॥ सा विद्या या विमुक्तये ॥

स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड

'ज्ञानतीर्थ', विष्णुपुरी, नांदेड – ४३१ ६०६ (महाराष्ट्र राज्य) भारत

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

'Dnyanteerth', Vishnupuri, Nanded - 431 606 (Maharashtra State) INDIA

स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड

Established on 17th September, 1994, Recognized By the UGC U/s 2(f) and 12(B), NAAC Re-accredited with 'B++' grade

Fax : (02462) 215572

Phone: (02462)215542

Academic-1 (BOS) Section

website: srtmun.ac.

E-mail: bos@srtmun.ac.

विज्ञान व तंत्रज्ञान विद्याशाखे अंतर्गत राष्ट्रीय शैक्षणिक धोरण २०२० नुसार पदव्यूत्तर द्वितीय वर्षाचे अभ्यासक्रम (Syllabus) शैक्षणिक वर्ष २०२४–२५ पासून लागू करण्याबाबत.

प रि प त्र क

या परिपत्रकान्वये सर्व संबंधितांना कळविण्यात येते की, या विद्यापीठा अंतर्गत येणा–या सर्व संलग्नित महाविद्यालयामध्ये शैक्षणिक वर्ष २०२४–२५ पासून राष्ट्रीय शैक्षणिक धोरणानुसार पदव्यूत्तर द्वितीय वर्षाचे अभ्यासक्रम लागू करण्याच्या दृष्टीकोनातून विज्ञान व तंत्रज्ञान विद्याशाखे अंतर्गत येणा–या अभ्यासमंडळांनी तयार केलेल्या पदव्यूत्तर द्वितीय वर्षाच्या अभ्यासक्रमांना मा. विद्यापरिषदेने दिनांक १५ मे २०२४ रोजी संपन्न झालेल्या बैठकीतील विषय क्रमांक १५/५९–२०२४ च्या ठरावाअन्वये मान्यता प्रदान केली आहे. त्यानुसार विज्ञान व तंत्रज्ञान विद्याशाखेतील खालील एम. एस्सी द्वितीय वर्षाचे अभ्यासक्रम (Syllabus) लागू करण्यात येत आहेत.

1) M. Sc. II year Biotechnology (Affiliated College)
2) M. Sc. II year Biotechnology (Campus)
3) M. Sc. II year Bioinformatics (Sub Campus Latur)
4) M. Sc. II year Bioinformatics (Affiliated College)
5) M. Sc. II year Clinical Research (Affiliated College)
6) M. Sc. II year Botany (Campus)
7) M. Sc. II year Herbal Medicine
8) M. Sc. II year Boany (Affiliated College)
9) M. Sc. II year Geology (Campus)
10) M. Sc. II year Dairy Science
11) M. Sc. II year Electronics
12) M. Sc. II year Environmental Science
13) M. Sc. II year Environmental Science (Campus)
14) M. Sc. II year Geography (Campus)
15) M. Sc. II year Applied Mathematics
16) M. Sc. II year Mathematics
17) M. Sc. II year Mathematics (Campus)
18) M. Sc. II year Microbiology
19) M. Sc. II year Microbiology (Campus)
20) M. Sc. II year Statistics
21) M. Sc. II year Statistics (Campus)

सदरील परिपत्रक व अभ्यासक्रम प्रस्तुत विद्यापीठाच्या **www.srtmun.ac.in** या संकेतस्थळावर उपलब्ध आहेत. तरी सदरील बाब ही सर्व संबंधितांच्या निदर्शनास आणून द्यावी, ही विनंती.

'ज्ञानतीर्थ' परिसर,
विष्णुपुरी, नांदेड – ४३१ ६०६.
जा.क्र.:शै–१/एनइपी/विवत्रंविपदवी/२०२४–२५/१०९
दिनांक १२.०६.२०२४

डॉ. सरिता लोसरवार
सहा.कुलसचिव
शैक्षणिक (१–अभ्यासमंडळ) विभाग

प्रत : १) मा. आधिष्ठाता, विज्ञान व तंत्रज्ञान विद्याशाखा, प्रस्तुत विद्यापीठ.
२) मा. संचालक, परीक्षा व मुंल्यमापन मंडळ, प्रस्तुत विद्यापीठ.
३) मा. प्राचार्य, सर्व संबधित संलग्नित महाविद्यालये, प्रस्तुत विद्यापीठ.
४) मा. संचालक, सर्व संकुले परिसर व उपपरिसर, प्रस्तुत विद्यापीठ
५) सिस्टीम एक्सपर्ट, शैक्षणिक विभाग, प्रस्तुत विद्यापीठ. याना देवून कळविण्यात येते की, सदर परिपत्रक संकेतस्थळावर प्रसिध्द करण्यात यावे.

SWAMI RAMANAND TEERTH
MARATHWADA UNIVERSITY, NANDED - 431 606

Two Years Post Graduate Degree Program in Herbal Medicine

(Faculty of Science and Technology)

Revised Syllabi as per NEP-2020 for

M.Sc. Second Year

HERBAL MEDICINE

(For Affiliated Colleges)

To be implemented from

Academic year 2024 - 2025

Framed by

BOARD OF STUDIES IN BOTANY

Forward by the Dean, Faculty of Science and Technology

From the Desk of the Dean:

Swami Ramanand Teerth Marathwada University, Nanded, enduring to its vision statement "***Enlightened Student: A Source of Immense Power",*** is trying hard continuously to enrich the quality of science education in its jurisdiction by implementing several quality initiatives. Revision and updating curriculum to meet the standard of the courses at national and international level, implementing innovative methods of teaching-learning, improvisation in the examination and evaluation processes are some of the important measures that enabled the University to achieve the **3Es, the *equity, the efficiency and the excellence*** in higher education of this region. To overcome the difficulty of comparing the performances of the graduating students and also to provide mobility to them to join other institutions the University has adopted the *cumulative grade point average* (CGPA) system in the year 2014-2015. Further, following the suggestions by the UGC and looking at the better employability, entrepreneurship possibilities and to enhance the latent skills of the stakeholders the University has adopted the *Choice Based Credit System* (CBCS) in the year 2018-2019 at graduate and post-graduate level. This provided flexibility to the students to choose courses of their own interests. To encourage the students to opt the world-class courses offered on the online platforms like, NPTEL, SWAYM, and other MOOCS platforms the University has implemented the credit transfer policy approved by its Academic Council and also has made a provision of reimbursing registration fees of the successful students completing such courses.

SRTM University has been producing a good number of high calibre graduates; however, it is necessary to ensure that our aspiring students are able to pursue the right education. Like the engineering students, the youngsters pursuing science education need to be equipped and trained as per the requirements of the R&D institutes and industries. This would become possible only when the students undergo studies with an updated and evolving curriculum to match global scenario.

Higher education is a dynamic process and in the present era the stakeholders need to be educated and trained in view of the self-employment and self-sustaining skills like start-ups. Revision of the curriculum alone is not the measure for bringing reforms in the higher education, but invite several other initiatives. Establishing industry-institute linkages and initiating internship, on job training for the graduates in reputed industries are some of the important steps that the University would like to take in the coming time. As a result, revision of the curriculum was the need of the hour and such an opportunity was provided by the New Education Policy

2020. National Education Policy 2020 (NEP 2020) aims at equipping students with knowledge, skills, values, leadership qualities and initiates them for lifelong learning. As a result the students will acquire expertise in specialized areas of interest, kindle their intellectual curiosity and scientific temper, and create imaginative individuals.

The curriculum given in this document has been developed following the guidelines of NEP-2020 and is crucial as well as challenging due to the reason that it is a transition from general science-based to the discipline-specific-based curriculum. The recommendations of the ***Sukanu Samiti*** given in the NEP Curriculum Framework-2023 have been followed, keeping the disciplinary approach with rigour and depth, appropriate to the comprehension level of learners. All the Board of Studies (BoS) under the Faculty of Science and Technology of this university have put in their tremendous efforts in making this curriculum of international standard. They have taken care of maintaining logical sequencing of the subject matter with proper placement of concepts with their linkages for better understanding of the students. We take this opportunity to congratulate the Chairman(s) and all the members of various Boards of Studies for their immense contributions in preparing the revised curriculum for the benefits of the stakeholders in line with the guidelines of the Government of Maharashtra regarding NEP-2020. We also acknowledge the suggestions and contributions of the academic and industry experts of various disciplines.

We are sure that the adoption of the revised curriculum will be advantageous for the students to enhance their skills and employability. Introduction of the mandatory ***On Job Training, Internship*** program for science background students is praise worthy and certainly help the students to imbibe first-hand work experience, team work management. These initiatives will also help the students to inculcate the workmanship spirit and explore the possibilities of setting up of their own enterprises.

Dr. M. K. Patil,

Dean,

Faculty of Science and Technology

Swami Ramanand Teerth Marathwada University, Nanded

From Desk of Chairman, Board of Studies of the Subject Botany

PREAMBLE

The M.Sc. Herbal Medicine semester pattern course is running in different affiliated colleges of the S.R.T.M.U. Nanded. The program is designed to encourage and support the growing demands and challenging trends in the academic environment. Our training focuses on holistic development of students to face the competitive world. The course content has been designed on NEP-2020 pattern. The course content of each theory paper is divided into four units by giving appropriate titles and subtitles. For each unit, total number of periods required, weightage of maximum marks and credits are mentioned. A list of practical exercises for laboratory course work based on theory papers to be completed in the academic year is also given. A list of selected reading material and a common skeleton question paper for all the theory papers of semester-III &IV are also provided at the end of the syllabus.

