



CIRCULAR NO.SU/Sci. & Tech./Colleges./NEP/24/2023

It is hereby inform to all concerned that, the syllabi prepared by the Board of Studies & Ad-hoc Boards and recommended by the Dean, Faculty of Science & Technology, the Hon'ble Vice-Chancellor has accepted **the following curriculum of Post Graduate Degree Courses as per Norms of National Education Policy – 2020 under the Faculty of Science & Technology run to the Affiliated Colleges, Dr.Babasaheb Ambedkar Marathwada University** in his emergency powers under section 12(7) of the Maharashtra Public Universities Act, 2016 on behalf of the Academic Council as appended herewith.

Sr.No.	Syllabi of Affiliated Colleges under BAMU, Aurangabad.	Semester
1.	M.Sc.Chemistry Specialization: Analytical Chemistry, Inorganic Chemistry, Physical Chemistry, Organic Chemistry, Polymer Chemistry and Drug Chemistry.	Ist and IInd Semester
2.	M.Sc.Electronics	Ist to IVth Semester
3.	M.Sc.Herbal Technology	Ist to IVth Semester
4.	M.Sc.Industrial Chemistry	Ist and IInd Semester
5.	MCA(Science)	Ist and IInd Semester

This is effective from the Academic Year 2023-24 and onwards.

All concerned are requested to note the contents of this circular and bring the notice to the students, teachers and staff for their information and necessary action.

University Campus,
Aurangabad-431 004.

REF.NO.SU/NEP/2023/10551-59

Date:- 22.08.2023.

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*Deputy Registrar,
Academic Section*

Copy forwarded with compliments to :-

- 1] The Principal of all concerned affiliated Colleges, Dr. Babasaheb Ambedkar Marathwada University,.
- 2] The Director, University Network & Information Centre, UNIC, with a request to upload this Circular on University Website.

Copy to :-

- 1] The Director, Board of Examinations & Evaluation, Dr.BAMU,A'bad.
- 2] The Section Officer,[M.Sc.Unit] Examination Branch,Dr.BAMU,A'bad.
- 3] The Programmer [Computer Unit-1] Examinations, Dr.BAMU,A'bad.
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- 5] The In-charge,[E-Suvidha Kendra], Rajarshi Shahu Maharaj Pariksha Bhavan, Dr.BAMU,A'bad.
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DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY,

AURANGABAD



FACULTY OF SCIENCE & TECHNOLOGY

2 Years P. G. Programme

As per National Education Policy - 2020

Program Structure & Curriculum

(Outcome based Credit System)

Program: Herbal Technology

(Effective from 2023-24)

(Dr. S. S. Bhusari)
Chairman

Adhoc-Board
Herbal Technology

Two-Year Post-graduate Program

Course and Credits Distribution of Two years/One Year PG/Master's Degree Program with

Entry & Exit Option

Faculty of Science & Technology

Year / level	Sem.	Major subject		RM	OJT /FP	RP	Credits	Degree
		DSC Core Mandatory	DSE (Elective)					
First year 6.0	I	3(4) +2=14	4	4			22	PG Diploma (after 3 years degree)
	II	3(4) +2=14	4		4		22	
Cum. Cr. For PG Diploma		28	08	4	4		44	
Exit option with Post-graduate Diploma (44 credits) after first year or two semester with completion of courses equivalent to 44 credits								
Secon d Year 6.5	III	3(4)+2=14	4			4	22	PG Degree after 3 years UG or PG Degree after 4 years UG
	IV	3(4)=12	4			6	22	
Cum. Cr. For 1 year PG Degree		26	8			10	44	
Cum. Cr. For 2 years PG Degree		54	16	4	4	10	88	
2 Years -4 sem.PG Degree (88 credits) after three year UG Degree or 1 Year -2 sem. PG Degree (44 credits) after four year UG degree								



(Dr. S. S. Bhushan)
Chairman

Adhoc Board - Herbal Technology

ABBREVIATION:

Major – Comprising Mandatory –is based on specialization

DSE- Discipline Specific Elective

OJT – On-the- Job Training

FP – Field Project (Corresponding to the Major (Core) Subject

RP – Research Project (Corresponding to the Major (Core) Subject

Internship/Apprenticeship - (Corresponding to the Major (Core) Subject

AS PER NEP 2020

Illustrative Credit distribution structure for Two Years/One Year Programme with Multiple Entry and Exit options –

Class: M.Sc. First Year

Semester: 1st Semester

Subject: HERBAL TECHNOLOGY

Co urse type	Course Code	Course Name	Teaching Scheme (Hrs./ week)		Credits Assigned		Total Credits
			Theory	Practical	Theory	Practical	
Major Mand atory DSC	HT/MJ/500	Introduction to herbs	2	-	2	-	14
	HT/MJ/501	Herbal Processing	2	-	2	-	
	HT/MJ/502	Isolation & Separation Techniques	2	-	2	-	
	HT/MJ/503	Photochemistry	2	-	2	-	
	HT/MJ/504	Practical based on HT/MJ/500	-	4	-	2	
	HT/MJ/505	Practical Based on HT/MJ/501	-	4	-	2	
	HT/MJ/506	Practical based on HT/MJ/502	-	4	-	2	
DSE (Choo se any one from pool of course s)	HT/DSE/507- 8	DSE -1-A	2	-	2	-	04
		DSE -1-A	-	4	-	2	
RM	HT/RM/509	RM	4	-	4	-	04
			14	16	14	08	22 credits

HT/DSE/507: Ancient Indian Herbal Technology

HT/DSE/508: Food and water analysis


(Dr. S. S. Bhudani)

(Chairman

Adhoc. Board Herbal Technology

Introduction to Herbs (Theory)

Code: HT/MJ/500

Credits: 2

Contact Hours: 2 Hrs./Week

Course Objectives:

1. To provide knowledge about classification and nomenclature of plants
2. To explain process of herbal cultivation to the students
3. To enrich students with knowledge of tissue culture and crude drug classification

Course Outcomes:

1. Students would understand the plant classification and its nomenclature
2. Student would be able to understand the process of herbal cultivation
3. Student would be able to know about tissue culture and crude drug identification

Syllabus

UNIT I.

Classification and Nomenclature:

Bentham and Hooker's Classification system, Concept of Nomenclature, Plant identification methods Study of some plants from following families:

- 1) Papaveraceae 2) Brassicaceae 3) Meliaceae 4) Apocynaceae
5) Lamiaceae 6) Verbenaceae 7) Euphorbiaceae 8) Liliaceae.

UNIT II.

