**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**Course Structure and Syllabi for M.Pharm-Pharmacognosy**

**(JNTUA-Affiliated Pharmacy Colleges 2017-18)**

**I YEAR - I Semester**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| S.No | CourseCode | Subjects | L | T | P | C |
| 1 | 17S01101 | Modern Pharmaceutical Analytical Techniques | 4 | - | - | 4 |
| 2 | 17S06101 | Advanced Pharmacognosy-1 | 4 | - | - | 4 |
| 3 | 17S06102 | Phytochemistry | 4 | - | - | 4 |
| 4 | 17S06103 | Industrial Pharmacognostical Technology | 4 | - | - | 4 |
| **5** | **17S06104** | **Pharmaceutical Analysis Practical for Pharmacognosy**  | **-** | **-** | **6** | **3** |
| **6** | **17S06105** | **Pharmacognosy Practical I** | **-** | **-** | **6** | **3** |
| **7** | **17S06106** | **Seminar/Assignment** | **-** | **-** | **7** | **4** |
|  Total | 16 | - | 19 | 26 |

**I YEAR II Semester**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| S.No | Course Code | Subject | L | T | P | C |
| 1 | 17S06201 | Medicinal Plant biotechnology | 4 | - | - | 4 |
| 2 | 17S06202 | Advanced Pharmacognosy-II | 4 | - | - | 4 |
| 3 | 17S06203 | Indian system of medicine | 4 | - | - | 4 |
| 4 | 17S06204 | Herbal cosmetics | 4 | - | - | 4 |
| **5** | **17S06205** | **Pharmacognosy Practical II** | **-** | **-** | **6** | **3** |
| **6** | **17S06206** | **Pharmacognosy Practical III** | **-** | **-** | **6** | **3** |
| 7 | 17S06207 | Seminar/Assignment | - | - | 7 | 4 |
|  Total | 16 | - | 19 | 26 |

**III SEMESTER**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| S.No | Subject Code | Subject | L | T | P | C |
| 1. | 17S01301 | Research Methodology and Biostatistics | 4 | - | - | 4 |
| 2.  | 17S06301 | Journal Club | 1 | - | - | 1 |
| 3. | 17S06302 | Teaching Assignment | 10 | - | - | 2 |
| 4. | 17S06303 | Comprehensive viva voce | - | - | - | 2 |
| 5. | 17S06304 | Discussion / Presentation (Proposal presentation) | - | - | 2 | 2 |
| 6.  | 17S06305 | Research Work | - | - | 28 | 14 |
|  Total | 15 | - | 30 | 25 |

**IV SEMESTER**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| S.No | Subject Code | Subject | L | T | P | C |
| 1. | 17S06401 | Journal Club | 1 | - | - | 1 |
| 2. | 17S06402 | Research work | 31 | - | - | 16 |
| 3. | 17S06403 | Discussion/ Final Presentation | 3 | - | - | 3 |
|  Total | 35 | - | - | 20 |

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**M. Pharm – I year I Sem. (Pharmacognosy) L T P C**

 **4 0 0 4**

**(17S01101)** **MODERN PHARMACEUTICAL ANALYTICAL TECHNIQUES**

Scope

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

Objectives

After completion of course student is able to know,

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

**THEORY 60 HOURS**

1. 11 hrs

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.

b. IR spectroscopy: Theory, Modes of Molecular vibrations, Sample handling,

Instrumentation of Dispersive and Fourier -Transform IR Spectrometer, Factors

affecting vibrationalfrequencies and Applications of IR spectroscopy

c. Spectroflourimetry: Theory of Fluorescence, Factorsaffecting fluorescence, Quenchers,

Instrumentation andApplications of fluorescence spectrophotometer.

d. Flame emission spectroscopy and Atomic absorptionspectroscopy: Principle,

Instrumentation, Interferences andApplications.

1. 11hrs

 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-Spincoupling, Coupling constant, Nuclear magnetic double resonance,Brief outline of principles of FT-NMR and 13C NMR. Applicationsof NMR spectroscopy.