OBJECTIVES OF THE M. Sc. HERBAL MEDICINE PROGRAMME:

1. Understand the scope and importance of discipline.
2. Instill a love and curiosity for nature through living plants.
3. To make students open-minded and curious, we try our best to nurture and develop scientific Attitude.
4. We make students fit for society by enabling them to work hard.
5. Make the students exposed to the diverse life forms.
6. Make them skilled in practical work, experiments, laboratory equipment and to interpret correctly on biological materials and data.
7. Develop interest in Biological research.
8. Encourage students to research related topics.
9. Develop a thirst for protecting natural resources and the environment.
10. Develop the ability to use the knowledge acquired in various spheres of life to make our country self-reliant
11. Appreciate and apply ethical principles to biological science research and practice.

PROGRAM SPECIFIC OUTCOMES (POs) OF M.Sc. HERBAL MEDICINE:

Plant science is now a blend of basic and applied science. In addition to having the unique ability of plants to trap solar energy and provide food for all, plants cannot be replicated by any system. Conventional studies like plant identification are now being supplemented with molecular techniques like DNA Barcoding. The courses have been designed to benefit all Herbal

Medicine students to study various aspects of plant science including its practical applications. Keeping in mind that these students can teach at various levels, research work in research institutes and or industry, doctoral work, environmental impact assessment, biodiversity studies, entrepreneurship, scientific writing are included in the curriculum.

PO 1: Understanding the taxonomy of plants from Algae to Angiosperm. Identification of plants in field increases the basics of plants. The study of biodiversity in relation to habitat will be related to climate change, land and forest degradation and types of ecosystems. Application of Herbal Medicine in agriculture is through study of plant pathology, seed technology, tricoderma cultivation and vermicomosting.

PO 2: Understand the ultra structure of Bacteria and Viruses, ultra structure and functions of cell, cell membranes, cell organisation, communications, signaling, genetics, plant breeding, anatomy, taxonomy, ecology and plant Physiology and biochemistry.

PO 3: Understand the multi-functionality of plant cells in the production of fine chemicals and their wide range of industrial applications.

PO 4: Understand research skills, research methodology and research projects during this program.

PO 4: Analyze and apply the methodologies and techniques learnt during the course of studying Herbal Medicine

PO 4: Share social, environmental and ethical concerns with fellow citizens

PO 5: The program enables the students to face NET, SET, MPSC, UPSC and other competitive examinations successfully.

Dr. Saheb Laxmanrao Shinde
Chairman,
Board of Studies in Botany
Swami Ramanand Teerth Marathwada University, Nanded

Details of the Board of Studies Members in the subject Botany under the faculty of Science & Technology of S.R.T.M. University, Nanded

Sr No	Name of the Member	Designation	Address	Contact No.
1.	Dr. Saheb Laxmanrao Shinde	Chairman	Yeshwant Mahavidylaya, Nanded	7588151967
2	Dr. Babasaheb Shivmurti Surwase	Member	School of Life Sciences, S.R.T.M.U. Nanded	9075829767
3	Dr. B. D. Gachande	Member	Science College, Nanded	8788727840
4	Dr Vijay Tulshiram Gorgile	Member	Shahir Annabhau Sathe Mahavidyalaya, Mkhed	9421762073
5	Dr. Sudhakar V. Chate	Member	Shivaji College, Udgir	8421241300
6	Dr. Suresh Manoharrao Telang	Member	Yeshwant Mahavidyalaya, Nanded	9822174684
7	Dr. R. M. Kadam	Member	M. G. M. Ahmedpur, Tq. Ahmedpur, Dist. Latur.	9422657976
8	Dr. Sopan Dnyanoba Dhavale	Member	Shahir Annabhau Sathe Mahavidyalaya, Mukhed,	9423614703
9.	Dr. Sanjay Marotrao Dalvi	Member	Shri Guru Buddhiswami Mahavidyalaya, Purna (Jn),	9921101210
10	Dr. Prashant A. Gawande	Professor from other University	Sant Gadge Baba Amravati University,Amravati.	9403622568
11	Dr. Ambadas Sheshrao Kadam	Experts	DSM College Parbhani.	8329151172
12	Dr. Kanhaiya Ranganathrao Kadam	Experts	K.K. Herbal Industries, Gut No. 252, Naleshwar Road, Limbgaon, Nanded.	9420261080
13	Bindu Maurya	Experts	07, Mangal Pravesh building Polt. C-16 Sector-3 Airoli, Navi Mumbai.	9987591561
14	Shri Bhanudas Balajirao Pendkar	Experts	K-Ferts Lab, W-4, MIDC Industrial Area, Nanded. Invitee Member	8888896710
15	Anjali Raut	PG Student	C/o Dayanand Science College Latur	7666670721
16	Diobale Sanyukta	UG Student	C/o Sahir Annabhau Sathe College, Mukhed	9021845705

Swami Ramanand Teerth Marathwada University, Nanded

Faculty of Science & Technology

Credit Framework for Two Year PG Program

Subject: Herbal Medicine

Year & Level 1	Sem. 2	Major Subject (DSC) 3	Major Subject (DSE) 4	RM 5	OJT / FP/CS 6	Research Project 7	Practicals 8	Credits 9	Total Credits 10
1	1	SHMC401 (4 Cr) SHMC402 (4 Cr) SHMC403 (4 Cr)	SHME401 (3+1 Cr)	SHMRM401 *Research Methodology* (3 Cr)	--		SHMP401 (1Cr) SHMP402 (1Cr) SHMP403 (1Cr) SHMEP40 (1Cr)	22	44
	2	SHMC451 (4 Cr) SHMC452 (4 Cr) SHMC453 (4 Cr)	SHME451 (3+1 Cr)	---	SHMOJ 451/ SHMFP 451/ SHMCS 451 (3 Cr)	--	SHMP451 (1Cr) SHMP452 (1Cr) SHMP453 (1Cr) SHMEP451 (1Cr)	22	
Exit option: Exit Option with PG Diploma *(after 2024-25)*									
2	3	SHMC501 (4 Cr) SHMC502 (4 Cr) SHMC503 (3Cr)	SHME501 (3+1 Cr) (*From same Department / School)*	--		Research Project SHMRP551 (4Cr)	SHMP501 (1 Cr) SHMP502 (1 Cr) SHMP503 (1 Cr) SHMEP501 (1 Cr)	22	44
	4	SHMC551 (4 Cr) SHMC552 (4 Cr)	SHME551 (3+1 Cr) (*From same Department / School)*	SHMPE 551 Publication Ethics (2 Cr)		Research Project SHMRP552 (6 Cr)	SHMP551 (1Cr) SHMP552 (1Cr) SHMEP551 (1Cr)	22	
Total Credits		43	12+04	05	03	10	11	88	

M. Sc. Second Year Semester III *(Level 6.0)*

Teaching Scheme

	Course Code	Course Name	Credits Assigned			Teaching Scheme (Hrs/ week)	
			Theory	Practical	Total	Theory	Practical
Major	**SHMC501**	Natural Plant Products	04	--	**04**	04	--
	SHMC502	Medicinal Plant Biotechnology	04	--	**04**	04	--
	SHMC503	Herbal Drug Technology	03	--	**03**	03	--
Elective (DSE)	**SHME501**	Herbal Cosmetics	03	--	**03**	03	--
Research Project	**SHMRP501**	Research Project	--	--	**04**	--	
DSC Practical	**SHMP501**	Lab 1 / Based on theory Paper **SHMC501**	--	01	**01**	--	02
	SHMP502	Lab 2/ Based on theory Paper **SHMC502**	--	01	**01**	--	02
	SHMP503	Lab 3/ Based on theory Paper **SHMC503**	--	01	**01**	--	02
DSE Practical	**SHMEP 501**	Based on Elective Paper **SHME501**	--	01	**01**	--	02
Total Credits			**14**	**04**	**22**	**14**	**08**

M. Sc. Second Year Semester III *(Level 6.0)*

Examination Scheme

[20% Continuous Assessment (***CA***) and 80% End Semester Assessment (***ESA***)]

(For illustration we have considered a paper of 02 credits, 50 marks, need to be modified depending on credits of individual paper)

Subject (1)	Course Code (2)	Course Name (3)	Theory				Practical		Total Col (6+7) / Col (8+9) (10)
			Continuous Assessment (CA)			ESA			
			Test I (4)	Test II (5)	Avg of (T1+T2)/2 (6)	Total (7)	CA (8)	ESA (9)	
Major	**SHMC501**	Natural Plant Products	20	20	20	**80**	--	--	**100**
	SHMC502	Medicinal Plant Biotechnology	20	20	20	**80**	--	--	**100**
	SHMC503	Herbal Drug Technology	15	15	15	**60**	--	--	**75**
Elective (DSE)	**SHME501**	Herbal Cosmetics	15	15	15	**60**	--	--	**75**
Research Project	**SHMRP501**	Research Project	20	20	20	**80**	--	--	**100**
DSC Practical	**SHMP501**	Lab 1 / Based on theory Paper SHMC501	--	--	--	--	05	20	**25**
	SHMP502	Lab 2/ Based on theory Paper SHMC502	--	--	--	--	05	20	**25**
	SHMP503	Lab 3/ Based on theory Paper SHMC503	--	--	--	--	05	20	**25**
DSE Practical	**SHMEP 501**	Based on Elective Paper **SHME501**	--	--	--	--	05	20	**25**