Conservation of Herbs:

Ex-situ and in-situ conservation of medicinal plants.

Herbal Cultivation I:

Systematic method of cultivation and post harvest technology of medicinal plants, Cultivation of following plants in India. Lemon grass, Aswagandha, Senna, Ispaghula, Opium, Turmeric and Ginger.

Herbal Cultivation II:

Exogenous and endogenous factors influencing the production of crude drugs, plant growth regulators (Auxins, Gibberelins, Cytokinins, Abscissic acid, Ethylene). Pest and weed control, Disease management of medicinal and aromatic plants.

Dietary antioxidants in disease prevention. Nutraceuticals.

UNIT III.

A} Study of medicinal plant parts:

The cell- Definition, structure, morphology, function, cell inclusions.

Plant tissue :- Classification, types – i) Meristmatic, ii) Permanent-

a) Simple tissues (Epidermis, Parenchyma, Sclerenchyma, Collenchyma, Cork)

b) Complex tissues: (Xylem, Phloem, Secretary)

B} Crude drugs and its classification :

i) Alphabetic – classification ii) Taxonomic classification.

iii) Morphological classification iv) Chemical classification.

iv) Pharmacological classification vii) Chemotaxonomic classification.

Herbal Processing (Theory)

Code: HT/MJ/501

Credits: 2

Contact Hours: 2 Hrs./Week

Course Objectives:

1. To provide in-depth knowledge of particle size analysis and its importance to the students
2. To aware the students about handling of solid plant material
3. To provide the details of equipment used for handling of solid plant materials
4. To make the students understand about filtration, filtration mechanisms and filtration aids

Course Outcomes:

1. Students would know particle size and its importance in herbal processing
2. Student would be able to know about handling of solid plant materials
3. Students would be able to know about various equipment used in handling of solid plant material
4. Student would be able to understand the filtration process, its mechanisms and its aids

Syllabus

UNIT I.

Particle size analysis: Particle size measurement Screen analysis – Differential, Cumulative analysis, Screening – Definition, types of Screening equipments – Grizzlies Trommels, constriction and working, Vibrating Screen – Principles and operations, variables in Screening operations, material balances over Screen, effectiveness of Screen, capacity of Screens.

UNIT II.

Handling of solids: Size reduction equipments-Crushers-Blake jaw crusher Dodge jaw crusher, Gyratory crusher(Principles constriction and working) Smooth Roll crusher, Grinders- Hammer Mill, Ball Mill (Principles constriction and working) comparison of crushing and Grinding operations. Ultra line grinder (Principles constriction and working), Classifying Hammer Mill

UNIT III.

Equipment for solid handling: Classification, Gravity settling tank, cone classifier, double cone classifier, mechanical classifier – Rake, spiral cyclone separator, liquid cyclone (hydrocyclone), Jigging-principles and operations, Hydraulic Jig (Principles construction and working) Electrostatic and magnetic separators – drum, pulleys, Tabling for shaking, Reffled tables (construction and working).

UNIT IV.

Fluid–solid systems: Filtration – Definition, principles, types – constant pressure filtration and constant rate filtration, characteristics of filter medium, pressure filter vacuum filter (advantages and disadvantages) Plate and Frame press filter - construction , working advantages and disadvantages, Rotary drum filter, Leaf filter, Moore filter, Rapid sand filter, pressure sand filter, (construction , working advantages and disadvantages) centrifuge filtration, suspended batch centrifugal (construction , working) Sedimentation - Definition, principles, laboratory batch sedimentation test, Thickener

Isolation and Separation Techniques (Theory)

Code: HT/MJ/502

Credits: 2

Contact Hours: 2 Hrs./Week

Course Objectives:

1. To impart knowledge of extraction and distillation to the students
2. To aware the students about basics of chromatography
3. To impart knowledge of column, Gas and Ion-exchange chromatography to the students
4. To make the students understand about HPLC, its principle, instrumentation and applications

Course Outcomes:

1. Students would get the knowledge of extraction and distillation with respect to plant material
2. Student s would understand the basics of chromatography
3. Students would know about column, Gas and Ion-exchange chromatography
4. Students would understand the HPLC and its role in analysis

Syllabus

UNIT I.

General techniques of Isolation and Separation:

A}-Solvent extraction: Introduction, principle of solvent of extraction, mechanism of solvent extraction, techniques of extraction such as Batch extraction, Stripping or Back extraction, Continuous extraction, counter-current extraction, extraction of solids, applications of solvent extraction.

B}-Distillation : Introduction, Principle of distillation process, types of distillation, experimental details of simple distillation, steam distillation, fractional distillation, distillation under reduced pressure and vacuum distillation and its applications.

UNIT II.

A}-Chromatography: Introduction, types of chromatography, theoretical principle underlying chromatographic techniques, Classification of chromatography, theories of chromatography, (Plate theory and Rate theory).

B}-Column chromatography:

Introduction, Principles, Experimental details, theory of development, column efficiency, factors affecting column efficiency and its applications.

UNIT III.

A}-Gas chromatography: Introduction, principle of gas chromatography, instrumentation, evaluation, retention volume, resolution, branches of gas chromatography, applications, introduction to head space gas chromatography

B}-Ion exchange chromatography: Introduction, definition, principal, cation and anion exchangers, use of exchange columns, technique and applications

UNIT IV.

High Performance Liquid Chromatography (HPLC): Introduction, Principle, instrumentation, apparatus and materials, column packing procedure, chromatography solvent (mobile phase), pumping system, detector system, comparison of high performance liquid chromatography and gas chromatography, applications.

Phytochemistry

(Theory)

Code: HT/MJ/503

Credits: 2

Contact Hours: 2 Hrs./Week

Course Objectives:

1. To introduce the details of phytochemical studies of plant material to the students
2. To enable students to elucidate the chemical structures of the phytoconstituents
3. To aware the students about vital phytochemicals present in variety of plants

Course Outcomes:

1. Students would understand the need of phytochemical studies
2. Students would be able to elucidate the chemical structures of the phyto-constituents
3. Students would know about vital phytochemicals present in the variety of plant materials

Syllabus

UNIT I.

Phytochemical study:

A)Introduction, Occurrence, Chemistry, Isolation and chemical tests of the following natural products—Alkaloids, Plant Resins and plant phenol, Terpenes and Terpenoids, Steroids and bile acids, Fatty acids, Vitamins, Purines and Pyrimidines, Nucleic acids, Carotenoids, Anthocyanins, Flavones, Lipids and Phospholipids.

B)Biogenesis of the natural products Alkaloids, Terpenes and Terpenoids, Steroids, Amino acids.