1. 11hrs

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

1. 11hrs

Chromatography: Principle, apparatus, instrumentation, chromatographic parameters, factors affecting resolution and applications of the following: a)Paper chromatography b) Thin Layer chromatographyc) Ion exchange chromatography d) Column chromatographye) Gas chromatography f) High Performance Liquidchromatographyg) Affinity chromatography

5 11hrs

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

b. X ray Crystallography: Production of X rays, Different X raydiffraction methods, Bragg‘s

law, Rotating crystal technique, Xray powder technique, Types of crystals and applications of Xray diffraction.

c. Immunological assays: RIA (Radio immuno assay), ELISA, Bioluminescence assays.5hrs

**REFERENCES**

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, 4thedition, 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, 3rdEdition, CBS Publishers, New Delhi, 1997.
7. Pharmaceutical Analysis- Modern methods – Part B - J W Munson, Volume11, Marcel Dekker Series

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**M. Pharm – I year I Sem. (Pharmacognosy) L T P C**

 **4 0 0 4**

**(17S06101)** **ADVANCED PHARMACOGNOSY – I**

Scope

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

OBJECTIVES

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

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

THEORY 60 Hrs

1. 12Hrs

Plant drug cultivation: General introduction to the importance ofPharmacognosy in herbal drug industry, Indian Council ofAgricultural Research, Current Good Agricultural Practices,Current Good Cultivation Practices, Current Good CollectionPractices, Conservation of medicinal plants- Ex-situ and Insituconservation of medicinal plants.

2 12Hrs

Marine natural products: General methods of isolation andpurification, Study of Marine toxins, Recent advances in researchin marine drugs, Problems faced in research on marine drugssuch as taxonomical identification, chemical screening and theirsolution.

3 12Hrs

Nutraceuticals: Current trends and future scope, Inorganicmineral supplements, Vitamin supplements, Digestive enzymes,Dietaryfibres, Cereals and grains, Health drinks of natural origin,Antioxidants, Polyunsaturated fatty acids, Herbs as functionalfoods, Formulation and standardization of neutraceuticals,Regulatory aspects, FSSAI guidelines, Sources, name of markercompounds and their chemical nature, medicinal uses and healthbenefits 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.

4 12Hrs

Phytopharmaceuticals: Occurrence, isolation and characteristicfeatures (Chemical nature, uses in pharmacy, medicinal andhealth 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

5 12Hrs

Pharmacovigilance of drugs of natural origin: WHO andAYUSH guidelines for safety monitoring of natural medicine,Spontaneous reporting schemes for biodrug adverse reactions,bio drug-drug and bio drug-food interactions with suitableexamples.

**REFERENCES** (Latest Editions of)

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 & M.V. Tracey, Vol. I&II

4. Text Book of Pharmacognosy by T.E. Wallis

5. Marine Natural Products-Vol.I to IV.

6. Natural products: A lab guide by Raphael Ikan , Academic Press 1991.

7. Glimpses of Indian Ethano Pharmacology, P. Pushpangadam. Ulf Nyman.V.George Tropical Botanic Garden & Research Institute, 1995.

8. Medicinal natural products (a biosynthetic approach), Paul M. Dewick,John Wiley & Sons Ltd., England, 1998.

9. Chemistry of Marine Natural Products- Paul J. Schewer 1973.

10. Herbal Drug Industry by RD. Choudhary, Eastern Publisher, New Delhi,1996.

11. Cultivation of Medicinal Plants by C.K. Atal & B.M. Kapoor.

12. Cultivation and Utilization of Aromatic Plants, C.K. Atal & B.M. Kapoor

13. Cultivation of medicinal and aromatic crops, AA Farooqui and B.S.Sreeramu. University Press, 2001.

14. Natural Products from Plants, 1st edition, by Peter B. Kaufman, CRCPress, New York, 1998

15. Recent Advances in Phytochemistry- Vol. 1&4: ScikelRuneckles- AppletonCentury crofts.

16. Text book of Pharmacognosy, C.K.Kokate, Purohit, Ghokhale, NiraliPrakasshan, 1996.

17. Pharmacognosy and Pharmacobiotechnology, Ashutoshkar, New AgePublications, New Delhi.

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 **4 0 0 4**

**(17S06102)** **PHYTOCHEMISTRY**

SCOPE

Students shall be equipped with the knowledge of natural product drugdiscovery and will be able to isolate, identify and extract and the phytoconstituents

OBJECTIVES

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

* Different classes of phytoconstituents, their biosynthetic pathways, their properties, extraction and general process of natural product drugdiscovery
* Phytochemical fingerprinting and structure elucidation of phytoconstituents.

