

BHARATHIAR UNIVERSITY, COIMBATORE – 641 046
ONE YEAR PG DIPLOMA COURSE IN HERBAL TECHNOLOGY

(For the candidates admitting during the academic year 2018-2019 batch and onwards)

COURSE CONTENTS AND SCHEME OF EXAMINATION

Semester	Code No.	Title of the paper	Class hours	University Examination			
				Int.Mar.	Ext.Mar.	Total	credit
First Semester	18DCBOTHT1	Paper I- Biodiversity and Phytochemistry	5	25	75	100	4
	18DCBOTHT2	Paper II- Cultivation and Conservation of Medicinal Plants	5	25	75	100	4
Second Semester	18DCBOTHT3	Paper III- Ethanopharmacology	5	25	75	100	4
	18DCBOTHT4	Paper IV-Techniques of herbal analysis	5	25	75	100	4
	18DCBOTHT5	Practical Paper – Paper I, II, III and IV (practical examination at the end of the semester)	5	25	75	100	4

PROGRAM OBJECTIVES

The aim of the one year PG diploma course in **Herbal Technology** is to provide knowledge for graduates and post graduates of any biological science discipline (Botany, Biochemistry, Biotechnology, Life sciences) with a good knowledge of the basic and applied know-how and professional skills in plant based technology through advanced teaching methods, hands on trainings and field visits. By these methods, students will acquire skills for performing research experiments, including data collection and results interpretation.

Eligibility : Applicants should have a graduate/postgraduate degree in any biological science discipline

Field trip shall be arranged in the relevant areas during any one of the semesters.

Project: A project work is to be given and dissertation should be submitted at the end of the course. This is to be valued for total 100 marks (75 marks for dissertation and 25 marks for viva-voce examination including field trip hands-on experience acquired by candidate).

**Title of the subject: BIODIVERSITY AND
PHYTOCHEMISTRY**

No. of Credits: 4

Code No: 18DCBOTHT1

No. of teaching hours: 5

COURSE OBJECTIVES:

- To define and understand the enormous diversity of plants from lower division to upper division which are present all over in the world
- To define and understand plant metabolites, their classification and occurrence
- To acquire knowledge on preliminary screening, isolation and characterization of some important phytochemicals

Unit I

Introduction to plant diversity, types of diversity-**algal diversity** –introduction to algae phyla and salient features of each phyla, **Fungal diversity**- introduction to four groups of fungi (Zygomycota, Ascomycota, Basidiomycota and Deuteromycota) and salient features of each group

Unit II

Lichen –definition, partners (mycobiont and photobiont), general structure, thallus types (crustose, squamulose, foliose, fruticose), reproduction (meiospores, conidia and vegetative propagules) diversity -**Bryophytes diversity**- introduction to three groups of bryophytes (Mosses, Liverworts and Hornworts) and salient features of each group

Unit III

Pteridophyte diversity- introduction to Lycophytes, Horsetails and ferns and salient features of each group, **Gymnosperm diversity**- introduction to four phyla (Ginkgophyta, cycadophyta, Gnetophyta and Coniferophyta) and their salient features Angiosperms-three broad categories of classification of angiosperms (introduction and important features) and introduction about Hutchinson's classification

Unit IV

Plant secondary metabolites- importance, classification (alkaloids, terpenes, phenols) sub types and function, secondary metabolites derived from lower and higher plants and their bioactivity (fresh and marine algae, conifer endophytes, bryophytes, pteridophytes, gymnosperms and angiosperms)

Unit V

Qualitative and quantitative methodologies for primary and secondary metabolites screening. Isolation and structure elucidation of bioactive steroids and alkaloids using column chromatography, TLC, UV, FTIR and GC-MS.

REFERENCE BOOKS

- Davis, P.H. and Heywood, V.H. 1963. *Principles of Angiosperm Taxonomy*. Oliver and Boyd, Edinburgh.
- Krishnamurthy, K.V. 2003. *An Advanced Text Book of Biodiversity: Principles and Practice*. Oxford IBH Pub. Pvt. Ltd., New Delhi
- Melchias, G. 2001. *Biodiversity and Conservation*. Oxford & IBH Pub. Co. Pvt. Ltd., New Delhi
- Quickie, D.I.J. 1993. *Principles and Techniques of Contemporary Taxonomy*. Blackie Academic and Professional, London.
- Radford, A.E., Dickison, W.C. Massey J.R and Bell, C.R. 1974. *Vascular Plant Systematics*. Harper and Row Publishers, New York.
- Sivarajan, V.V. 1991. *Introduction to Principles of Plant Taxonomy* (2nded). Edward Arnold, London.
- Smith, P.M. 1976. *The Chemotaxonomy of Plants*. Edward Arnold, London
- Harborne, J.B. 1984. *Phytochemical Methods* (2nd ed). Chapman and Hall, London
- Thomspn, R.H. (Ed.) .1985. *The Chemistry of Natural Products*. Blackie London
- Wilson, K. and Walker, J. (Eds). 1994. *Principles and Techniques of Practical Biochemistry* (4th ed) Cambridge University Press, Cambridge.