UNIT II.

Elucidation of Structure of the following phytoconstituents: Terpenes – Citral, Camphor, Lorcione, α – pinene, Steroids – Cholesterol, Alkaloids – nicotine, atropine, morphine, piperine, zingerone and papaverine, Caffeine, flavones, vitamin- B₁, vitamin – B₂, vitamin-B₃, penicillin and Cephalosporin, Chlorophyll, α -carotene, β -carotene and amygdalin

UNIT III.

Phyto-pharmaceuticals of the following therapeutic classes:

- 1) Anticancer-----*Catharanthus roseus* (Apocynaceae)
- 2) Hepatoprotective ----- (Antihepatotoxins) *Zingiber officinale* Zingiberaceae
- 3) Cardio sascular system ---- *Digitalis purpuria* (Scrophulariaceae)- Foxglove leaf
- 4) Immunomodulator ----- (Immunostimulants) *Echinacea pallida* (Asteraceae)
- 5) Neuropharmacological --- -*Passiflora incarnata* (Passifloraceae) Passion flower
- 6) or central nervos system----*Papaver somniferum* (Papaveraceae) – Opium.
- 7) Antiviral -----*Allium sativum* (Liliaceae)
- 8) Urinary disorders -----*Arctostaphylos uva-ursi* (Ericaceae) – Bearberry
- 9) Antidiabetic -----*Momordica charatia* (Cucurbitaceae) – Karela
-*Gymnema sylvestris* (Asclepedaceae)
- 10) Anti-inflammatory -----*Curcuma domestica* (Zingiberaceae)
-*Aloe vera*(Liliaceae)

Introduction to Herbs

(Practical)

Code: HT/MJ/504

Credits: 2

Contact Hours: 4 Hrs./Week

Course Objectives:

1. To learn herbarium preparation
2. To perform the studies pertaining to morphological characters of flowering plants
3. To perform the histo-chemical tests of plant materials
4. To learn the preliminary phytochemical investigation

Course Outcomes:

1. Students would be able to prepare herbarium of a plant
2. Students would be able to understand the morphology of the flowering plants
3. Students would be able to perform the histo-chemical tests
4. Students would be able to perform the preliminary phytochemical investigation

Syllabus

- 1} Study of herbarium
- 2} Study of morphological characters of some flowering plants
- 3} Study of following families
 - 1) Papaveraceae- *Argemone Mexicana*
 - 2) Malvaceae- *Hibiscus rosa – sinensis*
 - 3) Meliaceae- *Azadiracta indica*
 - 4) Cruciferae - *Brassica compestris*
 - 5) Cyperaceae- *Cyperus flabelliformis*
 - 6) Verbenaceae - *Lantana indica*
 - 7) Acanthaceae- *Adhatoda vasica*
 - 8) Labiateae- *Ocimum basilicum*
 - 9) Apocynaceae- *Catharanthus roseus*
 - 10) Asclepiadaceae- *Calotropis procera*
 - 11) Poaceae- *Triticum aestivum*
- 4} Identification and mounting of pollen grains (Acetolysis method)
- 5} Identification of plants up to species by using flora (flora of Bombay, flora of Marathawada)
- 6} Students should undertake excursion to ecologically different areas for plant study and submission of at least 10 wild plants herbarium at the time of examination.

(Practical)

Credits: 2

Course Objectives:

1. To learn preparation of herbs form further process
2. To learn understand machinery
3. To perform the which type of plant materials use for drug

1. Students would be able to prepare herbal plant part cleaning.
2. Students would be able to understand machinery which is use in herbal processing
3. Students would be able to operate herbal drug processing system

- 1) Study of histo-chemical tests :-1) Protein 2) Carbohydrates 3) Lipids
4) Starch 5) Cellulose 6) Hemi cellulose 7) Lignin 8) Tannin
- 2) Study of marine Biomedicals: - 1) Agar 2) Spirulina 3) Shark liver oil 4) Cod liver oil
- 3) Study of some dry drug materials
1) Clove 2) Ginger 3) Coriander 4) Vasaka 5) Black peper 6) Datura
- 4) Study of some Dietary Nutrients:- 1) Egg 2) Milk 3) Dietary fibres 4) Soyabean
- 5) Study how to screen plant material for process
- 6) Study and use plant material in Rotary drum filter.
- 7) Study of some herbal plant part standardization of technique
- 8) Demonstration of equipments-Crushers-Blake jaw crusher Dodge jaw crusher

Isolation & Separation Techniques (Practical)

Code: HT/MJ/506

Credits: 2

Contact Hours: 4 Hrs./Week

Course Objectives:

1. To develop skills to prepare extracts/fractions/sub-fractions
2. To learn purification techniques
3. To develop skills to deal with non-targeted plant material

Course Outcomes:

1. Students would be able to prepare extracts/fractions/sub-fractions
2. Students would be able to purify the extracts/fractions/sub-fractions
3. Students would be able to handle and deal with non-targeted plant material

Syllabus

1. Preparations of various extracts of plant materials by conventional techniques
2. Development of finger-prints of various extracts using conventional/non-conventional methods
3. Fractionation of extracts using open column chromatography
4. Identification of fractions of extracts using conventional/non-conventional techniques
5. Sub-fractionation of the material using conventional/non-conventional techniques
6. Characterization of the sub-fractioning using conventional/non-conventional techniques

Ancient Indian Herbal Technology

(Theory)

Code: HT/DSE/507

Credits: 2

Contact Hours: 2 Hrs./Week

Course Objectives:

1. To make the students understand thoroughly the principles, preparations of medicines of various Indian systems of medicine like Ayurveda, Siddha, Homeopathy and Unani.
2. To focus on clinical research of traditional medicines, quality assurance and challenges in monitoring the safety of herbal medicines.

Course Outcomes:

1. Students would be able to understand the basic principles of various Indian systems of medicine
2. Students would know the clinical research of traditional medicines, Current Good Manufacturing Practice of Indian systems of medicine and their formulations.

Syllabus

Unit-I:

Fundamental concepts of Ayurveda systems of medicine, Herbal cosmetics in ancient India

Unit-II:

Different dosage forms of the Ayurveda systems of medicine. Indians and was practiced with the help of natural resources

Unit-III:

Ancient processing of the plant materials for the preparation of Different dosage forms of the Ayurveda systems of medicine

Food and water analysis

(Theory)

Code: HT/DSE/508

Credits: 2

Contact Hours: 2 Hrs./Week

Course Objectives:

- 1) To develop skills about food quality
- 2) To develop skills water quality
- 3) To develop skills about adulteration identification

Course Outcomes:

- 1) Students should identified food and drug which is adulterated or not.
- 2) Students should have skill about water quality.
- 3) To develop a knowledge about market adulteration if drug

Syllabus

UNIT I.