THEORY 60 Hrs

1. 12Hrs

Biosynthetic pathways and Radio tracing techniques:Constituents& their Biosynthesis, Isolation, Characterization andpurification with a special reference to their importance in herbalindustries of followingphyto-pharmaceuticals containing drugs:

a) Alkaloids: Ephedrine, Quinine, Strychynine, Piperine,Berberine, Taxol, Vincaalkoloids.

b) Glycosides: Digitoxin, Glycyrrhizin, Sennosides,Bacosides, Quercitin.

c) Steroids: Hecogenin, guggulosterone and withanolides

d) Coumarin: Umbelliferone.

e) Terpenoids: Cucurbitacins

2 12Hrs

Drug discovery and development: History of herbs as source ofdrugs and drug discovery, the lead structure selection process,structure development, product discovery process and drugregistration, Selection and optimization of lead compounds withsuitable examples from the following source : artemesin,andrographolides. Clinical studies emphasising on phasesofclinical trials, protocol design for lead molecules.

3 12Hrs

Extraction and Phytochemical studies: Recent advances inextractions with emphasis on selection of method and choice ofsolvent for extraction, successive and exhaustive extraction andother methods of extraction commonly used like microwaveassisted extraction, Methods of fractionation. Separation ofphytoconstituents by latest CCCET, SCFE techniques includingpreparative HPLC and Flash column chromatography.

4 12Hrs

Phytochemical finger printing: HPTLC and LCMS/GCMSapplications in the characterization of herbal extracts. Structureelucidation of phytoconstituents.

5 12Hrs

Structure elucidation of the following compounds by spectroscopictechniques like UV, IR, MS, NMR (1H, 13C)

a. Carvone, Citral, Menthol

b. Luteolin, Kaempferol

c. Nicotine, Caffeine

d. Glycyrrhizin.

**REFERENCES** (Latest Editions of)

1. Organic chemistry by I.L. FinarVol.II

2. Pharmacognosy by Trease and Evans, ELBS.

3. Pharmacognosy by Tylor and Brady.

4. Text book of Pharmacognosy by Wallis.

5. Clark’s isolation and Identification of drugs by A.C. Mottal.

6. Plant Drug Analysis by Wagner &Bladt.

7. Wilson and Gisvolds text book of Organic Medicinnal and PharmaceuticalChemistry by Deorge. R.F.

8. The Chemistry of Natural Products, Edited by R.H. Thomson, SpringerInternationalEdn. 1994.

9. Natural Products Chemistry Practical Manual by Anees A Siddiqui andSeemiSiddiqui

10. Organic Chemistry of Natural Products, Vol. 1&2. Gurdeep R Chatwal.

11. Chemistry of Natural Products- Vol. 1 onwards IWPAC.

12. Modem Methods of Plant Analysis- Peach & M.V. Tracey, Vol. I&II

13. Medicinal Natural products – a biosynthetic approach, Dewick PM, JohnWiley& Sons, Toronto, 1998.

14. Chemistry of Natural Products, Bhat SV, Nagasampagi BA, MeenakshiS,Narosa Publishing House, New Delhi.

15. Pharmacognosy & Phytochemistry of Medicinal Plants, 2nd edition,Bruneton J, Interceptt Ltd., New York, 1999.

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 **4 0 0 4**

**(17S06103)** **INDUSTRIAL PHARMACOGNOSTICAL TECHNOLOGY**

SCOPE

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

OBJECTIVES

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

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

THEORY 60 Hrs

1. 12Hrs

Herbal drug industry: Infrastructure of herbal drug industryinvolved in production of standardized extracts and variousdosage forms. Current challenges in upgrading andmodernization of herbal formulations. EntrepreneurshipDevelopment, Project selection, project report, technicalknowledge, Capital venture, plant design, layout and construction.Pilot plant scale –up techniques, case studies of herbal extracts.Formulation and production management of herbals.

2 12Hrs

Regulatory requirements for setting herbal drug industry:Global marketing management. Indian and international patentlaw as applicable herbal drugs and natural products.

Export - Import (EXIM) policy, TRIPS.

Quality assurance in herbal/natural drug products.

Concepts of TQM, GMP, GLP, ISO-9000.

3 12Hrs

Monographs of herbal drugs: General parameters ofmonographs of herbal drugs and comparative study in IP, USP,Ayurvedic Pharmacopoeia, Siddha and UnaniPharmacopoeia,American herbal pharmacopoeia, British herbal pharmacopoeia,WHO guidelines in quality assessment of herbal drugs.