M. Sc. Second Year Semester IV *(Level 6.0)*

Teaching Scheme

	Course Code	Course Name	Credits Assigned			Teaching Scheme (Hrs/ week)	
			Theory	Practical	Total	Theory	Practical
Major	**SHMC551**	Industrial Pharmacognosy	04	--	**04**	04	--
	SHMC552	Herbal Drug Development	04	--	**04**	04	--
Elective (DSE)	**SHME551**	Drug Standardization And Validation	03	--	**03**	03	--
Publication Ethics	**SHMPE551**	Publication Ethic	02	--	**02**	02	--
Research Project	**SHMRP1551**	Research Project	--	--	**06**	--	--
DSC Practical	**SHMP551**	Lab 1 / Based on theory Paper **SHMC551**	--	01	**01**	--	02
	SHMP 552	Lab 2/ Based on theory Paper **SHMC552**	--	01	**01**	--	02
DSE Practical	**SHMEP 551**	Based on Elective Paper **SHME551**	--	01	**01**	--	02
Total Credits			**13**	**03**	**22**	**13**	**06**

M. Sc. Second Year Semester IV *(Level 6.0)*

Examination Scheme

[20% Continuous Assessment (***CA***) and 80% End Semester Assessment (***ESA***)]

(For illustration we have considered a paper of 02 credits, 50 marks, need to be modified depending on credits of individual paper)

Subject (1)	Course Code (2)	Course Name (3)	Theory				Practical		Total Col (6+7) / Col (8+9) (10)
			Continuous Assessment (CA)			ESA			
			Test I (4)	Test II (5)	Avg of (T1+T2)/2 (6)	Total (7)	CA (8)	ESA (9)	
Major	**SHMC551**	Industrial Pharmacognosy	20	20	20	**80**	--	--	**100**
	SHMC552	Herbal Drug Development	20	20	20	**80**	--	--	**100**
Elective (DSE)	**SHME551**	Drug Standardization And Validation	15	15	15	**60**	--	--	**75**
Publication Ethics	**SHMPE551**	Publication Ethic	10	10	10	**40**	--	--	**50**
Research Project	**SHMRP551**	Research Project				**150**			**150**
DSC Practical	**SHMP551**	Based on theory Paper **SHMC551**	--	--	--	--	05	20	**25**
	SHMP 552	Based on theory Paper **SHMC552**	--	--	--	--	05	20	**25**
DSE Practical	**SHMEP 551**	Based on Elective Paper **SHME551**	--	--	--	--	05	20	**25**

Syllabus for M. Sc. Herbal Medicine, Second Year

Semester – III

As Per National Education Policy- 2020

To be implemented from

Academic Year 2024-2025

National Education Policy 2020

M.Sc. Herbal Medicine, II Year (Semester - III)

Major Core Theory Course

Course Code – SHMC 501

Title of the Course: NATURAL PLANT PRODUCTS

[No. of Credits: 4 Credit] **[Total 60 Lectures]**

Course objectives:

1. To know the various basic and applied aspects of natural plant products
2. To understand the various extraction methods of herbal drugs

Course outcomes:

1. Learn the methods of isolation and preliminary screening of phytochemicals.
2. Understand the knowledge of various biological enzymes.

CURRICULUM DETAILS: SHMC 501: : NATURAL PLANT PRODUCTS

Module No.	Unit No.	Topic	Hrs. Required to cover the contents
1. 0		**Module-I: DRUGS CONTAINING RESINS AND TANNINS**	**15**
	1.1	Classification General Characteristics and Chemical Composition of Resins.	
	1.2	Biological Source, Geographical Source, Collection, Characteristics, Chemical Constituents, Uses and Marketed Products of Asafoetida, Cannabis, Capsicum, Ginger, Guggul, Turmeric, Jalap and Balsam Of Peru	
	1.3	Classification Hydrolysable Tannins Non-hydrolysable or Condensed Tannins Characteristics of Tannins. Biosynthesis of Tannins.	
	1.4	Biological Source, Geographical Source, Collection, Characteristics, Chemical Constituents, Uses and Marketed Products of Asafoetida, Cannabis, Capsicum, Ginger, Guggul, Turmeric, Jalap and Balsam Of Peru	
2.0		**Module-II: DRUGS CONTAINING VOLATILE OILS**	**15**
	2.1	General methods of extraction of volatile oils from plants, General methods of extraction of volatile oils from plants, Study of biological source, chemical constituents, chemical tests and uses of volatile oils of Mentha, Lemon peel, Orange peel, Lemon grass.	
	2.2	Study of biological source, chemical constituents, chemical tests and uses of volatile oils of Citronella, Caraway, Dill, Nutmeg, Chenopodium, Valerian, Musk, Palmarosa, Gaultheria	
	2.3	Detailed Pharmacognosy of Clove, Coriander, Fennel, Sandal wood, Cardamom, Cinnamon and Eucalyptus	
	2.4	Natural allergens and photosensitizing agents, Antioxidants from plant origin.	
3.0		**Module-III: Drug Groups**	**15**
	3.1	General methods of isolation and preliminary phytochemical	

		screening of glycosides.	
	3.2	Study of biological source, cultivation, collection, chemical constituents, adulterants, uses, macroscopic, microscopic features and chemical tests Drug containing Saponin: Liquorices, Ginseng, Dioscorea, Sarsaparilla and Senega,	
	3.3	Study of biological source, cultivation, collection, chemical constituents, adulterants, uses,macroscopic, microscopic features and chemical tests of Drug containing Cardio active sterols: Digitalis, Squill and Strophanthus,	
	3.4	Study of biological source, cultivation, collection, chemical constituents, adulterants, uses, macroscopic, microscopic features and chemical tests of Drug containing Anthraquinone cathartics: Aloes, Senna, Rhubarb and Cascara, Others: Psoralea, Gentian,Saffron, Chirata and Quassia	
4.0		**Module-IV: ENZYMES AND PROTEIN DRUGS**	
	4.1	**Enzymes:** Biological sources, Preparation, Chemical Composition, identification tests and uses of the following Enzymes: Diastase, Papain, Pepsin, Trypsine, Pancreatin. Urokinase and Streptokinase.	
	4.2	**Proteins:** Biological Source, Preparation, Characteristics, Chemical Constituents and uses of Malt extract, Gelatin, Casein and Collagen.	**15**
	4.3	General techniques of biosynthetic studies and basic metabolic pathways.	
	4.4	Biogenesis of aromatic amino acids.	
		Total	**60**

SELECTED READINGS:

1. Textbook of Pharmacognosy by C.K.Kokate and D.P.Purohit (Nirali Prakashan, Pune)
2. Trease G.E. and Evans w.e., Pharmacognosy (Baillere Tindall, Eastbourne)
3. Tyler V.E., Brady L.R. and Robbers J.E., Pharmacognosy (Len & Febiger, Philadelphia)
4. Pharmacognosy by T.E. Wallis (CBS Publisher, New Delhi)
5. Staba E.J., Plant Tissue Culture as a source of Bio-medicinals
6. Medicinal plants: Alkaloids and Glycosides By Toronto
7. CSIR- Cultivation and Utilization of Medicinal Plants
8. CSIR - Wealth of India, Raw Materials
9. Paul J. Schewer Chemistry of Marine Natural Products.
10. Dean F. Martin & George Padilla Marine Pharmacognosy.
11. Marine Natural Products-Vol.I to IV.
12. T. Swain Comparative Phytochemistry.
13. T. Swain Chemical Plant Taxonomy
14. C.K. Atal & B.M. Kapoor Cultivation of Medicinal Plants.
15. C.K. Atal & B.M.Kapoor Cultivation and Utilization of Aromatic Plants
16. Cultivation of medicinal and aromatic crops, Ist edn, by A.A.Farooqui and
17. B.S.shreeramu, University press., 2001
18. Medicinal plants of India, Ist edn, by S.N.Yoganarasimhan, Interline publication Pvt.Ltd.,
19. 2000
20. Medicinal natural products (a biosynthetic approach), Ist edn, by Paul M.Dewick, John
21. Wiley and sons Ltd., England 1998
22. Natural Products from plants, Ist edn, by Peter B. Kaufman, CRC press, Newyork, 1998

23. Glimpses of Indian Ethanopharmacology by P. Pushpangadam,UIF Nyman, V.George,
24. Tropical botanic Gardon and research institute., 1995
25. Natural Products:A lab guide by Raphael Ikan, IInd edn, academic press, 1991
26. Organic chemistry of natural products, volume 1 and 2. by Gurdeep R.Chatawal
27. Organic Chemistry by I.L.Finar –Vol. I and II
28. Text book of Pharmacognosy, by G.E.Treese nad W.C.Evans, 15th edn, W.B. Saunders
29. Edenburg, NewYork.,
30. Text book of Pharmacognosy by Tyler, Brady and Robers
31. Modern methods of Plant analysis by Peach and M.V.Tracey, Volume I and II
32. Chemistry of marine natural products by Paul J.Schewer, 1973.
33. Marine Pharmacognosy Ed by Dean F. Martin and George Pedilla
34. Marine natural products Volume I to IV
35. Cultivation of medicinal plants by C.K.Atal and B.M. Kapoor
36. Cultivation and utilization of aromatic plants,by C.K.Atal and B.M. Kapoor

National Education Policy 2020

M.Sc. Herbal Medicine, II Year (Semester - III)

Major Core Theory Course

Course Code – SHMC 502

Title of the Course: MEDICINAL PLANT BIOTECHNOLOGY

[No. of Credits: 4 Credit] **[Total 60 Lectures]**

Course objectives:

1. To know the basics of genetics and molecular biology
2. To learn the basic gene transfer methods

Course outcomes:

1. Learn the Crop quality improving methods.
2. Understand the knowledge of basic and applied aspects of tissue culture
3. Outcome: Students will gain the knowledge about various strategies of plant tissue culture and students will gain knowledge about various secondary metabolites produced by plant tissue culture.

