

Year: (2022 onwards)

**Aim**

To give the students an idea about the chemical composition of Ayurvedic medicines, various types of medicinal preparations for pharmacological activities, and quality of the formulations both physical and chemical. Separation and extraction of Phytochemicals from the formulations.

**Learning objectives**

1. To get an elementary idea about the origin of drugs from plants and the methods of formulations
2. To study the various physical tests done in the case of ayurvedic formulations
3. To study the various chemical tests done in the case of ayurvedic formulations
4. To familiarise the various extraction, distillation and other modern methods
5. To learn in detail the different instrumental methods used for separation

**Pedagogy**

Lecture cum discussion, video demonstration, group presentations, seminars, assignments, brain storming sessions, peer group discussion, ICT based teaching and learning

**Course outcome statement**

Units	Outcome statement
1	Ayurveda formulations; Preparation of diverse Ayurvedic medicines using various herbs, plants, minerals and animals. The purification of raw materials, 12 types of Ayurvedic medicinal preparation will be studied in this unit.
2	Physical test for Ayurvedic formulations; Determination of quality of the medicine using various physical parameters are discussed here. This unit helps the learner to identify whether the formulation meets quality standards.
3	Chemical test for Ayurvedic formulations; Qualitative and quantitative checking of phytochemical constituents inside the Ayurvedic formulations using various chemical characterization techniques are described in this unit.
4	Extraction methods: Ayurvedic medicine and raw material extraction procedures using various chemicals/ reagents as well as the chemical techniques used for the crude extract are detailed in this unit. Learner can distinguish the chemical methods used raw material and finished ayurvedic medicines depending upon its nature and properties.
5	Separation methods: various separation techniques used for the separation of crude formulations as well as medicinal extracts are portrayed in this unit. The learner can predict which extraction procedure is applicable for the formulation to separate its phytochemicals.

**Unit 1: Ayurveda formulations**

Preparation methods of Asava and Arishta, Arka, Panchavidha Kashaya Kalpana, Guggulu, Ghrita, Tailam, Lehyam, Kshara, Churna, Vati and Gutika. Animal origin drugs, Mineral origin drugs, plant origin drugs, Shodhana (Process of detoxification).

## Unit 2: Physical tests for Ayurvedic formulations

Determination of optical rotation and specific optical rotation, Viscosity, Saponification value, Iodine value, Acid value, Peroxide value, Unsaponifiable matter, Mineral oil, Rancidity, Reichert and Polenske value,

## Unit 3: Chemical test for Ayurvedic formulations.

Estimation of Phenolics, Alkaloids, Tannins, Sugars, Total sugars, non-reducing sugars, Sucrose, Fructose- Glucose ratio, Sulphur Dioxide, Pesticide residue, Volatile oil, fatty oil, Proteins.

## Unit 4: Extraction methods

Maceration, percolation, Decoction reflux extraction, Soxhlet extraction, Pressurised liquid extraction, Supercritical fluid extraction, Ultrasound assisted extraction, Microwave assisted extraction, Pulse electric field extraction, Enzyme assisted extraction, Hydro distillation and steam distillation.

## Unit 5: Separation methods

Adsorption column chromatography, Partition chromatography/Liquid-Liquid extraction, Membrane filtration, Gel-filtration chromatography, Ion exchange chromatography, Molecular distillation, Preparative gas chromatography (Prep-GC), Supercritical fluid chromatography (SFC), Molecular imprinted technology, Simulated moving bed chromatography, Multi-dimensional chromatographic separation

## Textbooks/References

1. The Ayurvedic Formulary of India (AFI) Volume 1& 2
2. A Textbook of Bhaisajya Kalpana Vijana (Pharmaceutical Science) by Ravindra Angadi, ISBN: 9390804639 (ISBN13: 9789390804634)
3. Ayurveda pharmacopeia of India (API) volume 6
4. Zhang et al. Chin Med (2018) 13:20, doi.org/10.1186/s13020-018-0177-x.
5. Separation Methods in Organic Chemistry and Biochemistry, Frank J. Wolf, eBook ISBN: 9781483220680.
6. Green Extraction in Separation Technology, Ali Haghghi Asl, Maryam Khajenoori, ISBN 9781032050409

## Scheme of Evaluation

Sl No	In-semester assessment		End-semester assessment	
1	Periodical Test	30 Marks	End semester examination	50 Marks
2	Assignment	10 Marks		
3	Seminar	10 Marks		
5	Sub Total	50 Marks	50 Marks	
	Grand Total		100 Marks	

**ACTIVITIES/ CONTENT WITH DIRECT BEARING ON EMPLOYABILITY/  
ENTERPRENEURSHIP/ SKILL DEVELOPMENT (based on NAAC Criteria):**

The learner will get a clear understanding of the concepts and ideas regarding the technical and theoretically relevant area which is explored in the course. This course will equip the learner to build a career as a Faculty in Ayurveda and Phytopharmaceutical chemistry, Researcher in the respective field, Analyst in Ayurveda as well as Phytopharmaceutical chemistry firms.