Food :- Introduction of food, general constituents of food. Types study of preservative color and antioxidant and method of estimation. Adulteration;- Introductio, types, test for adultrance.

Introduction slandered composition and analysis of food e.g. wheat, berad biscuits jam, jelly, honey, milk, ice cream, butter, cheese, milk powder, oils, tea, coffee, beverages, soft drinks, serial, pulse, vegetables, egg, fish and meat.

Technique of analysis: - introduction of instrumental and non- instrumental analysis method and application

UNIT II.

Water analysis:- Introduction of chemical nature of water, water resources, water quality standards, chemical parameter, significance of odor, temperature, turbidity, density, solid hardness, acidty, alkalinity, dissolve oxygen (BOD and COD),

AS PER NEP 2020

Illustrative Credit distribution structure for Two Years/One Year Programme with Multiple Entry and Exit options –

Class: M.Sc. First Year

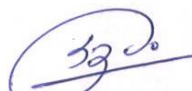
Semester: IInd Semester

Subject: HERBAL TECHNOLOGY

Course type	Course Code	Course Name	Teaching Scheme (Hrs./ week)		Credits Assigned		Total Credits
			Theory	Practical	Theory	Practical	
Major Mandatory DSC	HT/MJ/50	Herbal Products	2	-	2	-	14
	HT/MJ/51	Herbal Post Harvest Technology	2	-	2	-	
	HT/MJ/52	Herbal Biotechnology	2	-	2	-	
	HT/MJ/53	Analytical Techniques	2	-	2	-	
	HT/MJ/54	Practical based on HT/MJ/500	-	4	-	2	
	HT/MJ/55	Practical based on HT/MJ/501	-	4	-	2	
	HT/MJ/56	Practical based on HT/MJ/502	-	4	-	2	
DSE (Choose any one from pool of courses)	HT/DSE/557-58	DSE -1-A	2	-	2	-	04
		DSE -1-A	-	4	-	2	
			10	16	10	08	18 credits

HT/DSE/557: Herbal Use in Cosmetics

HT/DSE/558: Herbs and Drug Action


 (Dr. S. S. Bhusari)
 (Chairman)

Adhoc Board Herbal Technology

Herbal Products

(Theory)

Code: HT/MJ/550

Credits: 2

Contact Hours: 2 Hrs./Week

Course Objectives:

- 1.To know about importance of Churn and Kwath in herbal drug technology.
- 2.To enrich students about applications of Vati, Ksheera Paka, Tablets formulations in herbal drugs.
- 3.To discuss the Indian system of medicine and the scope, history of Indian system of medicine to students.
- 4.To learn about pharmaceutical instruments used in herbal products development and there internal and external applications.

Course Outcomes:

- 1.The students would understand about Churn and Kwath with there various classification and advantages in herbal drug technology.
2. The students would be able to classify between Vati, Ksheera Paka, Tablets formulations in herbal drug technology.
- 3.The students would get aware of scope and history on Indian system of medicine.
- 4.The students would acquire knowledge about internal and external applications of pharmaceutical instruments used in herbal drug technology.

Syllabus

UNIT I.

Internal applicants: -

A) Churn- Definition, precautions, advantages, disadvantages, and classification based on size particles, procedure and components of

a) Hingwashtaka b) Lavana Bhaskar c) Sitopaladi

B) Kwath- Definition, classification, based on pharmacotherapeutic effect, procedure and components of

a) Rasonadi kwath b) Punarnavashtaka kwath

UNIT II.

Internal applicants: -

A) Vati - a) Sanjivani vati b) Lavangadi vati c) Rasonadi vati.

B) Ksheera Paka- Procedure and components of a) Arjuna Ksheera Paka b) Rasana Ksheera Paka

C) Tablets - Definition, classification, Tablet binders, manufacturing methods. a) Wet granulation
b) Dry granulation c) Direct compression and d) coating of tablets

UNIT III.

A) Indian systems of medicine:- a) Agurveda b) Homeopathy c) Yoga d) Unani e) Siddha f) Naturopathy

B- Scope and history of- a) Pharmacy b) pharmacopoeia c) Pharmacognosy d) Pharmacodynamics

UNIT IV.

A) Pharmaceutical instruments: - a) Grinder b) Granulator c) Mixer- types, classification i) Liquid mixers ii) Solid mixers, iii) semi solid mixers d) Pulvarizer e) Micropulvarizer

B) Internal and external applicants:-

Internal - i) Kalp, Pakk, Asav, Arista, , Arka, Bhasms, Avaleha.

External - i) Glycerol, Ointment, Linment, Lotions, Cerates, Poultice

Herbal Post Harvest Technology

(Theory)

Code: HT/MJ/551

Credits: 2

Contact Hours: 2 Hrs./Week

Course Objectives:

1. To make students familiar with Post harvest technology in herbal drug technology.
2. To know basic principles used in herbal drying and know their importance and its types.
3. To enable students to use various herbal dryers used for drying in herbal drug technology with proper understanding.
4. To acquire the proper knowledge of herbal packaging and handling.

Course Outcomes:

1. The students would learn the concept of Post harvest technology in herbal drug technology.
2. The students would learn principles and types of drying techniques in herbal technology.
3. The students would be capable of handling various dryers used in herbals.
4. The students would get knowledge about herbal packaging and handling.

Syllabus

UNIT I.

Post Harvest Technology:- Introduction, definition, principal, history, priorities and strategy, steps, components, potential of income and employment, qualitative and quantitative losses, problems occurring in harvesting, threshing, transport etc.

UNIT II.

Herbal Drying : Principal, importance of drying, Types of drying i) Conduction drying ii) Convection drying iii) Radiation drying a) Sun drying b) Infra-red drying c) Radiation convection drying iv) Mechanical drying v) Chemical drying vi) Vacuum drying vii) Freeze drying. Comparison of conventional and freeze dehydration, effects of parameters on drying – Temperature, Air velocity, Relative humidity, Moisture contents etc. Characterization of drying– High temperature and low temperature.

UNIT III.