4 12Hrs

Testing of natural products and drugs: Herbal medicines -clinical laboratory testing. Stability testing of natural products,protocols.

5 12Hrs

Patents: Indian and international patent laws, proposedamendments as applicable to herbal/natural products andprocess. Geographical indication, Copyright, Patentable subjectmaters, novelty, non obviousness, utility, enablement and bestmode, procedure for Indian patent filing, patent processing, grantof patents, rights of patents, cases of patents, opposition andrevocation of patents, patent search and literature, Controllers ofpatents.

**REFERENCES** (Latest Editions of)

1. Herbal drug industry by R.D. Choudhary (1996), Eastern Publisher, NewDelhi.

2. GMP for Botanicals - Regulatory and Quality issues on PhytomedicinebyPulok K Mukharjee (2003), Ist Edition, Business horizons RobertVerpoorte, New Delhi.

3. Quality control of herbal drugs by Pulok K Mukarjee (2002), BusinessHorizons Pharmaceutical Publisher, New Delhi.

4. PDR for Herbal Medicines (2000), Medicinal Economic Company, NewJersey.

5. Indian Herbal Pharmacopoeia (2002), IDMA, Mumbai.

6. Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae (1996),NiraliPrakashan, New Delhi.

7. Text book of Pharmacognosy and Phytochemistry by Vinod D. RangarI(2002), Part I & II, Career Publication, Nasik, India.

8. Plant drug analysis by H.Wagner and S.Bladt, Springer, Berlin.

9. Standardization of Botanicals. Testing and extraction methods of medicinalherbs by V. Rajpal (2004), Vol.I, Eastern Publisher, New Delhi.

10. Phytochemical Dictionary. Handbook of Bioactive Compounds from PlantsbyJ.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), EasternPublisher, New Delhi.

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**M. Pharm – I year I Sem. (Pharmacognosy) L T P C**

 **0 0 6 3**

**(17S06104)** **PHARMACEUTICAL ANALYSIS PRACTICAL FOR PHARMACOGNOSY**

1. Analysis of Pharmacopoeial compounds of natural origin and their formulations by UV-Vis spectrophotometer
2. Analysis of recorded spectra of simple phytoconstituents
3. Experiments based on Gas Chromatography
4. Estimation of sodium/potassium by flame photometry
5. Estimation of quinine sulphate by fluorimetry
6. Demonstration of HPLC- estimation of glycerrhizin
7. Methods of extraction
8. Physical evaluation of biodrugs like determination of ash and extractive values.
9. Determination of bitterness value and foaming index.
10. Determination of moisture content, LOD and Swelling index.

11.Estimation of fibre content, total solids, FOM and the like.

12.Determination of haemolytic activity.

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 **0 0 6 3**

**(17S06105)** **PHARMACOGNOSY PRACTICAL – I**

1. Phytochemical screening.
2. Fluorescence analysis of biodrugs.
3. 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 PC & TLC/HPTLC methods.
4. Determination of leaf constants.
5. Determination of volatile oil content.
6. Monograph analysis of Volatile oil like Clove oil.
7. Monograph analysis of fixed oil like Castor oil.
8. Identification of bioactive constituents from plant extracts.
9. Estimation of bioactive constituents.
10. Formulation of different dosage forms and their standardization.
11. Preparation and standardization of simple ISM dosage forms.
12. Preparation of aromatherapy formulation.

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 **4 0 0 4**

**(17S06201)** **MEDICINAL PLANT BIOTECHNOLOGY**

SCOPE

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

OBJECTIVES

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

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

THEORY 60 Hrs

1. 12Hrs

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 ofgenome, cell signaling, DNA recombinant technology.

2 15Hrs

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.

3 15Hrs

Immobilisation techniques & Secondary MetaboliteProduction: Immobilization techniques of plant cell and itsapplication on secondary metabolite Production. Cloning of plantcell: Different methods of cloning and its applications. Advantagesand disadvantages of plant cell cloning. Secondary metabolism intissue cultures with emphasis on production of medicinal agents.Precursors and elicitors on production of secondary metabolites.

4 13Hrs

Biotransformation and Transgenesis: Biotransformation,bioreactors for pilot and large scale cultures of plant cells andretention of biosynthetic potential in cell culture. Transgenicplants, methods used in gene identification, localization andsequencing of genes. Application of PCR in plant genomeanalysis.

5 05 Hrs

Fermentation technology: Application of Fermentationtechnology, Production of ergot alkaloids, single cell proteins,enzymes of pharmaceutical interest.

