK		EVALUATION		DURATION OF UNI.EXAM (HOURS)
			Theory	Practical	Int.	Ext	
21T1	Modern Pharmaceutical Analysis	Th	3	-	30	70	3
31T2	Advanced Pharmacognosy-I	Th	3	-	30	70	3
31T3	Phytochemistry-I	Th	3	-	30	70	3
31T4	Medicinal Plant Biotechnology	Th	3	-	30	70	3
21P1	Modern Pharmaceutical Analysis	Pr	-	6	30	70	6
31P2	Phytochemistry-I	Pr	-	6	30	70	6
31T5	*Scientific and Technical Writing	Tutorials	1	-	50	-	
	*Seminars	-	2		25	-	
	Assignment	-	-		25		
	Total -700				280	420	

* only Internal Assessment

SEMESTER II
(Minimum of 20 weeks)

COURSE NO.	SUBJECTS/ PAPER	TH /PR	INSTRUCTIONS HRS/WEEK		EVALUATION		DURATION OF UNI.EXAM (HOURS)
			Theory	Practical	Int.	Ext	
31T6	Advanced Pharmacognosy-II	Th	3	-	30	70	3
31T7	Phytochemistry-II	Th	3	-	30	70	3
31T8	Herbal Product Development and Formulation	Th	3	-	30	70	3
31T9	Intellectual Property Rights & Regulatory Affairs	Th	3	-	30	70	3
31P3	Advanced Pharmacognosy -II	Pr	-	6	30	70	6
31P4	Herbal Product Development and Formulation	Pr	-	6	30	70	6
31T10	*Entrepreneurship Management	Tutorials	1	-	50	-	
	*Seminars	-	2		25		
	Assignment	-	-		25		
	Total -700				280	420	

*** only Internal Assessment**

SEMESTER III AND IV (Combined)
(Minimum of 40 weeks)

COURSE NO.	SUBJECTS/ PAPER	TH /PR	EVALUATION
			Marks
31P5	Dissertation and Viva-Voce	Pr	300

Dissertation. Original research work carried out by the candidate under the guidance of regular teaching faculty of the department should be submitted in the bound Form.

Note : Distribution of marks for dissertation and viva-voce shall be as under

Dissertation Work **Marks**

- | | |
|--------------------------------|-----|
| a) Reference Work | 20 |
| b) Experimental work | 100 |
| c) Scientific Contents | 20 |
| d) Presentation/ Communication | 30 |
| e) Results/ Conclusion | 30 |

Total Marks 200

Viva-Voce **Marks**

- | | |
|--------------------------------|----|
| a) Scientific Contents | 20 |
| b) Presentation/ Communication | 30 |
| c) Discussion | 50 |

Total Marks 100

Modern Pharmaceutical Analysis **(Minimum of 60 Hrs)**

Semester - I

Subject Code: 21T1

Period/Week : 3 hr

Examination : Theory

Sessional exam: 30

Uni. Examination: 70

Exam Duration : 3 hr

1. UV-Visible Spectroscopy: Brief review of Electro Magnetic Radiation, laws governing spectrophotometry. Interaction of EMR with matter and effects. Spectra of isolated Chromophores. absorption spectrum in qualitative and quantitative studies of drugs, shifts and their interpretation including solvent effects. Multicomponent analysis, derivative spectroscopy. 6 hr
2. Spectrofluorimetry: Fluorescence, Phosphorescence, Chemiluminescence- Theory, instrumentation and applications. 2 hr
3. Infra-Red spectroscopy: Basic principles, effects of substituents, ring size, H-bonding. Coupling and field effects on frequency. Sample preparation, qualitative methods, and their interpretation. FT-IR, applications with recent advances. 8 hr
4. Optical Rotatory Dispersion: Principle, plain curves, Cotton effect, Circular dichroism and. Measurement of rotation angle in ORD and applications 2 hr
5. Nuclear Magnetic Resonance spectroscopy: Fundamental principles, Proton magnetic spectrum characteristics and presentations, terms used, Brief outline of principles of ¹³C NMR. Introduction to 2-D-NMR technique in pharmacy and biotechnology. 12 hr
6. Mass spectroscopy: Principles, instrumentation, methods, interpretations and applications. 8 hr
7. X- ray Crystallography: Production of X rays, Different X ray methods, Braggs law, Rotating crystal technique, X ray powder technique, Types of crystals, Interpretation of diffraction patterns and applications of X-ray diffraction 4 hr
8. Chromatographic methods, Introduction, classifications,

- a) Liquid chromatography, instrumentation, materials, column selection, resolution optimization and efficiency parameters. HPLC detectors, modes of HPLC, Ion – pair, Ion exchange, Size exclusion, Supercritical, gel-permeation, flash chromatography, applications.
 - b) High performance thin layer chromatography: Detection methods qualitative and quantitative HPTLC
 - c) Gas Chromatography: Instrumentation, Column parameters, Resolution, Liquid Phases Derivatisation and detectors, Applications
 - d) Capillary electrophoresis.: Introduction, methods and applications 15 hr
9. Radio Immuno Assay and ELISA for some drugs. 3 hr