Herbal Dryers : Introduction, Types of dryers - i) Batch dryer ii) Continuous flow-columnar dryer iii) Recirculatory batch dryer – construction, operation, advantages and disadvantages iv) Baffle dryer – construction, operation, advantages and disadvantages. v) Horizontal rotary dryer – construction, operation, advantages and disadvantages. vi) Spray dryer – Types, operation, advantages and disadvantages vii) Tray dryer, viii) Tray freeze dryer, ix) Accelerated freeze dryer, x) Vacuum dryer xi) Infra-red dryer xii) solar dryer and solar energy utilization xiii) Solar cabinet dryer xiv) Sack dryer

UNIT IV.

Herbal Packaging and Handling:- Packaging requirement, packaging systems, packaging materials, moisture resistant materials (polyvinyl films, aluminium foil, polythene films), porous packaging materials, moisture proof materials, packaging machines, bagging scales, bag sewing machines, value-pack bags, Handling bags during packaging, Use of scale for weighing, platform scales, bagging scales, and Bagger-weigher (manual, automatic, semi-automatic) Filling of packages and process of packaging. Package labeling and recording, system of identifying lot numbers.

Herbal Biotechnology (Theory)

Code: HT/MJ/552

Credits: 2

Contact Hours: 2 Hrs./Week

Course Objectives:

1. To understand the fundamentals of Genetics and Molecular biology used in herbal biotechnology.
2. To study various methods of quality improvement techniques such as Plant breeding, hybridization used in herbal crops.
3. To study definition, classification and applications of mutation breeding in crop improvement and tissue culture in crop improvement.
4. To understand basics of germplasm conservation and various types in herbal biotechnology

Course Outcomes:

1. The students would understand the concept of Genetics and Molecular biology used in herbal biotechnology.
2. The student would acquire knowledge about quality improvement techniques used in herbal crops.
3. The student would understand about definition, classification and applications of mutation breeding in crop improvement and tissue culture in crop improvement.
4. The student would get knowledge of germplasm conservation and its various types used in herbal biotechnology.

Syllabus

UNIT I.

Genetics and Molecular Biology:-

A) Nucleic acid- DNA: structure, Chemical composition, replication of DNA, Recombinant DNA technology- principles, tools, applications & advantages.

B) Nucleic acid- RNA- structure and functions of tRNA, mRNA, RrnaGenetic code- nature, properties and genetic code dictionary.

UNIT II.

Quality improvement of Herbal crops:-

A) Plant Breeding: - Introduction, definition, history, nature, objectives, activities, types of selection i) Natural ii) Artificial (mass, pure line, clonal)

B) Hybridization :- Definition, objectives, techniques, and steps i) Selection of parents ii) Isolation iii) Emasculation iv) Bagging v) Collection and storage of pollen vi) Crossing vii) Labeling viii) Releasing

UNIT III.

A) Mutation breeding in crop improvement:- Definition, classification, types – Spontaneous and induced mutations, causes & practical applications, breeding procedure, effects on survival, limitations and applications

B) Tissue Culture in crop improvement: - a) Types- cell culture, embryo culture, meristem culture, anther culture. Techniques and applications of callus, suspension, haploid embryo, and organ culture.

UNIT IV.

A) Germplasm conservation :- Introduction, Germplasm material types, Gene pool concept, genetic erosion, germplasm regeneration, activities of germplasm conservation 1) Collection 2) Conservation (in- situ and Ex- situ) 3) Evaluation 4) Cataloguing 5) Multiplication and distribution 6) Utilization 7) Future activities.

B) Organogenesis, Embryogenesis, Somaclonal variation, Micro propagation.

Protoplast isolation, fusion, selection and culture, Biotransformation, Somatic hybridization

Analytical Techniques

(Theory)

Code: HT/MJ/553

Credits: 2

Contact Hours: 2 Hrs./Week

Course Objectives:

1. To make students familiar with the principles of quantitative estimation using UV-visible spectroscopy.
2. To enable students to use spectrometers with proper understanding.
3. To enable students to use IR spectrometers with proper understanding.
4. To give an understanding of structure elucidation of pure isolated phytoconstituents Theory and Problem solving, using spectral analysis such as UV, IR, Mass spectroscopy, NMR etc. which can be used for characterization of bioactive phytoconstituents from herbal sources.

Course Outcomes:

1. The students would get the knowledge learnt in developing new analytical procedures of the research work.
2. The students would understand principles and techniques of various types of spectroscopy such as UV, IR, NMR and Mass Spectroscopy etc..
3. The students would get skills regarding structure elucidation of pure isolated phytoconstituents - Theory and Problem solving, using spectral analysis such as UV, IR, Mass spectroscopy, NMR etc. which can be used for characterization of bioactive phytoconstituents from herbal sources.

Syllabus

UNIT I.

Spectroscopy : UV visible spectroscopy: Introduction, Principle, mode of electronic transition, terms used in UV spectroscopy, double beam UV – spectrophotometer and its components, types of detectors, woodward-fischer rule, effect of conjugation, solvent effect and their choice, effect of pH, applications of UV and problems.

UNIT II.

Spectroscopy : IR Spectroscopy:- Introduction, theory, Instrumentation, types of molecular vibrations, interpretation of IR spectra, functional group and finger print regions, fundamental vibrations and over tones, selection rule, effect of solvent on frequency group shifts, characteristic absorptions frequencies of various functional groups in organic molecules interpretation of IR spectra of some representative compounds, FTIR spectroscopy.

UNIT III.

NMR Spectroscopy:

A) Proton magnetic resonance (PMR) Spectroscopy:- Introduction, Principle, instrumentation chemical shifts, internal standards, shielding and deshielding, an isotropic effect, equivalence and non equivalence protons, spin- spin splitting, multiplicity coupling constant, integration application, interpretation of PMR spectra of some representative compounds, COSY and NOE spectra.

B) 13- Carbon magnetic resonance (CMR) Spectroscopy:- Introduction, Natural abundance, ^{13}C -NMR spectra – a general study, operating frequency, multiplicity, decoupled spectra, complete removal of 13-C-H coupling, off resonance decoupling, chemical shift, Chemical shift equivalence, and DEPT ^{13}C spectra.

UNIT IV.