REFERENCES (Latest Editions of)

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., CambridgeUniversity 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. Robberrt,ThatTjen, NGO.

14. Plant Biotechnology, CiddiVeerasham.

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 **4 0 0 4**

**(17S06202) ADVANCED PHARMACOGNOSY - II**

SCOPE

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

OBJECTIVES

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

* Validation of herbal remedies
* Methods of detection of adulteration and evaluation techniques for the herbal drugs
* Methods of screening of herbals for various biological properties

THEORY 60 Hrs

1. 12Hrs

Herbal remedies – Toxicity and Regulations: Herbals vsConventional drugs, Efficacy of Herbal medicine products,Validation of herbal therapies, Pharmacodynamic andPharmacokinetic issues.

2 12Hrs

Adulteration and Deterioration: Introduction, Types ofAdulteration/ Substitution of Herbal drugs, Causes and Measuresof Adulteration, Sampling Procedures, Determination of ForeignMatter, DNA Finger printing techniques in identification of drugs ofnatural origin, detection of heavy metals, pesticide residues,phytotoxin, microbial contamination in herbs and theirformulations.

3 12Hrs

Ethnobotany and Ethnopharmacology: Ethnobotany in herbaldrug evaluation, Impact of Ethnobotany in traditional medicine,New development in herbals, Bio-prospecting tools for drugdiscovery, Role of Ethnopharmacology in drug evaluation,Reverse Pharmacology.

4 12Hrs

Analytical Profiles of herbal drugs: Andrographispaniculata,Boswelliaserata, Coleus forskholii, Curcuma longa, Embelicaofficinalis, Psoraleacorylifolia.

5 12Hrs

Biological screening of herbal drugs: Introduction and Need forPhyto-Pharmacological Screening, New Strategies for evaluatingNatural Products, In vitro evaluation techniques for Antioxidants,Antimicrobial and Anticancer drugs. In vivo evaluation techniquesfor Anti-inflammatory, Antiulcer, Anticancer, Wound healing,Antidiabetic, Hepatoprotective, Cardio protective, Diuretics andAntifertility, Toxicity studies as per OECD guidelines.

**REFERENCES** (Latest Editions of)

1. Glimpses of Indian Ethano Pharmacology by P. Pushpangadam. UlfNyman. V.George Tropical Botanic Garden & Research Institute.

2. Natural products: A lab guide by Raphael Ikan, Academic Press.

3. Pharmacognosy - G. E. Trease and W.C. Evans. WB. SaundersEdinburgh, New York.

4. Pharmacognosy-Tyler, Brady, Robbers, Lee &Fetiger.

5. Modem Methods of Plant Analysis- Peach & M.V. Tracey, Vol. I &II,Springer Publishers.

6. Herbal Drug Industry by RD. Choudhary, Eastern Publishers, New Delhi.

7. Text book of Pharmacognosy by C.K.Kokate, Purohit, Ghokhale, NiraliPrakashan.

8. Text Book of Pharmacognosy by T.E. Wallis, J & A Churchill Ltd., London.

9. Quality control of herbal drugs by Pulok K Mukherjee, Business HorizonsPharmaceutical Publishers, New Delhi.

10. Indian Herbal Pharmacopoeia, IDMA, Mumbai.

11. Text book of Pharmacognosy and Phytochemistry by Vinod D. RangarI,Part I & II, Career Publication, Nasik, India.

12. Plant drug analysis by H.Wagner and S.Bladt, 2nd edition, Springer, Berlin.

13. Standardization of Botanicals. Testing and extraction methods of medicinalherbs by V. Rajpal (2004), Vol.I, Eastern PublisherS, New Delhi.

14. Herbal Medicine. Expanded Commission E Monographs, M.Blumenthal.

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**M. Pharm – I year II Sem. (Pharmacognosy) L T P C**

 **4 0 0 4**

**(17S06203) INDIAN SYSTEMS OF MEDICINE**

SCOPE

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

OBJECTIVES

After completion of the course, student is able to

* To understand the basic principles of various Indian systems ofmedicine
* To know the clinical research of traditional medicines, Current GoodManufacturing Practice of Indian systems of medicine and theirformulations.

THEORY 60 Hrs

1. 12Hrs

Fundamental concepts of Ayurveda, Siddha, UnaniandHomoeopathy systems of medicine

Different dosage forms of the ISM.