References:

1. Willard, H.H., Merrit, L.L., Dean, J.A., Settle P.A., Instrumental Methods of Analysis, Van Nostrand.
2. Skoog, D.A., Heller, F.J., Nieman, T.A., Principles of Instrumental Analysis, WB Saunders.
3. Hunson, J.W., ed. Pharmaceutical Analysis, Modern Methods, part A & B, Marcel Dekker.
4. Schirmer, R.E., ed. Modern Methods of Pharmaceutical Analysis, Vols 1, 2. Boca Raton F.L., CRC Press.
5. Mann, C.K., et al., Instrumental Analysis Harper & Row.
6. Jaffe, H.H., Orchin M., Theory & Applications of Ultraviolet Spectroscopy, Willy.
7. Silverstein, Spectrometric identification of Organic Compounds, Willy.
8. Bovey, F., Jelinski, L., Miran, P., Nuclear Magnetic Resonance Spectroscopy, Sau: Diego Academic.
9. Stothers, J.B., Carbon-13 NMR.Spectroscopy, Academic.
10. Gordy, W., Theory & Applications of Electron Spin Resonance, Willy.
11. Haswell, S.J., ed. Atomic Absorption Spectroscopy, Elsevier.
12. Ardrey, R.E., Pharmaceutical Mass Spectra, Pharmaceutical Press, London.
13. Budzikiewicz, et al., Interpretation of Mass Spectra of Organic Compounds, Holden-Day San Francisco.
14. Beckett and Stenlake, Practical Pharmaceutical Chemistry, CBS.
15. Stahl, E., Thin Layer Chromatography- A laboratory Handbook, Springer-Verlag
16. Giddings, J.C., Principles and Theory- Dynamics of Chromatography, Marcel Dekker.
17. Sethi, P.D., Quantitative Analysis of Pharmaceutical formulations, CBS Publishers, New Delhi.
18. Kemp William, Organic spectroscopy, Pal grave, New York.
19. Kalsi, P.S., Spectroscopy of organic compounds, New age publishers, New Delhi.
20. Gross - Mass Spectrometry
21. WHO - Quality Assurance of Pharmaceuticals, Vol. I, II.
22. Sethi, P.D., HPLC, Quantitative Analysis of Pharmaceutical Formulations, CBS

Publishers, Delhi.

23. Sethi, P.D., HPTLC, Quantitative Analysis of Pharmaceutical Formulations, CBS Publishers, Delhi.
24. Haffmann, Chromatography.
25. Sethi and Charcankar, Identification of Drugs in Pharmaceutical Formulations by TLC.
26. Robert D. Braun, Introduction to Instrumental Analysis.
27. Wilfried, M.A. Niessen- Liquid Chromatography-Mass Spectrometry.
28. Harry G. Brittain, Spectroscopy of Pharmaceutical Solids.
29. George, S., Steroid Analysis in Pharmaceutical Industry.
30. Higuchi, Pharmaceutical Analysis.
31. Bidingmeyer, Practical HPLC Methodology and Applications.
32. Hoffmann, Mass Spectrometry: Principle and Application.
33. Scott, Techniques and Practice of Chromatography.
34. Wilkins, Identification of Microorganism by Mass Spectrometry.
35. Wu, Handbook for Size Exclusion Chromatography and related Techniques.

Advanced Pharmacognosy-I

(Minimum of 60 Hrs)

Semester - I
Subject Code: 31T2
Period/Week : 3 hr
Examination : Theory

Sessional exam: 30
Uni eamination: 70
Exam Duration : 3 hr

Chapter I :- Plant drug cultivation

25 hr

- General introduction to the importance of Pharmacognosy in herbal drug industry,
- General aspects involved in cultivation of medicinal plants.
- Factors affecting the cultivation of curde drugs.(I) Exogenous (II) Endogenous factors (III) Mineral supplements (IV) Nutrients (V) Soil and Soil fertility (VI)Pest and Pest control (VII) Plant Growth Regulators (VIII) Genetic manupulators (IX) Diseases management of medicinal and aromatic plants
- Systemic method of Cultivation and post harvest technology of medicinal plant, cultivated in India

(i)Senna (ii) Opium (iii)Aswaghandha (iv)Lemon Grass (v) Ispaghula (vi)Turmeric (vii)Ginger.
- Conservation of medicinal plants - *Ex-situ* and *In-situ* conservation of medicinal plants

Chapter II :- Chemotaxonomy

5 hr

- Definition,significance and Types
- Chemotaxonomic significance of Flavonoids and Alkaloids