Mass Spectroscopy: -Introduction, theory, instrumentation, fragmentation, types of ions and peaks, McLafferty rearrangement, interpretation of mass spectrum, initial examination and confirmation of structures. Some problems pertaining NMR, IR, UV and Mass spectroscopy

Herbal Products

(Practical)

Code: HT/MJ/554

Credits: 2

Contact Hours: 4 Hrs./Week

Course Objectives:

1. To develop skills to prepare various phyto-formulations
2. To develop skills to standardize the phyto-materials
3. To learn the handling of laboratory equipment

Course Outcomes:

1. Students would be able to prepare various phyto-formulations
2. Students would be able to standardize the phyto-materials
3. Students would be able to handle the laboratory equipments

- 1) Preparation of internal applicants from the provided material
 - 1) Kwath
 - 2) Syrup
 - 3) Churn
 - 4) Watti
 - 5) Squash
- 2) Preparation of external applicants from the provided materials
 - 1) Lotion
 - 2) Cerates
 - 3) Poultices
 - 4) liniment
- 5) Ointments for wounds
- 6) Burns
- 3) To study the standardization techniques
 - a) Morphologivcal- Leaf, Flower
 - b) Microscopic- Palisade ratio, stomata, Tricheme
- c) Physical- Ash value, Mositure contents
- 4) Study of the some crude drugs
 - 1) Ajowan
 - 2) Turmeric
 - 3) Harda
 - 4) Behra
- 5) Study of the some laboratory instruments
 - 1) Oven
 - 2) Microscope
 - 3) Auto clove
 - 4) pH meter

Herbal Post Harvest Technology
(Practical)

Code: HT/MJ/555

Credits: 2

Contact Hours: 4 Hrs./Week

Course Objectives:

1. To develop skill for herbal material packaging
2. To develop skill for marketing of herbal drug
3. To develop skill for different storage systems

Course Outcomes:

1. Students would be able to packaging drug material
2. Students would be able to identification of different diseases and quality control
3. Students would be able understand marketing knowledge

Syllabus

- 1) Study about different type packaging
- 2) Study about different type of Storages, identification of pests and diseases.
- 3) Study about determination of physiological loss in weight in herbs
- 4) Study product evaluation and quality control
- 5) Study post-harvest disorders in produce
- 6) Study drying transport and distribution
- 7) Visit to markets, packaging houses and cold storage units.

Herbal Biotechnology (Practical)

Code: HT/MJ/556

Credits: 2

Contact Hours: 4 Hrs./Week

Course Objectives:

1. To develop skill investigate herbal product
2. To develop skill preservation herbal drug
3. To develop skill about advanced biotechnology

Course Outcomes:

1. Students would be able to investigate herbal bioactive compound.
2. Students would be able to adopt plant hybridization techniques
3. Students would be able to germplasm preservation by advanced techniques.

Syllabus

- 1) Investigation of medicinal plants and bioactive compound
- 2) Demonstration of isolation and of nucleic acid (DNA/RNA)
- 3) Study about hybridization in herbal plants
- 4) Study mutation breeding in herbal plants
- 5) Study role of tissue culture in crop improvement
- 6) Study about germplasm preservation techniques

Herbs Use in Cosmetics (Theory)

Code: HT/DSE/557

Credits: 2

Contact Hours: 2 Hrs./Week

Course Objectives:

1. To understand herbal cosmetic manufacturing
2. To understand pre-formulation requirements of herbal cosmetics
3. To understand various formulations of herbal cosmetics
4. To understand the safety assessment of the herbal cosmetics

Course Outcomes:

1. Students would be able to understand herbal cosmetic manufacturing
2. Students would be able to understand pre-formulation requirements of herbal cosmetics
3. Students would be able to understand various formulations of herbal cosmetics
4. Students would be able to understand the safety assessment of the herbal cosmetics

Syllabus

Unit-I:

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

Unit-II:

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

Unit-III:

Herbal Cosmetics : Physiology and chemistry of skin and pigmentation, hairs, scalp, lips and nail, Cleansing cream, Lotions, Face powders, Face packs, Lipsticks, Bath products, soaps and baby

product, Preparation and standardisation of the following : Tonic, Bleaches, Dentifrices and Mouth washes & Tooth Pastes, Cosmetics for Nails.

Unit-IV:

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

Unit-VI:

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

Herbs and Drug Action (Theory)

Code: HT/DSE/558

Credits: 2

Contact Hours: 2 Hrs./Week

Course Objectives:

- 1) To develop skill about ecology related to herbs
- 2) Develop skill to know active compound present
- 3) to develop skill about identification diseases for proper treatment.

Course Outcomes:

- 1) Students would be able to identify proper diseases, deficiency and different types of allergies
- 2) Students would be treat patient.
- 3) Students would be able know active compound and its action.

Syllabus

Unit I.

Terminologies – Definitions – Classification of medicinal plants based on their effects – Ecological status with special reference to India.

Unit II.

Allergens – types – sources – active principles – Chemical nature – Cell modifiers – Lectins – mutagens, teratogens – Allergic reactions with known examples.

Unit III.

Drugs acting on brain and nervous system – Rheumatic arthritis – Psychoactive drugs – Depressants, Stimulants, hallucinogens – sources, effects, basic mechanism of action.

Unit IV.

Cardiovascular diseases – blood pressure – cardiac drugs of plant origins – alkaloids, anticoagulants – basic mechanism of action. Pulmonary / respiratory disorders – asthma – bronchitis – common cold – allergy – Remedy from plants.

Unit V.

Drugs for urinogenital disorders – roots of *Withania somnifera* – Memory stimulants – *Centella asiatica* – Drugs for dissolving kidney stones – *Musa paradisiaca* (pseudostem) – Antiinflammatory drugs – *Cardiospermum* – Anticancer drugs – *Catharanthus roseus*.

AS PER NEP 2020

Illustrative Credit distribution structure for Two Years/One Year Programme with Multiple Entry and Exit options –

Class: M.Sc.Second Year

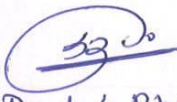
Semester: IIIrd Semester

Subject: HERBAL TECHNOLOGY

Course type	Course Code	Course Name	Teaching Scheme (Hrs./ week)		Credits Assigned		Total Credits
			Theory	Practical	Theory	Practical	
Major Mandatory DSC	HT/MJ/600	Herbal Trade and IPR	2	-	2	-	14
	HT/MJ/601	Herbal Beverages	2	-	2	-	
	HT/MJ/602	Herbal Business Management	2	-	2	-	
	HT/MJ/603	Pharmacognosy	2	-	2	-	
	HT/MJ/604	Practical based onHT/MJ/600	-	4	-	2	
	HT/MJ/605	Practical based on HT/MJ/601	-	4	-	2	
	HT/MJ/606	Practical based on HT/MJ/602	-	4	-	2	
DSE (Choose any one from pool of courses)	HT/DSE/607-8	DSE -1-A	2	-	2	-	04
		DSE -1-A	-	4	-	2	
			10	16	10	08	18 credits

HT/DSE/607:

HT/DSE/608:


 (Dr. S. S. Bhawari)
 Chairman

Adhoc-Board Herbal Technology

Herbal Trade and IPR
(Theory)

Code: HT/MJ/600

Credits: 2

Contact Hours: 2 Hrs./Week

Course Objectives:

1. To know about collection and stabilization techniques of herbal drugs.
2. To understand definition, characteristic and quality of entrepreneur, concept and types of entrepreneurship development.
3. To develop skills required for marketing and advertising and introduce about entrepreneurship development programme.
4. To gain basic knowledge of intellectual property rights and patent filling.