Curriculum Details: SHMC502: MEDICINAL PLANT BIOTECHNOLOGY

Module No.	Unit No.	Topic	Hrs. Required to cover the contents
1. 0		**Module-I: PLANT TISSUE CULTURE - I**	**15**
	1.1	Concepts of Biotechnology, History of Biotechnology, Scope of Biotechnology	
	1.2	The Indian Advantage Laboratory Organization, Maintenance of asepsis in tissue culture, Totipotency, Nutritional requirements, Media preparation, Explant preparation, Establishment of Aseptic cultures.	
	1.3	Biotechnological applications of Plant Tissue culture in pharmacy and allied fields. Types and techniques of plant tissue culture,	
	1.4	Initiation and maintenance of callus and suspension culture, growth parameters, Organogenesis and embryogenesis.	
2.0		**Module-II: Plant Tissue Culture - II**	**15**
	2.1	Micropropagation : Sterlization of Explant, Inoculation of Explant, Multiplication of Shoots or Somatic Embryo formation, Germination of Somatic Embryo and Rooting of regenerated shoot, Proliferation of Shoots in the Multiplication Medium	
	2.2	Acclimatization of Plant transferred to Soil, Browning of the Medium, Advantages of Micropropagation product development.	
	2.3	Protoplast: Isolation of Protoplast , Source of Plant Material, Techniques of Isolation of Protoplast Applications of Protoplast Culture. synthetic seed	
	2.4	Androgenic Haploid Production: Process of Androgenesis Factor Affecting Androgenesis, Application of Anther and Microspore	

		Culture, Merits & Demerits, Limitations, Gynogenic Haploids , Factors Affecting Gynogenesis , Applications of Ovule culture	
3.0		**Module-III:** BIOTRANSFORMATION AND TRANGENESIS	**15**
	3.1	Biotransformation of Plant Cell Culture and its importance. Biotechnological Methods For Production of secondary metabolites in Medicinal Plants.	
	3.2	In-Vitro Production of Phytomedicinal Secondary Metabolites, Factors Leading to elevated production of Secondary Metabolites in Medicinal Plant Cell Cultures	
	3.3	Large-Scale Production of Medicinal Secondary Metabolites in Bioreactor Systems..Production of Anthocyanins in Callus Cultures of Solanum melongena	
	3.4	Production of important secondary metabolites (Shikonin, Artemicin, Cinnamic acids and Flavonoids and Anthraquinones)., Production of ergot alkaloids, single cell proteins, enzymes of pharmaceutical interest. Transgenic technology- Hairy root multiple shoot cultures and their applications.	
4.0		**Module-IV:** CLONING AND GENE TRANSFER IN PLANTS	**15**
	4.1	Cloning of plant cells: Different methods of cloning and its application. . Advantages and disadvantages of plant cell cloning.	
	4.2	Transgenic plants, Application of transgenic plants with special reference to a) Resistant to Herbicide, insects, fungus and viruses. b) Resisitant to physiological stress. c) Production of Pytopharmaceuticals d) Edible vaccines	
	4.3	Gene Transfer in plants: Gene transfer methods, Vector mediated gene transfer,Agrobacterium mediated DNA transformation	
	4.4	Tumor inducing principle and Ti plasmid, T-DNA transfer, Virus mediated gene transfer.	
		Total	**60**

SELECTED READINGS:

1. Introduction to plant tissue culture by M.K. Razadam
2. Molecular biology & Biotechnology by J.M. Walker & E.D. Gingo
3. Advanced methods in plant breeding & biotiechnology by David R Mirray
4. Experiments in plant tissue culture by John, H.D. & Lorin W.R.
5. Plant cell & tissue culture by Jafferey. W. Pollard & John. M. Walker
6. Breeding field crops by John M.P. & David. A.S.
7. Pharmaceuticals Biotiechnology S.P. Vyas & V.K. Dixit
8. Biotechnology theory & technique vol I by Jack. G. C.
9. Pharmacognosy by G.E. Trease & W.C.Evans ELBS.
10. Biotechnology by purohit & Matherr
11. Comprehensive biotechnology by Mooyoung
12. Biotechnology application to tissue culture by Shargool.
13. Plant tissue culture by Dixon
14. Plant tissue culture by Street
15. Elements of Biotechnology by P.K. Gupta.
16. Elements in plant Biotechnology by P.K.Gupta

17. Molecular biology and biotechnology by J.M.Walker and E.D. Gingold
18. An introduction to plant tissue culture by M.K. Razdan
19. Plant cell and tissue culture by Jeffrey W. Pollard and J.M.Walker
20. Plant tissue culture by Dixon
21. Plant tissue culture by Street
22. Biotechnological application for tissue culture by Shargool
23. Plant cell culture and technology by M.M. Yeoman
24. Plant tissue culture – Theory and practice by S.S. Bhajwani and M.K. Razdan
25. Secondary plant metabolism by Margaret L. Vikery and Brain Vikery
26. Plant tissue culture by W.E Gorge
27. Plant chromosome Analysis, Menupulatia and Engineering by Arun and Archana
28. Sharma., Ist Edn., Academic publishers, 1999
29. Transgenic plants by R. Ranjan, Agrobotanica, 1999

National Education Policy 2020

M.Sc. Herbal Medicine, II Year (Semester - III)

Major Core Theory Course

Course Code – SHMC503

Title of the Course: HERBAL DRUG TECHNOLOGY

[No. of Credits: 3 Credit] **[Total 45 Lectures]**

Course objectives:

1. To learn the general methods of extraction and purification of phytoconstituents
2. To understand role of nutraceuticals in human health

Course outcomes:

1. Learn the making and uses of herbal medicines for common ailments
2. Understand the knowledge of Quality Control and Quality Assurance of Herbal ingredient

Curriculum Details: SHMC503: HERBAL DRUG TECHNOLOGY

Module No.	Unit No.	Topic	Hrs. Required to cover the contents
1. 0		**Module-I: PLANT DRUG PREPARATIONS AND ANALYSIS**	**12**
	1.1	Definition of Herbal drug, Importance of Herbal therapies, Herbal verses conventional drugs, Safety in herbal drugs. Toxicity in Herbal drugs and their interactions	
	1.2	General methods of extraction, isolation and purification of phyto-constituents.Determination of tannins, Ash value, Extractable matter and Pesticide residues.	
	1.3	Preparation of herbal infusions, decoctions, lotions, insect repellents, suppositories, tinctures, syrups, poultices, plasters, ointments Successive solvent extraction,super critical Fluid extraction, Steam distillation	
	1.4	Isolation, identification tests and estimation methods for Aloin from Aloes, Vasicine from Adhatoda vasica, Andrographolides from Andrographis paniculata, Curcumin from Curcuma longa ,Piperine from Piper longum	
2.0		**Module-II:** APPLICATION OF HERBAL MEDICINES	**10**
	2.1	Making and using herbal medicines for common ailments like cold, skin infections and Diarrhea	
	2.2	Analytical Profiles of selected herbs – Brahmi, Aradrographis paniculata Aegle marmelos and Gymnema sylvestre.	
	2.3	Screening methods for herbal drugs with current innovations in following therapeutic classes: Antibacterial, Antifungal, Antihypertensive, Antioxidant, Antipyretic & anti-inflamatory Antidiabetic Drugs	
	2.4	Screening methods for herbal drugs with current innovations in following therapeutic classes: Anticancer, Antihepatotoxic, Immunomodulatory, Anti-ulcer drugs,screening methods for diuretics, Antifertility agents, Analgesic activity	

3.0		**Module-III: HERBAL PRODUCT DEVELOPMENT**	**10**
	3.1	The sources and description of raw materials of herbal origin used like fixed oils, waxes, gums, hydrophilic colloids, colours, perfumes, protective agents, bleaching agents, preservatives, antioxidants and other ancillary agents	
	3.2	Herbal product development Lipid orals, tablets, capsules, dermatologic and herbal cosmetics	
	3.3	Methods involved in monoherbal and polyherbal formulations with their merits and demerits.	
	3.4	Quality control of finished herbal medicinal products	
4.0		**Module-IV: NUTRACEUTICALS**	**13**
	4.1	Herbal Neutraceuticals as new source of medicine. , concept of nutritional requirements at different age, sex and in different conditions like normal, diseases, pregnancy etc.	
	4.2	Current trends and future scope, Inorganic mineral supplements, Vitamin supplements, Digestive enzymes, Dietary fibres, Cereals and grains,	
	4.3	Health drinks from natural origin, Antioxidants, Polyunsaturated fatty acids, Herbs as functional foods, Formulation and standardization of neutraceuticals, Regulatory aspects, FSSAI guidelines,	
	4.4	Sources, name of marker compounds and their chemical nature, medicinal uses and health benefits 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.	
		Total	**45**

Suggested Books:

1. Trease and Evan's Pharmacognosy 15th edition
2. Indian Herbal Pharmacopeia Vol-I and II
3. Quality Control methods for medicinal plant material by W.H.O., Geneva.
4. Quality Control of Herbal drugs by Dr. Pulak K. Mukherjee
5. Botanical safety hand book by Michael Meguffin, Christopher Hobbs published by
6. American Herbal Product Association.
7. Herbal drugs by P.Mukherjee
8. Herbal Drugs Industry by R.D. Chowdary
9. Quality control of Herbal Drugs by Pulok. K. Mukarjee
10. Pharmacognosy, Phytochemistry, Medicinal Plants by Jean Bruneton
11. Natural Products a laboratory guide by Raphael Ikan.
12. Foye's Principles of Medicinal Chemistry by Thomas L.Lemke David A. Williams et.al.
13. Pharmacognosy by C.K. Kokate
14. Pharmacognosy by Trease & Evans
15. Pharmacognosy & Phytochemistry by Vinod Rangari
16. Pharmacognosy by Brady Taylor et. al.
17. Natual Excipients by R.S. Guad, Surana et. al.
18. Spectrometric identification of Organic compounds by Silverstein
19. Organic chemistry by Morrison & Byod
20. Cultivation of Medicinal and aromatic crops by A..A.Farooqui and B.S. Sreeramu.
21. Pharmacognosy & Pharmacobiotechnology by Ashutosh kar
22. Advances in Harticulture Volume.II Medicinal and Aromatic Plants by K.L. Chada &
23. Rajendra Gupta.