Course outcomes:

On successful completion of the course, the student will be able to:

CO1– Demonstrate the ability to assimilate and integrate information form lectures and practical on plant diversity, their salient features and screening of plant secondary metabolites

Course prepared by : Dr. N. Geetha
Course verified by : Prof. A. Rajendran

**Title of the subject: CULTIVATION AND
CONSERVATION OF MEDICINAL
PLANTS**

No. of Credits: 4

Code No: 18DCBOTHT2

No. of teaching hours: 5

COURSE OBJECTIVES:

- To understand profitable cultivation of economically important medicinal plants practiced by farmers/companies/entrepreneurs along with traditional agricultural/horticultural crops as sole crops, intercrops, sequential crops, etc.
- To understand the role of IPR with special emphasis on pharmaceuticals and to get knowledge on Red Data Book
- To instruct need for conservation of economically important medicinal plants through *ex-situ* and *in situ* methods
- To dispense knowledge on pests and disease management of some important medicinal plants

Unit I

Cultivation methods followed for some of the economically important medicinal crops- Senna (*cassia senna*), Winter cherry (*Withania somnifera*), Long pepper (*Piper longum*), Indian goose berry (*Emblica officinalis*), King of bitters (*Andrographis paniculata*), Coleus (*Coleus fors kohlii*), Rauvolfia (*Rauvoffia serpentina*), Asparagus (*Asparagus racemosus*) and Aloe (*Aloe vera*)

Unit II

Types of Intellectual properties, role of undisclosed information in intellectual property, rationale of patent and license, role of patent cooperation treaty, nature of pharmaceutical industry and management of intellectual property in pharmaceutical industries, introduction on Red Data Book, and role of IUCN in making RED list

Unit III

Need for conservation of medicinal plants, *ex-situ* and *in-situ* methods for conservation of plant genetic resources, *ex-situ* methods-seed storage, DNA storage, pollen field gene bank (importance and methodology), Cryopreservation and artificial seeds- importance and methodology,

Unit IV

In vitro propagation- Introduction to plant tissue culture, term and definitions, laboratory organization, tools and techniques, methods of sterilization and laboratory contaminants, its control and measures. Media composition and preparation, basic tissue culture techniques- suspension culture, plant organ culture (ovary), shoot tip culture, callus culture.

Unit V

Management of insect and mite pests – soil pests, sap sucking pests, stem/bark borers, flower and fruit feeding pests, management of bacterial diseases, fungal diseases and nematodes.

REFERENCE BOOKS:

- Bhattacharjee, S.K. 2004. *Handbook of Medicinal Plants* (4th ed.). Pointer Publishers, Jaipur
- Kameswara Rao, C.2000. *Database of medicinal plants*. KSCST, Bangalore
- Trivedi, P.C. 2004. *Medicinal Plants: Utilization and Conservation*. Aavishkar Publishers and Distributors, Jaipur
- Farooqui, A.A., Khan, M.M. and Sreeramu, B.S. 1997. *Cultivation of Medicinal and Aromatic Crops in India*. Naya Prakash, Kolkatta
- Hurtmann, H.T., Kester, D.E., Davies, F.T. and Geneva, R.L. 2004. *Plant Propagation: Principle and Practice*. Prentice-Hall of India, New Delhi
- Reddy, T.Y. and Reddy, G.H.S. 2005. *Principles of Agronomy*. Kalyani Publishers, New Delhi.
- Singh, R.S. 1984. *Introduction to Principles of Plant Pathology*. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi
- Callow, J.A., Ford-Lloyd, B.V. and Newbury, H.J. 1997. *Biotechnology and Plant Genetic Resources Conservation and Use*. CAB International Oxon
- Chirikjian, J.G. (ed). 1995. *Biotechnology: Theory and Techniques* (Vol. 1&2). Jones & Barlett Pub., Boston
- Gamborg, O.L. and Phillips, G.C. (eds). 1995. *Plant Cell, Tissue and Organ culture*. Narosa Pub. House, New Delhi
- Banerjee, U. "Horticulture". Mangal Deep Publications, Jaipur, 2008.
- Miller, L. G. and Murray, W.J. "Herbal Medicines" – A Clinician's Guide. Viva Books (P) Ltd., New Delhi, 2005.
- Dutt, A., "An Introduction to medicinal plants". Adhyayan Pub and Distributions, New Delhi, 2008.