Chapter III :- Marine natural products

10 hr

- Definition, Present status, Classification of important bioactive agents from marine sources
- General methods of isolation and purification
- Study of Marine toxins, Marine biomedical products falling under the class of Cardiovascular, Anticancer, Antimicrobial, Antiinflammatory and Antibiotic drugs

Chapter IV :- Extraction Methods And Chromatography

10 hr

- General methods, types and principles of extraction.
- Selection of solvents for extraction and purification of extracts using chromatographic methods including HPLC, HPTLC and GC

Chapter V :- Nutraceuticals

10 hr

- General introduction
- Classification
- Inorganic mineral supplements
- Vitamin supplements
- Digestive enzymes
- Probiotics
- Prebiotics
- Dietary fibres
- Cereals and grains
- Health drinks
- Antioxidants
- Polyunsaturated fatty acids
- Herbs as functional foods

References

1. Cultivation of medicinal and aromatic crops, Ist edn, by A.A.Farooqui and B.S.shreeramu, University press., 2001
2. Medicinal plants of India, Ist edn, by S.N.Yoganasimhan, Interline publication Pvt.Ltd., 2000
3. Medicinal natural products (a biosynthetic approach), Ist edn, by Paul M.Dewick, John Wiley and sons Ltd., England 1998
4. Natural Products from plants, Ist edn, by Peter B. Kaufman, CRC press, Newyork, 1998
5. Glimpses of Indian Ethanopharmacology by P. Pushpangadam,UIF Nyman, V.George, Tropical botanic Gardon and research institute., 1995
6. Natural Products:A lab guide by Raphael Ikan, IInd edn, academic press, 1991
7. Organic chemistry of natural products, volume 1 and 2. by Gurdeep R.Chatawal
8. Organic Chemistry by I.L.Finar –Vol. I and II
9. Text book of Pharmacognosy, by G.E.Treese nad W.C.Evans, 15th edn, W.B. Saunders Edenburg, NewYork.,
10. Text book of Pharmacognosy by Tyler, Brady and Robers
11. Modern methods of Plant analysis by Peach and M.V.Tracey, Volume I and II
12. Chemistry of marine natural products by Paul J.Schewer, 1973.
13. Marine Pharmacognosy Ed by Dean F. Martin and George Pedilla
14. Marine natural products Volume I to IV
15. Cultivation of medicinal plants by C.K.Atal and B.M. Kapoor
16. Cultivation and utilization of aromatic plants,by C.K.Atal and B.M. Kapoor
17. Text book of Pharmacognosy by C.K.Kokate, Purohit, Ghokhale, 5th edn nirali prakassan., 1996

Phytochemistry-I

(Minimum of 60 Hrs)

Semester - I
Subject Code:-31T3
Periods/Week:- 3 hr
Examination:-Theory

Sessionals:-30
Examination:-70
Examination Duration:-3 hr

Chapter-I:- Biogenesis 5 hr

- General techniques involved in biosynthetic studies and brief introduction to the biogenesis of secondary metabolites
- Primary and secondary metabolites
- Factors affecting secondary metabolites in medicinal plants

Chapter-II :- Biosynthetic studies on the following 6 hr

- Alkaloids:- Ephedrine, Hyoscyamine, Hyoscine, Morphine, Papaverine, Reserpine and Ergometrine
- Glycosides :- Digitoxin, Scillaren and Sennosides

Chapter-III :- Extraction, Isolation and Purification of Phytoconstituents 15 hr

- General Methods of extraction, isolation and purification of phytoconstituents
- Isolation, identification, tests and estimation methods for the following phytoconstituents with special emphasis on HPLC, HPTLC and other advanced techniques.
 - a) Asavone from *Acorus Calamus*
 - b) Aloin from *Aloes*
 - c) Vasicine from *Adhatoda vasica*
 - d) Andrographolides from *Andrographus paniculata*
 - e) Curcumin from *Curcumin Longa*
 - f) Piperine from *Piper Longum*
 - g) Berberine from *Berberis aristata*
 - h) Gingerol from *Zingiber Officinale*
 - i) Hesperidine from Orange peel

Chapter-IV:- General methods for determining the structure of the following class of compounds

16 hr

- a) Alkaloids
- b) Glycosides
- c) Flavanoids
- d) Terpenoids
- e) Carotenoides

Chapter-V:- Structural elucidation of following class of phytoconstituents

18 hr

- Structural elucidation of important phytoconstituents belonging to different groups
 - a) Alkaloids- Nicotine, Atropine, Morphine, Caffeine.
 - b) Glycosides- Amygdalin, Strophanthidin
 - c) Steroids- Cholesterol,
 - d) Caratenoids- Vitamin A, Lycopine and Beta-carotene
 - e) Terpinods-Camphor, Eugenol, Taxol, Pyrethrine.
 - f) Flavonoids:-Rutin, Quercetin.