Course Outcomes:

1. The students would get knowledge of collection and stabilization of herbal drugs with better understanding.
2. The students would understand definition, characteristic and quality of entrepreneur, concept and types of entrepreneurship development.
3. The students would develop skills for marketing and advertising and understand entrepreneurship development programme.
4. The students would develop skills for patent filling through knowledge of IPR with better understanding.

Syllabus

UNIT I.

Collection and stabilization : Cultivation practices, Collection, Harvesting, Drying, Dressing (Garbling), Packing, Preservation and forwarding of crude drugs, Detection of adulterants with reference to anatomical features, quality assurance.

UNIT II.

Entrepreneurship development:

Definition, Characteristic and quality of Entrepreneur, concept and types of Entrepreneur, Factors promoting to Entrepreneur, role and functions of Entrepreneur, Social responsibilities of Entrepreneur, Concept of Entrepreneurship, meaning and importance, Characteristics, barriers, origin and development of entrepreneurship in India, sources of finance technical assistance of Entrepreneurship.

UNIT III.

Marketing and advertising: Legal formalities and provisions, export and import policies with reference to Herbal products and Herbal drugs.

Entrepreneurship development programme (EDP): -Introduction, needs, objectives EDP, role of Government in EDP.

UNIT IV.

IPR and Patenting: Intellectual Property Right: Introduction, history, protection, choice of IPR protection, management, benefits and problems from IPR, IPR in developing countries, Indian response to the IPR. Patent- Introduction, requirements, limits, procedure. Registration of new products and drugs, Indian patent Acts, US patent Acts and European patent Acts, Regulation, Requirement for filling patent, patent protection and patent servicing, Issues in registering Herbal products / Drugs

Herbal Beverages

(Theory)

Code: HT/MJ/601

Credits: 2

Contact Hours: 2 Hrs./Week

Course Objectives:

1. To learn about introduction, scope, types and importance of beverages in human diets.
2. To understand basics about fermentation such as introduction, history, component parts and process, large scale techniques and its improvement and process of fermentation.
3. To understand different types of processes used for different types of beverages used in diet such as fermentation, brewing, distillation.

Course Outcomes:

1. The students would learn about all basics of beverages used in diet.
2. The students would understand basics about fermentation and its processes used in industries for manufacturing of beverages.
3. The students would develop skills through better understanding of theoretical knowledge for different manufacturing processes of beverages.

Syllabus

UNIT I.

Beverages: Introduction, Scope, types and importance in human diets.

Non alcoholic beverages :

Derived from tea, coffee and cocoa. Botanical characters, Climate, soil, cultivation, pruning, plucking, withering, rolling, fermentation, Drying, Grading, Sorting, marketing and production of above beverage plants.

Fruit Juices: Orange, Grape, Mango, Apple, Lemon, Santra, Pine apple, Tomato etc.

UNIT II.

Fermentation : Introduction, History, component parts and process, large scale techniques and its improvement, process of fermentation.

1) Fermentation by Glycolysis– role of microorganisms, growth of industrial fermentation, computer application in fermentation technology, approaches for fermentation.

2) Fermentation by Antibiotics:a) **Penicillin:** Introduction, chemical nature, Biosynthesis, process, recovery and purification.

b) **Streptomycin :** Introduction, medium, process, recovery and purification

UNIT III.

Alcoholic beverages I :-

Fermented beverages: Alcoholic fermentation – Industrial fermentation for alcohol production, enzymes used in fermentation, preparation of ethanol from molasses, barely grains, starch, grapes, mechanism of ethyl alcohol fermentation.

Brewing: - Introduction and process. Wines: classification, chemical composition, types – grape wine, red wine, citrus wine, fruit wine etc.

UNIT IV.

Alcoholic beverages II :- Distilled beverages: Introduction, effects of alcohol on human body.

1) Rum: Introduction, composition, production.**2) Glycerol:** Introduction, uses of glycerol.

Processes – a) Sulphite process b) Cokking lily process.

Herbal Business Management (Theory)

Code: HT/MJ/602

Credits: 2

Contact Hours: 2 Hrs./Week

Course Objectives:

1. To learn about field and farm management and farm financial management through it's different parameters such as introduction, need, importance and planning.
2. To understand and develop skills for herbal business communication and management and utilize it for growth of herbal business.
3. To conduct research to identify new business trends in herbal market and customer needs.
4. To learn more about updated policies for exports and imports through better understanding.

Course Outcomes:

1. The students would acquire skills about field and farm management and farm financial management through it's different parameters such as introduction, need, importance and planning.
2. The students would develop skills for herbal business communication and management and utilize it for growth of herbal business.
3. The students would able to conduct research to identify new business trends in herbal market and customer needs.
4. The students would able to understand newly updated policies for exports and imports through better understanding.

Syllabus

UNIT I.

Farm Management:-

a) Field & Farm Management: Introduction, Definition, need of the farm management, success of manager, scope of farm management, importance of farm management in India, Contract and Integrated farming.

b) Farm Financial Management: Introduction, need of financial management, importance and financial management, role of credit in production and marketing, Repayment plan.

UNIT II.

Herbal Business Communication and Management :- Introduction, types, purpose, skills and classification of communication, organization of management, organizational status, principles of organization, functional organization, commandments of organization, strategy and business organization goals, nature, culture, characteristics and categories of organization development, communication networks in organization.

UNIT III.

Herbal Marketing :- Introduction, definition, concept, meaning, scope, components of market, classification and growth of market, factors affecting rate of market growth concept, products and services of business marketing, marketing practices, marketing challenges in 21st century, nature and skills of marketing, marketing planning, advertising and its effects in marketing.

UNIT IV.

Policy and Prospects of exports and imports :- Introduction, export – import policy – 1997, Negative list of exports and imports, main feature of export – imports policy – 2002 to 2007, current export – import policy, International trade agreements. Business environment in 21st century, business community industrialization, population growth, Economy, knowledge of customer, political, social, cultural, technical and International environment.