24. Herbal Medicine expanded commission E Monographs. Blumenthal/
25. Goldberg/Brinckmam.
26. 24. A handbook of Cosmetics by B.M. Mithal & RN Saha
27. 25. The Complete Technology Book on Herbal Perfumes&Cosmetics by Panda 19. Plant
28. Drug Analysis by Wagner H. and Bladt S.
29. 26. "The Wealth of India" Raw materials, (I-XI) and Industrial Products – Volumes (I-VIII)
30. (A to Z) by CSIR, New Delhi.
31. 27. "Indian Medicinal Plants" Volumes by Kirtikar K.R. and Basu B.D.
32. 28. Medicinal Plant Biotechnology by Ciddi Veeresham
30. Plant Tissue Culture by Bhojwani
31. Plant Tissue culture by M.K. Razdan.
32. Wilson and Gisvold's Text Book of Organic medicinal and Pharmaceutical Chemistry.
33. Burger's Medicinal Chemistry and Drug Discovery.
34. PHARMACOLOGY by H.P. Rang, M.M. Dale et. al.
35. Goodman and Gilman's Pharmacological Basis of Therapeutics.
36. Journals Publishing Phytochemical and Pharmacological investigations on plants.
37. Websites on Herbal Medicines/Products.
38. Pharmacognosy and Pharmacobiotechnology by Robert Sipero et. al.
39. Medicinal Natural Products by Paul M. Deweek.

National Education Policy 2020

M.Sc. Herbal Medicine, II Year (Semester - III)

Elective Theory Course

Course Code – SHME 501

Title of the Course: HERBAL COSMETICS

[No. of Credits: 3 Credit] **[Total 45 Lectures]**

Course objectives:

1. To know the fundamentals of cosmetic technology
2. To learns the quality control of different cosmetic products

Course outcomes:

1. Students will design the hair and skin care products
2. Student will establish a small scale industry of herbal cosmetics

Curriculum Details: SHME 501: HERBAL COSMETICS

Module No.	Unit No.	Topic	Hrs. Required to cover the contents
1. 0		**Module-I: FUNDAMENTALS OF COSMETIC TECHNOLOGY**	**12**
	1.1	Classification of cosmetics, A brief study of raw materials used for Cosmetic preparations	
	1.2	Preservatives, surfactants, humectants, oils, colours, and some functional herbs, cream bases, aerosol propellants, perfumes	
	1.3	Preformulation studies, compatibility studies	
	1.4	Possible interactions between chemicals and herbs, design of herbal cosmetic formulation.	
2.0		**Module-II: DESIGN OF HERBAL COSMETICS**	**10**
	2.1	Physiology and chemistry of skin and pigmentation, hairs, scalp, oral and nail, Cleansing cream	
	2.2	Physiology and chemistry of Lotions, Vanishing and Foundation creams, Anti- sun burn preparations, Moisturizing cream, deodorants, Face powders, Face packs, Lipsticks, Bath products, soaps and baby product	
	2.3	Preparation and standardisation of Shampoos, Conditioners, Tonic, Bleaches, Colorants, Depilatories and Hair oils	
	2.4	Preparation and standardization of Dentifrices and Mouth washes & Tooth Pastes, Cosmetics for Nails	
3.0		**Module-III: FORMULATION OF COSMETICS**	**10**
	3.1	Building blocks for different product formulations of cosmetics. Surfactants – Classification and application.	
	3.2	Emollients, rheological additives: classification and application. Antimicrobial used as preservatives, their merits and demerits.	
	3.3	Factors affecting microbial preservative efficacy. Building blocks for formulation of a moisturizing cream, vanishing cream, cold cream, shampoo and toothpaste.	
	3.4	Soaps and syndetbars. Perfumes; Classification of perfumes. Perfume	

		ingredients listed as allergens in EU regulation. Controversial ingredients: Parabens, formaldehyde liberators, dioxane.	
4.0		**Module-IV:** REGULATORY ASPECTS OF COSMETICS	**13**
	4.1	Definition of cosmetic products as per Indian regulation. Indian regulatory requirements for labeling of cosmetics Regulatory provisions relating to import of cosmetics. Misbranded and spurious cosmetics.	
	4.2	Regulatory provisions relating to manufacture of cosmetics – Conditions for obtaining license, prohibition of manufacture and sale of certain cosmetics, loan license, offences and penalties.	
	4.3	Review of guidelines for herbal cosmetics by private bodies like cosmos with respect to preservatives, emollients, foaming agents, emulsifiers and rheology modifiers	
	4.4	Challenges in formulating herbal cosmetics.	
		Total	**45**

SELECTED READINGS:

1. The Theory and Practice of Industrial Pharmacy by Lachman L., Liberman, H.A.
2. Modern Cosmetics by Thomson, E.G.
3. Paucher's Perfumes, cosmetics & soaps by W.A.Paucher.
4. Hary's cosmeticology by J.B.Wilkimsson.
5. Herbal Cosmetics - H.Pande, Asia Pacific Business press, New Delhi.
6. H.Pande, "The complete technology book on herbal perfumes and cosmetics", National
7. Institute of Industrial Research, Delhi.
8. Panda H. 2007. Herbal Cosmetics (Hand book), Edition I, Asia Pacific Business Press
9. Inc, New Delhi.
10. Thomson EG. 2006. Modern Cosmetics, Edition I, Universal Publishing Corporation,
11. Mumbai.
12. P.P.Sharma. 2008. Cosmetics- Formulation, Manufacturing & Quality Control, Edition 4,
13. Vandana Publications, New Delhi.
14. Supriya K B. 2005. Handbook of Aromatic Plants, Edition II(Revised and Enlarged),
15. Pointer Publishers, Jaipur.
16. Skaria P. 2007. Aromatic Plants (Horticulture Science Series Vol. 1) , Edition I, New
17. India Publishing Agency, New Delhi.
18. Kathi Keville and Mindy Green.1995. Aromatheraphy (A Complete Guide to the Healing
19. Art), Edition I, Sri Satguru Publications, New Delhi.
20. Chattopadhyay PK. 2000. Herbal Cosmetics & Ayurvedic Medicines (EOU), Edition I,
21. National Institute of Industrial Research, Delhi.
22. Balsam MS & Edward Sagarin. 2008. Cosmetics Science and Technology, Edition II
23. (Vol-II), Wiley Interscience, New York.
24. Harry's Cosmeticology. 8th edition
25. Poucher's perfume cosmetics and Soaps, 10th edition
26. Cosmetics - Formulation, manufacture and quality control PP.Sharma, 4th edition
27. Handbook of cosmetic science and Technology A.O.Barel, M.Paye and
28. H.I.Maibach. 3rdedition
29. S.P.Vyas and Roop K.Khar Controlled Drug Delivery system, Concepts and Advances
30. Cosmetic and Toiletries recent suppliers catalogue.
31. CTFA directory.

National Education Policy 2020

M.Sc. Herbal Medicine, II Year (Semester - III)

Core Practical Course

Course Code – SHMP501

Title of the Course: Based on theory Paper SHMC501

[No. of Credits: 1 Credit] **Lab 1** **[Total: 30 Lectures]**

Curriculum Details: SHMP501: Based on theory Paper SHMC501

Sr. No	Practical Exercises	Hrs. Required to cover the contents
1.	Identification of Resin containing crude drugs mentioned in theory	5
2.	Study of pharmaceutical aids.	2
3.	Micro chemical tests of Tannin containing crude drugs mentioned in theory .	3
4.	Identification testsof Enzymes mentioned in theory	5
5.	Specific identification tests for protein crude drugs listed in theory	5
6.	Phytochemical screening of glycosides	2
7.	Identification of drug containing Saponin	3
8.	Identification of drug containing Cardio active sterols	2
9.	Identification of drug containing Drug containing Anthraquinone cathartics	1
10.	Visit to Herbal drug industries,Research centres etc.	2
	Total	**30**

National Education Policy 2020

M.Sc. Herbal Medicine, II Year (Semester - III)