References

1. Text book of Pharmacognosy, by G.E. Treese and W.C. Evans, 15th edition, W.B. Saunders Edenburg, New York.,
2. Phytochemistry – Volume I to IV, by Miller Jan, Nostrant Renhold
3. Recent advances in Phytochemistry - Volume I to IV, Scikel Runeckles Appleton century Crofts
4. Pharmacognosy and Phytochemistry of Medicinal plants by Jean Bruneton, Rechnique and documentation – Lavoiser, 1995
5. Pharmacognosy and Phytochemistry by Vinod D. Rangari Part I and II
6. Organic chemistry of natural products, Volume 1 and 2 by Gurdeep R. Chatawal
7. Organic chemistry by I.L. Finar – Vol. I and II
8. Natural product chemistry by Nakanishi Golo
9. Introduction to Molecular Phytochemistry by C.H. J. Wells (Chapman And Hall)
10. Comparative Phytochemistry, Ed. By T. swain
11. Natural products: A lab guide by Raphael Iran. IInd Edition Academic press, 1991
12. Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae

Medicinal Plant Biotechnology

(Minimum of 60 Hrs)

Semester - I

Subject Code:-31T4

Periods/Week:- 3 hr

Examination:-Theory

Sessionals:-30

Examination:-70

Exam Duration:-3 hr

Chapter-I :- Introduction

5 hr

- Historical prospective and prospects for development of medicinal plant biotechnology.
- Applications of plant biotechnology in Pharmacy and Allied field.

Chapter-II:- Tissue culture

22 hr

- Type, techniques and application of Callus, Suspension, Haplod and Embryo, and Organ Culture.
- Embryogenesis, organogenesis , synthtic seeds.and Somoclonal variations
- Micropropogation- Advantages , Disadvantages and factors influencing micropropogation.
- Different Methods and stages involved in micropropogations.
- Hairy root culture, multiple shoot culture and there application.
- Protoplast culture, isolation and purification of protoplast. Method of Protoplast fusion and protoplast culture
- Immobilization teqniques and advantages of immobilization teqniques
- Effect of immobilization in secondary metabolites.

Chapter-III:- Biotranformation

6 hr

- Factors affecting biotransformation on the production of biomedical. and its application in pharmacy
- Cyropreservation - Different Methods of cyropreservation and its impact on the production of biomedical.

Chapter-IV:- Cloning of plant cells

14 hr

- Different methods of cloning and its application.
- Advantages and disadvantages of plant cell cloning
- Transgenic plants, Application of transgenic plants with special reference to
 - a) Resistant to Herbicide, insects, fungus and viruses.
 - b) Resistant to physiological stress.
 - c) Production of Phytopharmaceuticals
 - d) Edible vaccines

Chapter-V:-Gene mapping & Molecular maps of plant genomes. 13 hr

- Plant Chromosome Analysis
- Uses of PCR in gene mapping
- Molecular Maps-RFLP,RAPD
- Physical maps using in-situ hybridization.

References

1. Elements in plant Biotechnology by P.K.Gupta
2. Molecular biology and biotechnology by J.M.Walker and E.D. Gingold
3. An introduction to plant tissue culture by M.K. Razdan
4. Plant cell and tissue culture by Jeffrey W. Pollard and J.M.Walker
5. Plant tissue culture by Dixon
6. Plant tissue culture by Street
7. Biotechnological application for tissue culture by Shargool
8. Plant cell culture and technology by M.M. Yeoman
9. Plant tissue culture – Theory and practice by S.S. Bhajwani and M.K. Razdan
10. Secondary plant metabolism by Margaret L. Vikery and Brain Vikery
11. Plant tissue culture by W.E Gorge
12. Plant chromosome Analysis, Manipulation and Engineering by Arun and Archana Sharma., 1st Edn., Academic publishers, 1999
13. Transgenic plants by R. Ranjan, Agrobotanica, 1999

Modern Pharmaceutical Analysis **(Minimum of 120 Hrs)**

Semester - I
Subject Code:-21P1
Periods/Week:- 6 hr
Examination:-Practical

Sessionals:-30
Uni. Examination:-70
Examination Duration:-6 hr

List of Experiments

1. UV/Visible spectrum scanning of a few organic compounds for UV- absorption and correlations of structures (2 compounds) and isobestic point in case of mixtures.
2. Effect of solvents and pH on UV spectrum of drugs.
3. Estimation of multicomponent formulation by UV- Spectrophotometer in formulations.
(2 experiments)
4. Experiments based on the derivatisation spectroscopy.
5. Experiments based on TLC and HPLC (Isocratic and Gradient elution) techniques.
6. Workshop of spectroscopy: (UV, IR, NMR, MASS) structural elucidation of at least 5 compounds. (4 experiments)
7. ELISA Test/ LAL Test based experiments
8. Any other relevant experiments based on theory.