Ayurveda: Ayurvedic Pharmacopoeia, Analysis of formulationsand bio crude drugs with references to: Identity, purity and quality.Siddha: Gunapadam (Siddha Pharmacology), raw

drugs/Dhatu/Jeevam in Siddha system of medicine, Purificationprocess (Suddhi).

2 12Hrs

Naturopathy, Yoga and Aromatherapy practices

a) Naturopathy - Introduction, basic principles and treatmentmodalities.

b) Yoga - Introduction and Streams of Yoga. Asanas, Pranayama,Meditations and Relaxation techniques.

c) Aromatherapy – Introduction, aroma oils for common problems,carrier oils.

3 12Hrs

Formulation development of various systems of medicineSalient features of the techniques of preparation of some of theimportant class of Formulations as per Ayurveda, Siddha,Homeopathy and Unani Pharmacopoeia and texts.

Standardization,Shelf life and Stability studies of ISM formulations.

4 12Hrs

Schedule T – Good Manufacturing Practice of Indian systems ofmedicineComponents 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 andGLP. Preparation of documents for new drug application andexport registration.

Challenges in monitoring the safety of herbal medicines:Regulation, quality assurance and control, National/RegionalPharmacopoeias.

5 12Hrs

TKDL, Geographical indication Bill, Government bills in AYUSH, ISM, CCRAS, CCRS, CCRH, CCRU

**REFERENCES** (Latest Editions of )

1. Ayurvedic Pharmacopoeia, The Controller of Publications, Civil Lines,Govt. of India, New Delhi.

2. Hand Book on Ayurvedic Medicines, H. Panda, National Institute ofIndustrial Research, New Delhi.

3. Ayurvedic System of Medicine, KavirajNagendranathSengupata, SriSatguru Publications, New Delhi.

4. Ayurvedic Pharmacopoeia. Formulary of Ayurvedic Medicines, IMCOPS,Chennai.

5. Homeopathic Pharmacopoeia. Formulary of Homeopathic Medicines,IMCOPS, Chennai.

6. Homeopathic Pharmacy : An introduction & Hand book, Steven B. Kayne,Churchill Livingstone, New York.

7. Indian Herbal Pharmacopoeia, IDMA, Mumbai.

8. British Herbal Pharmacopoeia, bRITISH Herbal Medicine Association, UK.

9. GMP for Botanicals - Regulatory and Quality issues on Phytomedicine,Pulok K Mukharjee, Business Horizons, New Delhi.

10. Indian System of Medicine and Homeopathy in India, Planning andEvaluation Cell, Govt. of India, New Delhi.

11. Essential of Food and Nutrition, Swaminathan, Bappco, Bangalore.

12. Clinical Dietitics and Nutrition, F.P. Antia, Oxford University Press, Delhi.

13. Yoga - The Science of Holistic Living by V.K.Yoga, Vivekananda YogaPrakashna Publishing, Bangalore.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**M. Pharm – I year II Sem. (Pharmacognosy) L T P C**

 **4 0 0 4**

**(17S06204) HERBAL COSMETICS**

SCOPE

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

OBJECTIVES

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

* Understand the basic principles of various herbal/natural cosmetic preparations
* Current good manufacturing practices of herbal/natural cosmetics asper the regulatory authorities

THEORY 60 Hrs

1. 12Hrs

Introduction: Herbal/natural cosmetics, Classification &Economic aspects.

Regulatory Provisions relation to manufacture of cosmetics: -License, GMP, offences & Penalties, Import & Export ofHerbal/natural cosmetics, Industries involved in the production ofHerbal/natural cosmetics.

2 12Hrs

Commonly used herbal cosmetics, raw materials, preservatives,surfactants, humectants, oils, colors, and some functional herbs,preformulation studies, compatibility studies, possible interactionsbetween chemicals and herbs, design of herbal cosmeticformulation.

3 12Hrs

Herbal Cosmetics : Physiology and chemistry of skin andpigmentation, hairs, scalp, lips and nail, Cleansing cream,Lotions, Face powders, Face packs, Lipsticks,Bath products, soaps and baby product, Preparation andstandardisation of the following :Tonic, Bleaches, Dentifrices and Mouth washes & Tooth Pastes,Cosmetics for Nails.

4 12Hrs

Cosmeceuticals of herbal and natural origin: Hair growthformulations, Shampoos, Conditioners, Colorants & hair oils,Fairness formulations, vanishing & foundation creams, anti-sunburn preparations, moisturizing creams, deodorants.