Core Practical Course

Course Code – SHMP502

Title of the Course: Based on theory Paper SHMC502

[No. of Credits: 1 Credit] **Lab 2** **[Total :30 Lectures]**

Curriculum Details: SHMP502: Based on theory Paper SHMC502

Sr. No	Practical Exercises	Hrs. Required to cover the contents
1.	Study of design and organization or plant tissue culture laboratory	3
2.	Preparation of Plant Tissue Culture media	3
3.	Establishment of callus culture	2
4.	Micro propagation of endangered medicinal plant	2
5.	Fermentation technology in lab scale	2
6.	Immobilization techniques	2
7.	Establishment of callus culture for isolation of various secondary metabolites	2
8.	Establishment of suspension culture	2
9.	Isolation of Protoplast and fusion	2
10.	Anther and Microspore Culture	2
11.	Quantitative estimation of DNA	2
12.	Gene transfer by rDNA technology	2
13	Screening methods for rDNA technology	2
14	Short and Long excursion to Visit Tissue Culture Lab.University department, Research lab.	2
	Total	**30**

National Education Policy 2020

M.Sc. Herbal Medicine, II Year (Semester - III)

Core Practical Course

Course Code – SHMP503

Title of the Course: Based on theory Paper SHMC503

[No. of Credits: 1 Credit] Lab 3 [Total: 30 Lectures]

Curriculum Details: SHMP503: Based on theory Paper SHMC503

Sr. No	Practical Exercises	Hrs. Required to cover the contents
1.	Preparation of herbal infusions, decoctions, lotions	1
2.	Preparation of herbal insect repellents, suppositories, tinctures	1
3.	Preparation of herbal syrups, poultices, ointments	2
4.	Preparation of herbal syrups, poultices, ointments	2
5.	Detection/Estimations of Vasicine from Adhatoda vasica	2
6.	Identifacation of Curcumin from Curcuma longa by HPTLC	1
7.	Identifacation of Piperine from Piper longum by HPTLC	1
8.	Antibacterial activity of selected drugs	2
9.	Antibacterial activity of selected drugs	2
10.	Antifungal activity of selected drugs	2
11.	Antioxidant activity of selected drugs	2
12.	To perform preliminary phytochemical screening of crude drugs	2
13.	Analytical Profiles of selected herbs – Brahmi,and Aradrographis paniculata	2
14.	Analytical Profiles of selected herbs Aegle marmelos and Gymnema sylvestre.	2
15.	Study of active compounds and medicinal uses of Spirulina , Soya bean , Ginseng and Garlic	2
16.	Study of active compounds and medicinal uses of Flax seeds , Green Tea and Turmeric.	2
17	Visit to Pharmaceutical industries, Department of Pharmacy in University, Research institutes.	2
	Total	**30**

National Education Policy 2020

M.Sc. Herbal Medicine, II Year (Semester - III)

Elective Practical Course

Course Code – SHMEP 501

Title of the Course: Based on theory Paper SHME501

[No. of Credits: 1 Credit] **Lab 3** **[Total: 30 Lectures]**

Curriculum Details: SHMEP 501: Based on theory Paper SHME 501

Sr. No	Practical Exercises	Hrs. Required to cover the contents
1.	Preparation and evaluation of, Anti dandruff Shampoo	2
2.	Preparation and evaluation of, Anti dandruff Shampoo	2
3.	Preparation of Mouth washes	2
4.	Preparation and evaluation of Cold Creams, Vanishing Creams	2
5.	Preparation and evaluation of Gels like Shaving gels	2
6.	Preparation and evaluation of Face powder and Dusting Powder	2
7.	Preparation and evaluation of Eye liners and Lip sticks	2
8.	Preparation of Hand and Body Lotions	2
9.	Preparation and evaluation of Foundation Creams and Cleansing Creams	2
10	Preparation of Hair oils to prevent hair fall	2
11.	Preparation and evaluation of Aloe vera Gel	2
12.	Preparation of Antiseptic cream (Turmeric)	2
13..	Preparation and evaluation of Perfumes	2
14.	Preparation and evaluation of Herbal Henna	2
15.	Collection of various packaging materials used for cosmetics and their description (Each student shall collect at least 10 different types of containers.)	2
	Total	**30**

Syllabus for M. Sc. Herbal Medicine, Second Year

Semester – IV

As Per National Education Policy- 2020

National Education Policy 2020

M.Sc. Herbal Medicine, II Year (Semester - IV)

Major Core Theory Course

Course Code – SHMC 551

Title of the Course: INDUSTRIAL PHARMACOGNOSY

[No. of Credits: 4 Credit] **[Total 60 Lectures]**

Course objectives:

1. To understand the concept and applications of bioreactors
2. To Understand the various methods of bio-separations

Course outcomes:

1. The student shall be able to know the requirements for setting up the herbal/natural drug industry.
2. Student will understand the guidelines for quality of herbal/natural medicines and regulatory issues
3. Interest will develop to establish Herbal product industry

Curriculum Details: SHMC 551: INDUSTRIAL PHARMACOGNOSY

Module No.	Unit No.	Topic	Hrs. Required to cover the contents
1. 0		**Module I: HERBAL DRUG INDUSTRY DEVELOPMENTS**	**15**
	1.1	Legal requirements and Licenses for API and formulation industry, Plant location-Factors influencing.	
	1.2	Plant layout: Factors influencing, Special provisions, Storage space requirements, sterile and aseptic area layout. Infrastructure of herbal drug industry involved in production of standardized extracts and various dosage forms.	
	1.3	Current challenges in upgrading and modernization of herbal formulations. Entrepreneurship Development, Project selection, project report, technical knowledge, Capital venture, plant design, layout and construction.	
	1.4	Pilot plant scale –up techniques, case studies of herbal extracts. Formulation production management.	
2.0		**Module II: REGULATORY REQUIREMENTS FOR SETTINGHERBAL DRUG INDUSTRY**	**15**
	2.1	Global marketing management. Indian and international patent law as applicable herbal drugs and natural products.Export –import (EXIM) policy, TRIPS, IPR. Quality assurance in herbal/natural drug products.	
	2.2	Concepts of TDM, GMP, GLP, ISO-9000. Documentation in pharmaceutical industry: Three tier documentation, Policy,	

		Procedures and Work instructions, and records (Formats), Basic principles- How to maintain, retention and retrieval etc.	
	2.3	Standard operating procedures (How to write), Master Formula Record, Batch Formula Record, Quality audit plan and reports.	
	2.4	Specification and test procedures, Protocols and reports. Distribution records. Electronic data.	
3.0		**Module III: SCALE UP OF FERMENTATION PROCESS**	
	3.1	Principles, theoretical considerations, techniques used, media for fermentation, HTST sterilization, advantage and disadvantage, liquid sterilization.	
	3.2	Cultivation and immobilized culture system, Cultivation system - batch culture, continuous culture, synchronous cultures, fed batch culture.	**15**
	3.3	Graphical plot representing the above systems. Introduction to immobilization, Techniques, immobilization of whole cell, immobilized culture system to prepare fine chemicals.	
	3.4	Immobilization of enzymes and their applications in the industry. Reactors for immobilized systems and perspective of enzyme engineering.	
4.0		**Module IV: MANUFACTURING PROCESS TECHNOLOGY**	
	4.1	Process Automation in Pharmaceutical Industry with specific reference to manufacturing of tablets and coated products	
	4.2	Improved Tablet Production: Tablet production process, granulation and palletization equipment, continuous and batch mixing, rapid mixing granulators, rota granulators, spheronizers and marumerisers, and other specialized granulation and drying equipments. Problems encountered.	**15**
	4.3	Coating technology: Process, equipments, particle coating, fluidized bed coating, application techniques. Problems encountered. Description of industrial processes; Process flow sheeting; Sedimentation; Flocculation; Microfiltration; Sonication; Bead mills; Homogenizers; Chemical lysis; Enzymatic lysis	
	4.4	Membrane based purification: Ultrafiltration; Reverse osmosis; Dialysis; Diafiltration; Pervaporation; Perstraction	
		Total	**60**

SELECTED READINGS:

1. Industrial Biotechnology: L E Casida
2. Industrial Biotechnology: B M Miller and W Litsky
3. Microbial Technology Vols j & II: H Peppler
4. Industrial Biotechnology: Vedpal S Malik and Padma Sridhar
5. Biochemistry of Industrial Microorganisms: C Rainbow and A H Rose
6. Animal Cell Culture: Ian Freshney
7. Microbial Genetics: David Freifelder
8. Biochemical Engineering Fundaments: Bailey and Ollis

9. Biotechnology of Antibiotics and Other Bioactive Microbial Metabolites: Giancarlo Lancini and Roland Lorenzetii
10. Bioreactor Design and Product Yield: Butterworth and Heinemann
11. Enzyme Assays - A Practical Approach: Robert Eisenthal and Michael J Danson
12. Fermentation and Biochemical Engineering Handbook: Henry C Vogel
13. E L V Harris and S. Angal, Protein Purification Methods, Ed. IRL Press at Oxford University Press, 1989.
14. P.A. Belter, E.L. Cussler and Wei-Shou Hu., Bioseparations-Downstream Processing for
15. Biotechnology, Wiley- Interscience Publication, 1988.
16. J. E. Bailey and D. F. Ollis, Biochemical Engineering Fundamentals, 2nd Edition, Mc- Graw Hill, Inc., 1986.
17. R. K. Scopes, Berlin, Protein Purification: Principles and Practice, Springer, 1982.
18. Bernard Rosner, Fundamentals of Biostatistics, 5th Edition, Thomson Brooks/Cole, 2000.
19. Richard A. Johnson, Probability and Statistics for Engineers, 6th Edition, Prentice Hall, 2000.
20. Morris H. DeGroot, Mark J. Schervish, Probability and Statistics, 3rd Rev. Edition, Addison-Wesley, 2002.
21. E. Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley, 2006.
22. Lachman L, Lieberman HA, Kanig JL. The theory and practice of industrial pharmacy, 3rd ed., Varghese Publishers, Mumbai 1991.
23. Sinko PJ. Martin's physical pharmacy and pharmaceutical sciences, 5 th ed., B.I. Publications Pvt. Ltd, Noida, 2006.
24. Lieberman HA, Lachman L, Schwartz JB. Pharmaceutical dosage forms: tablets Vol. IIII, 2 nd ed., CBS Publishers & distributors, New Delhi, 2005.
25. Banker GS, Rhodes CT. Modern Pharmaceutics, 4 th ed., Marcel Dekker Inc, New York, 2005.
26. Sidney H Willing, Murray M, Tuckerman. Williams Hitchings IV, Good manufacturing of pharmaceuticals (A Plan for total quality control) 3rd Edition. Bhalani publishing house Mumbai.
27. Indian Pharmacopoeia. Controller of Publication. Delhi, 1996.
28. British Pharmacopoeia. British Pharmacopoeia Commission Office, London, 2008.
29. United States Pharmacopoeia. United States Pharmacopeial Convention, Inc, USA
30. Dean D A, Evans E R and Hall I H. Pharmaceutical Packaging Technology. London, Taylor & Francis, 1st Edition. UK.
31. Edward J Bauer. Pharmaceutical Packaging Handbook. 2009. Informa Health care USA Inc. New york.
32. Shaybe Cox Gad. Pharmaceutical Manufacturing Handbook. John Willey and Sons, New Jersey, 2008.