Phytochemistry-I **(Minimum of 120 Hrs)**

Semester - I
Subject Code:-31P2
Periods/Week:- 6 hr
Examination:-Practical

Sessionals:-30
Uni. Examination:-70
Examination Duration:-6 hr

List of Experiments

1. Phytochemical screening*
2. Thin layer chromatography and identification of phytoconstituents*
3. Paper chromatography and identification of phytoconstituents*
4. Isolation of Caffeine from tea dust
5. Isolation of Nicotine as Nicotine picrate from Tobacco leaves
6. Isolation of Piperine from Black pepper
7. Isolation of Curcumin from Turmeric
8. Isolation of Berberine from Berberis spp
9. Isolation of Hesperidine from Orange peel
10. Estimation of Eugenol in Clove oil- IP*
11. Estimation of Citral in Lemon grass oil- IP*
12. Estimation of Caffeine by HPLC*
13. Separation of active constituents using flash chromatography

*** Minor Experiments**

Scheme of Examination

Sr. No.	Synopsis	Major Expt.	*Minor Expt.	Viva-voce	Total
1.	10	30	20	10	70

SCIENTIFIC AND TECHNICAL WRITING

(Minimum of 20 Hrs)

Semester - I

Subject Code : 31T5

Periods/week : 1 hr

Nature of Exam : Tutorials

Sessional : 50

Uni. Examination : --

Exam Duration: --

Course Objectives

- To be able to appreciate and understand importance of writing scientifically.
- To Develop competence in writing and abstracting skills.
- To write either a draft research proposal or a chapter of dissertation.

Chapter - I :- COLLECTION AND EVALUATION OF INFORMATION 2 hr

- Identification sources, searching information, classifying information under fact/opinion, tabulating information, summarizing a text and presenting sequence of topics in different forms.

Chapter – II :- WRITING AS A MEANS OF COMMUNICATION 3 hr

- Different forms of scientific and technical writing.
- Articles in journals, Research notes and reports, Review articles, Monographs,
- Dissertations, Bibliographies.
- How to formulate outlines: The reasons for preparing outlines
 - as a guide for plan of writing
 - as skeleton for the manuscript

Kinds of outline: topic outlines, conceptual outline, sentence outlines and combination of topic and sentence outlines

Chapter – III:- DRAFTING TITLES, SUB TITLES, TABLES, ILLUSTRATIONS

3 hr

- Tables as systematic means of presenting data in rows and columns and lucid way of indicating relationships and results.
- Formatting Tables: Title, Body tab, Stab Column, Column Head, Spanner Head, Box Head
- Appendices: use and guidelines
- The Writing process: Getting started, Use outline as a starting device, Drafting, Reflecting and Re-reading
- Checking: Organization, Headings, Content, Clarity and Grammar
- Brevity and Precision in writing - Drafting and Re-drafting based on critical evaluation

Chapter - IV:- PARTS OF DISSERTATION/RESEARCH REPORT/ARTICLE

2 hr

- Introduction, Review of Literature, Methodology, Results and Discussion
- Ask questions related to: content, continuity, clarify, validity internal consistency and objectivity during writing each of the above parts.

Chapter – V:- WRITING FOR GRANTS

10 hr

- Clearly state the question to be addressed
- Rationale and importance of the question being address
- Emperial and theoretical conceptualization
- Presenting pilot study/data
- Research proposal of method
- Clarity, specificity of method.
- Clear organization
- Outcome of study and its implications
- Budgetting
- Available infra-structure and resourses
- Executive summary

References

1. APA (1984): Publication Manual of American Psychological Association (3rd Edition),
Washington: APA.
2. Cooper, H.M. (1990): Integrating Research: A Guide for Literature Reviews (2nd Edition).
California: Sage.
3. Dunn, F.V & Others.(Ed.) (1984): Disseminating Research: Changing Practice. NY:Sage.

Advanced Pharmacognosy –II **(Minimum of 60 Hrs)**

Semester - II
Subject Code:-31T6
Periods/Week:- 3 hr
Examination:-Theory

Sessionals:-30
Examination:-70
Exam Duration:-3 hr

Chapter-I :- Methods of improving quality of crops and their application 10 hr

- Plant Breeding
- Chemodemes
- Hybridization
- Mutation
- Polyploidy

Chapter-II :- Alternative system of medicine 12 hr

- Principles of Ayurveda, Homeopathy and Unani system of medicines, their merits and demerits
- Formulation of ayurvedic dosage forms
 - a) Asava
 - b) Arista
 - c) Churna
 - d) Bhasma
- Ayurvedic cosmetic formulations
- Standardisation of Ayurvedic dosage forms using
 - a) Physical methods
 - b) Chemical methods
 - c) Biological methods

Chapter-III:- Role of Medicinal Plants in National Economy

8 hr

- Economic Growth Potential in natural health and cosmetic products. Future economic growth. Development of Herbal medicine industry
- Demand For Medicinal Plants and Herbal plants. Trends in worldwide trade in medicinal plants.
- Export potential of Indian medicinal herbs. Indian Medicinal plants used in aromatherapy.
- Spices and there export

Chapter –IV :- WHO Guidelines for the assessment of crude drugs.