5 12Hrs

Analysis of Cosmetics, Toxicity screening and test methods:Quality control and toxicity studies as per Drug and CosmeticsAct.

**REFERENCES** (Latest Editions of)

1. Panda H. Herbal Cosmetics (Hand book), Asia Pacific Business Press Inc,New Delhi.

2. Thomson EG. Modern Cosmetics, Universal Publishing Corporation,Mumbai.

3. P.P.Sharma. Cosmetics - Formulation, Manufacturing & Quality Control,Vandana Publications, New Delhi.

4. Supriya K B. Handbook of Aromatic Plants, Pointer Publishers, Jaipur.

5. Skaria P. Aromatic Plants (Horticulture Science Series), New IndiaPublishing Agency, New Delhi.

6. KathiKeville and Mindy Green. Aromatheraphy (A Complete Guide to theHealing Art), Sri Satguru Publications, New Delhi.

7. Chattopadhyay PK. Herbal Cosmetics &Ayurvedic Medicines (EOU),National Institute of Industrial Research, Delhi.

8. Balsam MS & Edward Sagarin. Cosmetics Science and Technology, WileyInterscience, New York.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**M. Pharm – I year II Sem. (Pharmacognosy) L T P C**

 **0 0 6 3**

**(17S06205) PHARMACOGNOSY PRACTICALS II**

1. Isolation of nucleic acid from cauliflower heads

2. Isolation of RNA from yeast

3. Quantitative estimation of DNA

4. Preparation of different types of tissue culture mediums

5.Sterilization methods involved in plant tissue culture.

6. Sub- culturing techniques.

7. Establishment of callus culture

8. Establishment of suspension culture

9. Immobilization technique

10.*In vitro* determination of antioxidant

11*. In vitro* determination of anti-inflammatory activity.

12.Preparation of Asavas and Aristas and their standardization.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**M. Pharm – I year II Sem. (Pharmacognosy) L T P C**

 **0 0 6 3**

**(17S06206) PHARMACOGNOSY PRACTICALS - III**

1. Preparation of herbal cosmetic formulation such as lip balm and lipstick.
2. Preparation and standardization of herbal hair care and scalp care products.
3. Preparation and standardization of hair growth promoting herbal formulations.
4. Preparation and standardization of nail care products.
5. Preparation and standardization of sunscreen, UV protection cream, skin care formulations.
6. Preparation and standardization of oral hygiene products.
7. Preparation and standardization of baby care products.
8. Evaluation of herbal tablets and capsules
9. Formulation & standardization of herbal cough syrup.
10. Toxicity screening of herbal cosmetics.
11. Formulation and standardization of wound healing herbal ointments / creams.
12. Formulation of herbal neutraceuticals.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**M. Pharm – III Sem. (Pharmacognosy) L T P C**

 **4 0 0 4**

**(17S01301) RESEARCH METHODOLOGY & BIOSTATISTICS**

UNIT – I

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

UNIT – II

Biostatistics: Definition, application, sample size, importance of sample size,factors influencing sample size, dropouts, statistical tests of significance, typeof significance tests, parametric tests(students “t” test, ANOVA, Correlationcoefficient, regression), non-parametric tests (wilcoxan rank tests, analysis ofvariance, correlation, chi square test), null hypothesis, P values, degree offreedom, interpretation of P values.

UNIT – III

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

UNIT – IV

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

UNIT – V

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

References

1. *C.R.Kothari* “*Research Methodology Methods & Techniques”, Second Edition, New Delhi: New Age International publisher*
2. *Pharmaceutical Statistics 5th edition by Sanford Bolton and Charles Bon.*
3. *Biostatistics by R.S. Shukla and P.S.Chandel-S.Chand.*
4. *Guidelines On The Regulation Of Scientific Experiments On Animals; Government of India June 2007*, <https://www.aaalac.org/resources/SOP_CPCSEA.pdf>.
5. *WMA Declaration of Helsinki - Ethical Principles for Medical Research Involving Human Subjects:* [*http://anesthesia.gr/wp-content/uploads/2012/01/Decleration-of-Helsinki.pdf*](http://anesthesia.gr/wp-content/uploads/2012/01/Decleration-of-Helsinki.pdf)*.*
6. *Garrett et. al., Health Care Ethics. Prentice Hall, 2nd Edition, 1993,*