National Education Policy 2020

M.Sc. Herbal Medicine, II Year (Semester - IV)

Major Core Theory Course

Course Code – SHMC 552

Title of the Course: HERBAL DRUG DEVELOPMENT

[No. of Credits: 4 Credit] **[Total 60 Lectures]**

Course objectives:

1. To know the general methods of processing of herbs.
2. To understand the various extraction methods of herbal drugs

Course outcomes:

1. Student will know the techniques for processing of herbs
2. Student will understand the methods of isolation and estimation of phytochemicals.
3. Student will prepare herbal formulations.

Curriculum Details: SHMC 552: HERBAL DRUG DEVELOPMENT

Module No.	Unit No.	Topic	Hrs. Required to cover the contents
1.0		**Module I: DRUG DISCOVERY AND PROCESSING OF HERBS**	**11**
	1.1	Drug discovery and development: History of herbs as source of drugs and drug discovery, the lead structure	
	1.2	selection process, structure development, product discovery process and drug registration.	
	1.3	Definition, sources, identification and authentication of herbs, Different methods of processing of herbs like collection, harvesting, garbling, packing and storage conditions,	
	1.4	Methods of drying – Natural and artificial drying methods with their merits and demerits.	
2.0		**Module II: HERBAL PRODUCT DEVELOPMENT**	**11**
	2.1	Preparation of liquid orals, tablets, capsules, ointments, creams and cosmatics	
	2.2	Methods involved in monoherbal and polyherbal formulation with their merits and demerits. Excipeints used in herbal formulation	
	2.3	Compatibility studies. Stability studies. Bioavability & Pharmacokinetic aspects for herbal drugs with examples of well known documented, clinically used herbal drugs.	
	2.4	Quality Control of finished herbal medicinals products.	
3.0		**Module III: ISOLATION AND ESTIMATION OF PHYTOCONSTITUENTS**	**11**

	3.1	Different methods (including industrial) for isolation and estimation of phytoconstituents from the following drugs (with special emphasis on HPLC and HPTLC): Hypericin / Hyperforin from Hypericum species., Forskoline from Coleus forskoli,	
	3.2	Catechins from Green tea, L-Hydroxy citric acid from Garcinia combogia, L-Dopa from Mucuna pruriens,.	
	3.3	Andrographolides from Andrographis paniculata, Alicin from Garlic, Piperine from Piper nigram / Piper longum,	
	3.4	Bacosides from Bacopa monnieri, Berberine from Berberis aristata.	
4.0		**Module IV: HERBAL FORMULATION DEVELOPMENT**	
	4.1	Principles of extraction and selection of suitable extraction method, Different methods of extraction including maceration, percolation, hot continuous extraction, pilot scale extraction and supercritical fluid extraction with their merits and demerits	**12**
	4.2	Purification and Recovery of Solvents. Selection of herbal ingredients	
	4.3	Different dosage forms of herbal drugs	
	4.4	Evaluation of different dosage forms, Stability studies of herbal formulations.	
		Total	**45**

SELECTED READINGS:

1. Quality control of herbal drugs by Pulok K Mukarjee, Ist edition, Business horizons Pharmaceutical publisher, New Delhi, 2002.
2. PDR for herbal medicines, 2nd edition, medicinal economic company, New Jersey, 2000.
3. Indian Herbal Pharmacopoeia, Vol.1&2, RRL, 1DMA, 1998, 2000.
4. Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae, 4th edition, Nirali Prakashan, 1996.
4. Text book of Pharmacognosy and Phytochemistry by rangare.
5. Plant drug analysis 2nd edition by Wagner, Bladt.
6. Herbal drug industry by R.D. Choudhary (1996), Ist Edn, Eastern Publisher, New Delhi
7. GMP for Botanicals - Regulatory and Quality issues on Phytomedicine by Pulok K
5. Mukharjee (2003), Ist Edition, Business horizons Robert Verpoorte, New Delhi.
6. Herbal Cosmetics by H.Pande, Asia Pacific Business press, Inc, New Delhi.
7. The complete technology book on herbal perfumes and cosmetics, by H.Pande, National Institute of Industrial Research, Delhi.
8. Quality control of herbal drugs by Pulok K Mukarjee (2002), Ist Edition, Business Horizons Pharmaceutical Publisher, New Delhi
9. PDR for Herbal Medicines (2000), 2nd Edition, Medicinal Economic Company, New Jersey.
10. Indian Herbal Pharmacopoeia (2002), Revised Edition, 1DMA, Mumbai.
11. Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae (1996), 4th Edition, Nirali Prakashan, New Delhi.
12. Text book of Pharmacognosy and Phytochemistry by Vinod D. RangarI (2002), Part I & II, Career Publication, Nasik, India.
13. Plant drug analysis by H.Wagner and S.Bladt, 2nd edition, Springer, Berlin
14. Standardization of Botanicals. Testing and extraction methods of medicinal herbs by V. Rajpal (2004), Vol.I, Eastern Publisher, New Delhi.
15. Phytochemical Dictionary. Handbook of Bioactive Compounds from Plants by J.B.Harborne, (1999), IInd Edition, Taylor and Francis Ltd, UK.
16. Herbal Medicine. Expanded Commission E Monographs by M.Blumenthal, (2004), IST Edition,

National Education Policy 2020

M.Sc. Herbal Medicine, II Year (Semester - IV)

Elective Theory Course

Course Code – SHME 551

Title of the Course: DRUG STANDARDIZATION AND VALIDATION

[No. of Credits: 3 Credit] **[Total 45 Lectures]**

Course objectives:

1. To know the basics concepts of drug standardization
2. To understand the methods of qualitative and quantitative estimation of herbal extracts

Course outcomes:

1. Learn the good agricultural practices of herbal drug processing
2. Understand the knowledge of drug validation.

Curriculum Details: SHME 551: DRUG STANDARDIZATION AND VALIDATION

Module No.	Unit No.	Topic	Hrs. Required to cover the contents
1. 0		**Module I: STANDARDIZATION OF HERBAL MATERIAL**	
	1.1	Standardization of herbal raw materials including Pharmacognostic, physical, chemical and biological methods with examples, Standardization of herbal extracts, physical, chemical and spectral analysis.	**12**
	1.2	Standaridization of herbal extracts as per WHO/CGMP Guidelines: Physical, chemical, spectral and toxicological standardization	
	1.3	qualitative and quantitative estimations exemplified by the methods of preparation of at least two standardized extracts.	
	1.4	Stability studies for extracts. Predictable chemical and galenical changes.	
2.0		**Module II: HERBAL DRUG PROCESSING PRACTICES**	
	2.1	Good Agricultural Practices, Good practices in collection of plant materials,	**10**
	2.2	Primary processing of herbal products. Documentation required other guidelines for Quality Assurance of Herbal drugs.	
	2.3	Qualitative and Quantitative estimation of active principles from standardized extracts by HPTLC	
	2.4	Biological standardization -Pharmacological screening of herbal extracts and Microbiological evaluation of herbal extracts Toxicity studies of herbal extracts.	
3.0		**Module III: DRUG VALIDATION**	
	3.1	Introduction to validation: Definition of Calibration, Qualification and Validation, Scope, frequency and importance.	**10**
	3.2	Difference between calibration and validation. Calibration of weights and measures. Advantages of Validation, scope of Validation, Organization for Validation, Validation Master plan, Types of	

		Validation, Streamlining of qualification & Validation process and Validation Master Plan.	
	3.3	Qualification: User requirement specification, Design qualification, Factory Acceptance Test (FAT)/Site Acceptance Test (SAT)	
	3.4	Installation qualification, Operational qualification,Performance qualification, Re-Qualification (Maintaining status-Calibration Preventive Maintenance, Change management).	
4.0		**Module IV: PROCESS VALIDATION**	
	4.1	Qualification of analytical instruments: Electronic balance, pH meter, UV-Visible spectrophotometer, FTIR, GC, HPLC, HPTLC	**13**
	4.2	Disintegration and Dissolution Qualification of Glassware: Volumetric flask, pipette, beakers and burette	
	4.3	Validation of Utility systems - Pharmaceutical Water System & pure steam, HVAC system, Compressed air and nitrogen. Cleaning Validation: Cleaning Validation-Cleaning Method development	
	4.4	Validation and validation of analytical method used in cleaning. Cleaning of Equipment, Cleaning of Facilities. Cleaning in place (CIP). General principles, Validation of analytical method as per ICH guidelines	
		Total	**45**