20 hr

- Evaluation of identity, quality and purity of crude drugs.
- Determination of Pesticidal Residue
- Determination of Arsenic and heavy metals.
- Determination of microorganism.

Chapter –V:- Patents

10 hr

- Indian and International patent laws,proposed amendments as applicable to herbals / natural products and processes
- Important points while to be kept in mind while drafting and file a patents
- Plant breeders rights.

References

1. Text book of Pharmacognosy, by G.E. Treese and W.C. Evans, 15th edition, W.B. Saunders
2. Edenburg, New York.,
3. Pharmacognosy and Phytochemistry by Vinod D. Rangari, Part I and II
4. Ayurvedic Formulary of India, Government of India
5. W.H.O Quality control methods for medicinal plant material
6. Quality control of herbal drugs by pulok Mukherjee, Business horizon
7. Text book of Industrial pharmacognosy by A.N. Kalia, CBS publishers and Distributors, New Delhi
8. Herbal drug industry by Choudhary R.D. Eastern publication
9. PDR for herbal medicines, IInd Edn, Medicinal economic company, New Jersey

Phytochemistry-II

(Minimum of 60 Hrs)

Semester - II
Subject Code:-31T7
Periods/Week:- 3 hr
Examination:-Theory

Sessionals:-30
Examination:-70
Exam Duration:-3 hr

Chapter-I :- Phytochemical Study

20 hr

- Definition, Distribution, Occurrence, Properties, Classification, Extraction, Isolation and test of
 - a) Alkaloids,
 - b) Glycosides,
 - c) Flavonoids,
 - d) Terpenoids,
 - e) Steroids ,
 - f) Carotenoids
 - g) Tannins
 - h) Resins

Chapter-II:- Source, Uses and Chemistry of the following drugs

20 hr

- a) Tropane alkaloids
- b) Indole alkaloids
- c) Quinoline alkaloids
- d) Isoquinoline alkaloids
- e) Steroidal alkaloids
- f) Cardiac glycosides
- g) Anthracene glycosides
- h) Resins – Cannabis and Podophyllum
- i) Tannins

Chapter-III:- Characterisation of phytopharmaceuticals

8 hr

- Characterization of the following phytopharmaceuticals by UV,IR, HPLC, HPTLC, GC-MS Methods
 - a) Vasicine
 - b) Andrographoloids
 - c) Phylanthin
 - d) Solasodine
 - e) Gingerol
 - f) Curcumin
 - g) Lupeol

Chapter-IV:- Natural products as Lead Compounds

6 hr

- Natural products leads to new drugs:- approaches to discovery and developments of natural products as potential new drugs, selection and optimization of lead compounds for further development with suitable examples from CNS, Anticancer, Antibiotics and cardiovascular drugs.

Chapter-V:- Bitter Principles

6 hr

- Definition,classification of bitter principles,isolation,characteristic features,identification tests and uses

References

1. Text book of Pharmacognosy, by G.E. Treese and W.C.Evans,15th edn,W.B. Saunders
Edenburg,New York.
2. Phytochemistry-Volume I to IV, by Miller Jan,Nostrant Renhold
3. Pharmacognosy and Pharmacobiotechnology by Ashutoshkar,New Age Publications,
New Delhi.
4. Recent Advances in Phytochemistry-Volume I nad IV , Scikel Remeckles Appleton
century Crofts
5. Pharmacognosy and Phytochemistry of Medicinal Plants by Jean Bruneton,Technique
and documentation-Lavoiser,1995
6. Pharmacognosy and Phytochemistry by Vinod D. Rangari Part I and II
7. Organic Chemistry of natural products,volume I and II by Gurdeep R. Chatawal
8. Organic Chemistry by I.L.Finar- Vol. I and II
9. Natural Product Chemistry by Nakanishi Golo
10. Introduction to molecular Phytochemistry by C.H.J. Wells(Chapman and Hall)
11. Comparative Phytochemistry Ed. By T.Swain

Herbal Product Development & Formulation

(Minimum of 60 Hrs)

Semester - II
Subject Code:-31T8
Periods/Week:- 3 hr
Examination:-Theory

Sessionals:-30
Examination:-70
Exam Duration:-3 hr

Chapter-I : Introduction 6 hr

- Herbal Based industry : Scope, study of infrastructure, staff requirements, project profiles,equipments,processing,research and development & Regulatory requirements.
- Role of natural products in herbal medicines.
- General status and importance of herbal medicines.
- Safety of herbals/herbalpharmacovigilance.
- W.H.O Policy on herbal medicines.

Chapter-II : Herbs as raw materials 6 hr

- Definition of herb,herbal medicines,herbal medicinal product and herbal drug preparations.
- Source,selection,identification and authentication of herbal materials.
- Drying and processing of herbal raw materials.
- Packing and labelling of finished products.