Course outcomes:

On successful completion of the course, the student will be able to:

CO1– demonstrate the ability to acquire knowledge on cultivation practice of some economically importance medicinal plants of India.

CO2– able to learn the various conservation methods for these plants.

Course prepared by : Dr. N. Geetha
Course verified by : Prof. A. Rajendran

Title of the subject: ETHANOPHARMACOLOGY
Code No: 18DCBOTHT3

No. of Credits: 4
No. of teaching hours: 5

COURSE OBJECTIVES:

- To introduce the importance of ethanobotany
- To impart knowledge on how ethanobotany plays a role in modern drug development
- To give detailed report on ethanopharmacological works carried out in the world so far
- To give general methodologies for various pharmacognostic studies and also for different bioassays for active phytocompound/s screening

Unit I

Ethnobotany – definition, history, Collection of ethnic information, Various ethnic groups found in India, groups of ethnic plant wealth, role of ethanobotany in conservation of natural resources

Unit II

Role of ethanobotany in drug development- plant identification, plant harvesting and processing of plants, involvement of modern scientific approach to the study of ethanobotany

Unit III

Ethanopharmacology-introduction, examples of ethanopharmacological studies, world geographical coverage of ethanobotanical and ethanopharmacological works, development of database for collaborative ethanomedicinal research

Unit IV

Pharmacognostic evaluation- Study of physical evaluation of crude drugs-determination of total ash value, acid soluble ash value and water soluble ash value, moisture, fibre of crude drug samples; morphological/taxonomic description (including morphological description of useful plant parts). organoleptic evaluation of crude drug samples: colour, odour, taste and other features

Unit V

Bioassays related to active principles from plants: anti-bacterial, anti-fungal and anti-viral agents; anti-malarials, plant derived immuno-modulators, mediators of inflammation, anti-hepatotoxic agents, platelet aggregating factors, acute toxicity testing

REFERENCE BOOKS

- Gokhale, S.S., Kokate, C.K. and Purohit A.P. 1994. Pharmacognosy. Nirali Prakashan. Pune.
- Jain, S.K. 1995. Contribution to Indian Ethnobotany. 3rd edn., Scientific Publishers, Jodhpur, India.
- Jain, S.K. 1995. A Manual of Ethnobotany. 2nd edn. Scientific Publishers, Jodhpur, India.

- Sinha, R.K. and Sinha, S. 2001. Ethnobiology. Surabhe Publications, Jaipur.
- Rao, C.K. 2000. Database of Medicinal Plants. KSCST, Bangalore
- Schultes, R.E. and Reis, S. V. 1995. Ethnobotany: Evolution of a Discipline. Chapman and Hall, London
- Remington. 1995. The Science and Practice of Pharmacy, Vol 1 (9th edition) Mack Publishing Company, Pennsylvania.
- Kumar, N.C. (1993). An Introduction to Medical botany and Pharmacognosy. Emkay Publications, New Delhi.
- Dhawan, B.N. and Srimal, R.C. 1984. The Use of Pharmacological Techniques for the Evaluation of Natural Products. CDRI, Lucknow and UNESCO
- Barar, F.S.K. 2004. Essentials of Pharmacotherapeutics. S.Chand and Company, New Delhi

Course outcomes:

On successful completion of the course, the student will be able to:

CO1– demonstrate the ability to acquire basic knowledge on ethanobotany and pharmacology.

CO2– able to learn the basic principle and procedures for plant proximate analysis and bioassays for isolation for various phytocompounds.