Pharmacognosy
(Theory)

Code: HT/MJ/603

Credits: 2

Contact Hours: 2 Hrs./Week

Course Objectives:

1. To understand basic of pharmacognosy such as introduction, history of medicinal and aromatic plants and their importance.
2. To learn about synonyms, biological source collection and cultivation, macroscopic and microscopic characteristics, chemical constituents and uses of medicinal plants.
3. To study different types of medicinal plants with different active constituents such as Drugs containing carbohydrates, glycosides, tannins, lipids, volatile oil, resins and resin combinations and alkaloids.

Course Outcomes:

1. The students would understand basics of pharmacognosy such as introduction, history of medicinal and aromatic plants and their importance.
2. The students would get knowledge of medicinal plants regarding it's synonyms, biological source collection and cultivation, macroscopic and microscopic characteristics, chemical constituents and uses.
3. The students would get familiar with different types of medicinal plants with their active constituents through better understanding.

Syllabus

UNIT I.

A) Introduction, History of Medicinal and Aromatic Plants (MAPs) and their importance
Demand and supply of MAPs in India and world.

B) Synonyms. Biological source Geographical Source, Cultivation practices, Macroscopic characters, microscopic characters, chemical constituents and uses in respect to following medicinal plants.

UNIT II.

a) Drug containing carbohydrates

- 1) Isapgol (*Plantago ovate*) Plantaginaceae.
- 2) Bael (*Aegle marmelos*) Rutaceae.
- 3) Acacia (*Acacia Arabica*) Mimosaceae.

b) Drugs containing glycosides

- 1) Aloe (*Aloe barbadensis*) Liliaceae.
- 2) Liquorice (*Glycyrrhiza glabra*) Leguminosae.
- 3) Shatavari (*Asparagus racemosus*) Liliaceae.

UNIT III.

a) Drugs containing Tannins

- 1) Myrobalan (*Terminalia chebula*) Combretaceae.
- 2) Behda (*Terminalia belerica*) Combretaceae.
- 3) Arjuna (*Terminalia arjuna*) Combretaceae.

b) Drugs Containing lipids

- 1) Castor Oil (*Ricinus communis*) Euphorbiaceae.
- 2) Linseed Oil (*Linum usitatissimum*) Linaceae.
- 3) Sesame oil (*Sesamum indicum*) Pedaliaceae.

UNIT IV.

Drugs Containing Volatile Oil

- 1) Eucalyptus Oil (*Eucalyptus globules*) Myrtaceae.
- 2) Lemon grass oil (*Cymbopogan martini*) Graminae.
- 3) Peppermint oil (*Mentha piperita*) Lamiaceae.
- 4) Coriander (*Coriandrum sativum*) Apiaceae.
- 5) Cinnamon (*Cinnamomum zeylanicum*) Lauraceae.
- 6) Tulsi (*Ocimum sanctum*) Lamiaceae.
- 7) Clove (*Eugenia caryophyllus*) Myrtaceae.

UNIT V.

a) Resins & Resin Combinations

- 1) Asafetida (*Ferula Foetida*) Apiaceae.
- 2) Cannabis (*Cannabis sativa*) Cannbinaceae.
- 3) Guggal (*Commiphora weightii*) Burseraceae

b) Drugs Containing Alkaloid

- 1) Vinca (*Catharanthus roseus*) Apocynaceae.
- 2) Ashwagandha (*Withania somnifera*) Solanaceae.
- 3) Adulsa (*Adhatoda vasica*) Acanthaceae.

Herbal Trade & IPR
(Practical)

Code: HT/MJ/604

Credits: 2

Contact Hours: 4 Hrs./Week

Course Objectives:

- 1) To learn actual herbal product marketing
- 2) To develop skill of herbal business

Course Outcomes:

- 1) Students will learn actual process in direct in company
- 2) Students will learn whole marketing process (Level: - Producer to consumer)

Syllabus

Visit to nearest herbal product Producer Company and submit visit report.

Herbal Beverages

(Practical)

Code: HT/MJ/604

Credits: 2

Contact Hours: 4 Hrs./Week

Course Objectives:

1. To learn alcoholic beverages preparation
2. To learn non-alcoholic beverages preparation
3. To learn the identification methods for adulteration
4. To learn techniques to study the antibiotics

Course Outcomes:

1. Students would be able to prepare alcoholic beverages preparations
2. Students would be able to prepare non-alcoholic beverages preparations
3. Students would be able to identify the adulterations in plant material

- 1) Preparation of alcoholic beverages from the following materials
1) Molasses 2) Barely grains 3) Starch 4) Grapes 5) Sugarcane juice
- 2) Preparation of non – alcoholic beverages from the following materials
1) Orange 2) Grape 3) Mango 4) Apple 5) Tomato 6) Citrus
- 3) Identification of adulteration of food /beverages /powders by chemical tests.
1) Tea 2) Coffee 3) Turmeric
- 4) Study of some antibiotics
1) Streptomycin 2) Penicillin
- 5) Study of some juicy fruits
1) Banana 2) Lemon 3) Santra 4) Mosambi 5) Mango 6) Apple

Herbal Business Management
(Practical)

Code: HT/MJ/606

Credits: 2

Contact Hours: 4 Hrs./Week

Course Objectives:

1. To learn about business aspects of herbal drugs
2. To learn about the techno-economics of herbal business

Course Outcomes:

1. Student would understand the business aspects of herbal drugs
2. Students would be able to understand, learn and implement the techno-economics of the herbal business into actual practice

Syllabus

1. Audio-visual presentation of herbal business management
2. Small and medium scale herbal industry visits
3. Audio-visual online and offline session of techno-economics of the herbal business
4. Visit in national/ international conferences related to herbal business

AS PER NEP 2020

Illustrative Credit distribution structure for Two Years/One Year Programme with Multiple Entry and Exit options –

Class: M.Sc. Second Year

Semester: IVth Semester

Subject: HERBAL TECHNOLOGY

Course type	Course Code	Course Name	Teaching Scheme (Hrs./ week)		Credits Assigned		Total Credits
			Theory	Practical	Theory	Practical	
Major Mandatory DSC	HT/MJ/650	Dissertation	-	20	-	22	22
			-	20	-	22	22 credits

Code: HT/MJ/650

Credits: 22

Contact Hours: 20 Hrs./Week

Course Objectives:

1. To develop hands-on skill set(s) related to herbal technology

Course Outcomes:

1. Student would be able to perform practically in the area of herbal technology

Syllabus

1. To prepare research work proposal related to the herbal technology
2. To perform the research work as per proposal
3. To prepare report of the research work completed
4. To present the research work component


(Dr. S. S. Bhavsari)
Chairman
Adhoc Board - Herbal Technology