Chapter-III : Standaridization of herbal extracts as per WHO/CGMP

Guidelines 15 hr

- Physical,chemical,spectraland toxicologicals standardization,qualitative and quantitative estimations exemplified by the methods of preparation of at least two standardized extracts.
- Stability studies for extracts.
- Predictable chemical and galenical changes

Chapter-IV : Herbal Product Development

20 hr

- Preparation of liquid orals, tablets, capsules ,ointments ,creams and cosmetics
- Methods involved in monoherbal and polyherbal formulation with their merits and demerits.
- Excipients used in herbal formulation
- Compatibility studies
- Stability studies
- Bioavailability & Pharmacokinetic aspects for herbal drugs with examples of well known documented,clinically used herbal drugs.
- Quality Control of finished herbal medicinals products.

Chapter-V : Screening of natural products for the following biological activities

13 hr

- (a)Antidiabetic (b)Antifertility (c)Antihypertensive (d) Antiarrhythmics
(e)Antipyretics (f)Antioxidants (g)Antibacterial (h)Antifungal
(i)Antiepileptics,(j)Osteoporosis (k) Nephroprotective
(l)Immunomodulators,(m)Alzheimers

References

- Pharmacognosy by G.E. Trease, W.C.Evans, ELBS.
2. Pharmacognosy by Verno E. Taylor, Linn. R.Braddy, James E.Robberts, K.M.Varghese Co. Mumbai.
3. Text Book of Pharmacognosy by T.E.Wallis, CBS Publication, Delhi.
4. Clark's Isolation and Identification of drugs by A.C.Mottal.
5. Drug Analysis by Chromatography by P.K.Lalla
6. Phytochemical methods of chemical analysis by Harborne
7. Quantitative Thin layer chromatography and its industrial application by Trieber L.R.
8. HPTLC- Quantitative analysis of Pharmaceutical Formulation by P.D.Sethi
9. Plant drug analysis by H.Wagner
10. Indian Herbal Pharmacopoeia Vol. I and II
11. British Herbal Pharmacopoeia
12. Herbal drug industry by R.D.Chaudhari
13. The complete German Commission E. Monographs- Bluementol, Busse, Goldberg Greenwald.Hall, klien, Riggins and Rister
14. Quality control methods of Herbal Drugs by Pulok. V.Mukherjee
15. HPLC methods of drug analysis by Mantuke Ghosh
16. Standardisation of botanicals testing and extraction methods of Medicinal Herbs by Dr. Rajpal.Vol. I and II
17. General Pharmacy by J.W. Cooper and Coline Gunn
18. Tutorial Pharmacy by S.J.Carter
19. Cosmeceuticals- Drugs Vs Cosmetics by Peter Elsnerand Hovard. D. Maibach
20. Herbal Medicinal Plants by Fraukle and Barbana Steinhoff
21. Research guideline for evaluating for the safety and efficacy of herbal medicines, WHO publications (ISBN)
22. Quality control methods for medicinal plant materials- WHO

**INTELLECTUAL PROPERTY RIGHTS
& REGULATORY AFFAIRS
(Minimum of 60 Hrs)**

Semester - II

Subject Code : 31T9

Periods/week : 3 hr

Nature of Exam: Theory

Sessional : 30

Examination : 70

Exam Duration: 3 hrs

Chapter –I

15 hr

Patents and Intellectual Property Rights (IPR) : Definition, scope, objectives, sources of patent information, patent processing & application, Patents, copyrights, trademarks, salient features, trade related aspects (TRIPS), international & regional agreements.

Chapter –II

15 hr

GATT and WTO : GATT – Historical perspective, objectives, fundamental principles, impact on developing countries. WTO – objectives, scope, functions, structure, status, membership & withdrawal, dispute settlement, impact on globalization, India – tasks & challenges.

Chapter – III

10 hr

Regulatory affairs : Indian context – Requirements and guidelines of GMP, understanding of Drugs and Cosmetic Act 1940 and rules 1945 with reference to schedule M, U and Y.

Chapter -IV

5 hr

Related quality systems: Objectives and guidelines of USFDA, WHO and ICH, Introduction to ISO series.

Chapter – V

15 hr

Documentation: Types related to pharmaceuticals industry, protocols, Harmonizing formulation development for global filings, NDA, ANDA, CTD, dealing with post-approval changes – SUPAC, handling and maintenance including electronic documentation.

References:

1. Good manufacturing practices for pharmaceuticals, SH Willing, Vol. 78, Marcel Dekker, NY.
2. Protection of industrial property rights, P Das and Gokul Das.
3. Law and drugs, 1st Publ. S.N. Katju
4. Original laws published by Govt. of India
5. Laws of drugs in India, Hussain
6. New drug approval process, RA Guarino, Vol 100, Marcel Dekker, NY
7. fda.org, wipo.int, patentlawlinks.com, hc-sc.gc.ca, inch.org, cder.org.