Course prepared by : Dr. N. Geetha
Course verified by : Prof. A. Rajendran

Title of the subject: TECHNIQUES OF HERBAL ANALYSIS **No. of Credits: 4**
Code No : 18DCBOTHT4 **No. of teaching hours: 5**

COURSE OBJECTIVES:

- To introduce various plant extraction methods
- To impart knowledge on separation of phytoconstituents
- To introduce techniques for structure elucidation of phytochemicals
- To give knowledge on role of bioinformatic tools in drug development

Unit I

Cold and hot extraction methods, liquid-liquid extraction techniques, liquid-carbon dioxide extraction, concentration and evaporation techniques, lyophilisation; TLC, preparative TLC-principle, methodology and applications

Unit II

column chromatography, gel-chromatography, affinity chromatography, ion-exchange chromatography gel-liquid chromatography - principle, methodology and applications.

Unit III

High performance liquid chromatography, high performance thin layer chromatography and colorimetric analysis of extracts- principle, methodology and applications

Unit IV

UV/Visible, IR, ¹H and ¹³ C NMR, 2D NMR and MS- principle, method and application of spectroscopic techniques in structural elucidation of secondary metabolites.

Unit V

Atomic spectroscopy, GC-MS, LC-MS, basic principle of centrifugation techniques and types of centrifugation, principle of electrophoresis, PAGE, IEF and 2D electrophoresis, role of bioinformatic tools in drug development.

REFERENCE BOOKS:

- Agarwal, P.K., Thakur, R.S. and Bansal, C.M. 1989. *Carbon-13 NMR of Flavonoids*. Elsevier Science Publishers, Amsterdam.

- Atta-ur-Rahman. 1989. One and Two Dimensional NMR Spectroscopy (1st ed.). Elsevier, New York.
- Braithwaite, A. and Smith, F.J. 1996. *Chromatographic Methods* (5th ed) Blackie Academic & Professional London.
- Budzikiewicz, H., Djerassi, C. and Williams, D.H. 1968. Mass Spectrometry of Organic Compounds. Holden-Day, San Francisco, CA.
- Derome, A.E. 1987. Modern NMR Techniques for Chemistry Research (1st ed.). Pergamon Press, New York.
- Schwedt, G. 1997. *The Essential Guide to Analytical Chemistry*. John Wiley & Sons, New York.
- Silverstein, R.M., Bassler, G.C. and Morrill, T.C. 1981. *Spectroscopic Identification of Organic Compounds* (4th ed.). John Wiley, New York.
- Solomon, P.H. and Nakanishi, K. 1998. Infrared Absorption Spectroscopy (2nd ed.). Adams E (Pr) Inc.
- Wilson, K. and Walker, J. (Eds). 1994. *Principles and Techniques of Practical Biochemistry* (4th ed) Cambridge University Press, Cambridge.

Course outcomes:

On successful completion of the course, the student will be able to:

CO1– acquire knowledge on principles, procedures and applications of various techniques for herbal analysis.

Course prepared by : Dr. N. Geetha
Course verified by : Prof. A. Rajendran

**Title of the subject: PRACTICALS: Biodiversity and
Phytochemistry, Cultivation and Conservation of Medicinal
Plants, Ethanopharmacology, Techniques of herbal analysis**

No. of Credits: 4

Code No: 18DCBOTHT5

No. of teaching hours: 5

BIODIVERSITY AND PHYTOCHEMISTRY

1. Identification of plant diversity- Algae (*Ulva*), Fungi (*Aspergillus*), Lichen (Crustose), Bryophyte (*Marchantia*), Pteridophyte (*Salvia*), Gymnosperm (*Cycas*), Angiosperm (Monocot and Dicot seeds)
2. Alkaloid-Nicotine-Tobacco, Terpene-Pine
3. Primary phytochemical test (qualitative)-Test for alkaloids and terpenes
4. Secondary phytochemical test (quantitative)-Test for total phenols and total flavonoids

CULTIVATION AND CONSERVATION OF MEDICINAL PLANTS

1. Identification of locally available medicinal plants. *Emblica officinalis*, *Andrographis paniculata*, *Aloe vera*
2. Establishment of plant shoot tip culture
3. Spotters for artificial seeds (*Withania somnifera*), cryopreservation (using liquid Nitrogen), fungal diseases (leaf rust –Indian gooseberry and leaf blight- Indian ginseng)

ETHANOPHARMACOLOGY

1. Determination of moisture
2. Determination of fibre
3. Determination of total ash value
4. Determination of antimicrobial activity

TECHNIQUES OF HERBAL ANALYSIS

1. Separation of phytocompounds by TLC method
2. Running of SDS-PAGE
3. Preparation of column chromatography
4. HPLC-demonstration