Advanced Pharmacognosy –II **(Minimum of 120 Hrs)**

Semester - II
Subject Code:-31P3
Periods/Week:- 6 hrs
Examination:-Practical

Sessionals:-30
Uni Examination:- 70
Exam Duration:-3 hr

List of Experiments

1. Methods of extraction
2. I.P. Monograph of Medicinal Plants
3. WHO methods of standardization of Herbal drugs*
 - a) Determination of Swelling Index*
 - b) Determination of Foaming Index*
 - c) Determination of Ash values*
 - d) Determination of Extractive values*
 - e) Determination of Volatile oil*
 - f) Determination of Moisture content*
 - g) Determination of Hemolytic activity*
 - h) Determination of Tanins
 - i) Determination of Bitter value
 - j) Determination of Leaf constant
 - k) Determination of foreign organic matter by Lycopodium Spore method
4. Preparation of Asava and Arista
5. Screening of drugs for the presence of enteric organisms
6. Screening of drugs for Microbial count
Isolation, Separation and purification of bioactive agents from marine sources
7. Interpretation of U.V. I.R, NMR and Mass spectra of drugs mentioned in theory

*** Minor Experiments**

Scheme of Examination

Sr. No.	Synopsis	Major Expt.	*Minor Expt.	Viva-voce	Total
1.	10	30	20	10	70

Herbal Product Development And Formulation

(Minimum of 120 Hrs)

Semester - II

Subject Code:-31P3

Periods/Week:- 6 hrs

Examination:-Practical

Sessionals:-30

Uni Examination:- 70

Exam Duration:-3 hr

List of Experiments

1 Formulation and Evaluation of Herbal Preparations

(a) Liquid Orals

(b)Tablets

© Dermatological

(D)Cosmetics

2. HPTLC analysis of Herbal extracts *

3. Antimicrobial screening of Herbal drugs/Extracts *

4. Antifungal screening of Herbal drugs/Extracts *

*** Minor Experiments**

Scheme of Examination

Sr. No.	Synopsis	Major Expt.	*Minor Expt.	Viva-voce	Total
1.	10	30	20	10	70

ENTREPRENEURSHIP MANAGEMENT

(Minimum of 20 Hrs)

Semester - II
Subject Code : 31T10
Periods/week : 1 hr
Nature of Exam: Tutorials

Sessional : 50
Examination : --
Exam Duration: --

Course Objectives:

- To provide conceptual inputs regarding entrepreneurship management.
- To sensitise and motivate the students towards entrepreneurship management.
- To orient and impart knowledge towards identifying and implementing entrepreneurship opportunities.
- To develop management skills for entrepreneurship management.

Chapter – I:- CONCEPTUAL FRAME WORK

5 hr

- Concept need and process in entrepreneurship development.
- Role of enterprise in national and global economy
- Types of enterprise – Merits and Demerits
- Government policies and schemes for enterprise development
- Institutional support in enterprise development and management

Chapter – II:- THE ENTREPRENEUR

4 hr

- - Entrepreneurial motivation – dynamics of motivation.
- - Entrepreneurial competency – Concepts.
- - Developing Entrepreneurial competencies - requirements and understanding the process of entrepreneurship development, self awareness, interpersonal skills, creativity, assertiveness, achievement, factors affecting entrepreneur's role.

Chapter – III:- LAUNCHING AND ORGANISING AN ENTERPRISE 5 hr

- - Environment scanning – Information, sources, schemes of assistance, problems.
- - Enterprise selection, market assessment, enterprise feasibility study, SWOT Analysis.
- - Resource mobilisation - finance, technology, raw material, site and manpower.
- - Costing and marketing management and quality control.
- - Feedback, monitoring and evaluation.

Chapter – IV:- GROWTH STRATEGIES AND NETWORKING 4 hr

- - Performance appraisal and assessment
- - Profitability and control measures, demands and challenges
- - Need for diversification
- - Future Growth – Techniques of expansion and diversification, vision strategies
- - Concept and dynamics
- - Methods, Joint venture, co-ordination and feasibility study

Chapter – V:- PREPARING PROJECT PROPOSAL TO START ON NEW ENTERPRISE 2 hr

- Project work – Feasibility report; Planning, resource mobilisation and implementation.

References

1. Akhauri, M.M.P.(1990): Entrepreneurship for Women in India, NIESBUD, New Delhi.
2. Hisrich, R.D & Brush, C.G.(1996) The Women Entrepreneurs, D.C. Health & Co., Toronto.
3. Hisrich, R.D. and Peters, M.P. (1995): Entrepreneurship – Starting, Developing and Managing a New Enterprise, Richard D., Inwin, INC, USA.
4. Meredith, G.G. etal (1982): Practice of Entrepreneurship, ILO, Geneva.
5. Patel, V.C.(1987): Women Entrepreneurship – Developing New Entrepreneurs, Ahmedabad EDII.