SELECTED READINGS:

1. Ayurvedic Pharmacopoeia. Ayurvedic Formulary of India, the Indian Medical
2. Practitioners Co-operative Pharmacy and Stores Ltd, IMPCOPS.
3. Hand Book on Ayurvedic Medicines, H.Panda National Institute of Industrial Research, Delhi-7.
4. Ayurvedic system of medicine, 2nd edition, Kaviraj, Nagendranath Sengupata, vol. I &II.
5. Siddha Pharmacopoeia by Dr.S. Chidambarathanu pillai, Ist edition.
6. Unani Pharmacopoeia.
7. Homeopathic Pharmacopoeia.
8. Homeopathic Pharmacy An introduction & Hand book by Steven B. Kayne.
9. Alternative medicine, by Dr. K.B. Nangia.
10. Aromatherapy, Valerie Gennari Cooksley.
11. Indian Herbal Pharmacopoeia vol. I &II Indian Drug Manufacturer's association, Mumbai.
12. British Herbal Pharmacopoeia British Herbal Medicine Association,1990 vol.I.
13. Screening methods of Pharmacology by Robert turner.
14. Toxicology and Clinical Pharmacology of Herbal Products, Melanie Johns Cupp1.
15. Herbal drug industry by R.D. Choudhary, Ist edition, eastern publisher, NewDelhi: 1996.
16. GMP for Botanicals - Regulatory and Quality issues on Phytomedicine Business horizons, New Delhi, First edition, 2003. Robert Verpoorte, Pulok K Mukharjee.

17. Quality control of herbal drugs by Pulok K Mukarjee, Ist edition, Business horizons Pharmaceutical publisher, New Delhi, 2002.
18. PDR for herbal medicines, 2nd edition, medicinal economic company, New Jersey, 2000.
19. Indian Herbal Pharmacopoeia, Vol.1&2, RRL, 1DMA, 1998, 2000.
20. Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae, 4th edition, Nirali Prakashan, 1996.
21. Text book of Pharmacognosy and Phytochemistry by rangare.
22. Plant drug analysis 2nd edition by Wagner, Bladt.
23. Biological standardization by J. N. Barn, D. J. Finley and L.G. Good win
24. B. T. Loftus & R. A. Nash, "Pharmaceutical Process Validation", Drugs and Pharm Sci. Series, Vol. 129, 3rd Ed., Marcel Dekker Inc., N.Y.
25. The Theory & Practice of Industrial Pharmacy, 3rd edition, Leon Lachman, Herbert A. Lieberman, Joseph. L. Karig, Varghese Publishing House, Bombay.
26. Validation Master plan by Terveeks or Deeks, Davis Harwood International publishing.
27. Validation of Aseptic Pharmaceutical Processes, 2nd Edition, by Carleton & Agalloco, (Marcel Dekker).
28. Michael Levin, Pharmaceutical Process Scale-Up‖, Drugs and Pharm. Sci. Series, Vol. 157, 2nd Ed., Marcel Dekker Inc., N.Y.
29. Validation Standard Operating Procedures: A Step by Step Guide for Achieving Compliance in the Pharmaceutical, Medical Device, and Biotech Industries, Syed Imtiaz Haider
30. Pharmaceutical Equipment Validation: The Ultimate Qualification Handbook, Phillip A. Cloud, Interpharm Press
31. Validation of Pharmaceutical Processes: Sterile Products, Frederick J. Carlton (Ed.) and James Agalloco (Ed.), Marcel Dekker, 2nd Ed.
32. Analytical Method validation and Instrument Performance Verification by Churg Chan, Heiman Lam, Y.C. Lee, Yue. Zhang, Wiley Interscience.

National Education Policy 2020

M.Sc. Herbal Medicine, II Year (Semester - IV)

Publication Ethics Theory Course

Course Code – SHMPE 551

Title of the Course: PUBLICATION ETHICS

[No. of Credits: 2 Credit] **[Total :30 Lectures]**

Course objectives:

1. To know rules, issues, options, and resources for research ethics.
2. To familiarize with various institutional ethics review boards/academic integrity guidelines.
3. To understand the purpose and value of ethical decision-making.
4. To have a positive disposition towards continued learning about research ethics

Course outcomes:

1. To have a positive disposition towards continued learning about research philosophy & ethics.
2. To know Rules, Regulations, Issues, Options, and Scientific Resources of Research Ethics.
3. To learn the culture of fairness, honesty and integrity in academic communications and to understand the purpose and value of ethical decision-making.
4. Avoid wasteful and duplicate publications & encourage original contributions to advance Academic Research and Scholarship.
5. Acquiring knowledge & professional competence and expertise about Patents, Copyrights, and other forms of Intellectual Property Rights.
6. To promote social good and prevent or mitigate societal hazards through innovative ideas, creativity and research advocacy

CURRICULUM DETAILS: SHMPE 551: PUBLICATION ETHICS

ModuleNo.	UnitNo.	Topic	Hrs. Required to cover the contents
1.0		**Module I: PUBLICATION ETHICS**	
	1.1	Publication ethics: definition, introduction and importance 2. Best practices/standards setting initiatives and guidelines: COPE, WAME, etc. Conflicts of interest	**08**
	1.2	Publication misconduct: definition, concept, problems that lead to unethical behavior and vice verse, types	
	1.3	Violation of publication ethics, authorship and contributor ship	
	1.4	Identification of publication misconduct, complaints and appeals. Predatory publishers and journals	
2.0		**Module II: OPEN ACCESS PUBLISHING**	
	2.1	Open access publications and initiatives.	**07**
	2.2	SHERPA/RoMEO online resource to check publisher copyright and self- archiving policies	
	2.3	Software tool to identify predatory publications developed by SPPU	
	2.4	Journal finder/ journal suggestion tools viz. JANE	

3.0		**Module III: PUBLICATION MISCONDUCT**	
	3.1	Subject specific ethical issues, FFP, authorship	**07**
	3.2	Conflicts of interest	
	3.3	Complaints and appeals: examples and fraud from India and abroad	
	3.4	Use of plagiarism software like Turnitin, Urkund and other open source software tools.	
4.0		**Module IV: DATABASES AND RESEARCH METRICS**	
	4.1	Databases: Indexing databases	**08**
	4.2	Citation databases: Web of Science, Scopus, etc.	
	4.3	Research Metrics: Impact Factor of journal as per journal citation report, SNIP, SJR, IPP, Cite Score.	
	4.4	Metrics: h-index, g index, i10 index, altmetrics	
		Total	**30**

SELECTED READINGS:

1. The Handbook of Social Research Ethics, Donna M. Mertens, Pauline E. Ginsberg, SAGE (2009).
2. What are Qualitative Research Ethics? Rose Wiles, Bloomsbury (2013).
3. Research Ethics: Cases and Materials, Robin Levin Penslar, eds, Indiana University Press (1995).
4. Research Ethics: A Philosophical Guide to the Responsible Conduct of Research, Gary Comstock, Cambridge University Press (2013)
5. Bird, A. (2006). Philosophy of Science. Routledge.
6. MacIntyre, Alasdair (1967) A Short History of Ethics London
7. P. Chaddah, (2018) Ethics in Competitive Research: Do not get scooped; do not get plagiarized, ISBN:978-
8. 9387480865
9. National Academy of Sciences, National Academy of Engineering and Institute of Medicine. (2009). On Being
10. a Scientist: A Guide to Responsible Conduct in Research. Third Edition. National Academies Press.
11. Resnik, D. B. (2011). What is ethics in research & why is it important. National Institute of Environmental
12. Health Sciences, 1-10. Retrieved from https www.nichs.nih.gov/research/resources/bioethics/whatis/index.cfm
13. Beall, J. (2012). Predatory publishers are corrupting open access. Nature, 489(7415), 179-179.
14. https://doi.org/10.1038/489179a
15. Indian National Science Academy (INSA), Ethics in Science Education, Research and Governance(2019),
16. ISBN:978-81-939482-1-7. http://www.insaindia.res.in/pdf/Ethics Book.pdf

National Education Policy 2020

M.Sc. Herbal Medicine, II Year (Semester - IV)

Core Practical Course

Course Code – SHMP 551

Title of the Course: Based on theory Paper SHMC 551

[No. of Credits: 1 Credit] Lab 1 [Total 30 Lectures]

CurriculumDetails: SHMP 551: Based on theory Paper SHMC 551

Sr. No	Practical Exercises	Hrs. Required to cover the contents
1.	Case studies of herbal extracts	4
2.	Preparation of project report for development of herbal drug industry	2
3.	Preparation of media for fermentation	4
4.	Centrifugation in batch and continuous centrifuge	2
5.	Conventional filtration	2
6.	Adsorption process in batch and continuous mode	2
7.	Immobilization of enzymes	2
8.	Tablet production process	2
9.	Membrane based filtration-ultra filtration in cross flow modules and micro filtration	2
10.	Membrane based purifications	2
11.	Protein precipitation and its recovery	2
12.	Visit to Pharmaceutical industries, Department of Pharmacy in University, Research institutes.	4
	Total	**30**

National Education Policy 2020

M.Sc. Herbal Medicine, II Year (Semester - IV)

Core Practical Course

Course Code – SHMP 552

Title of the Course: Based on theory Paper SHMC 552

[No. of Credits: 1 Credit] **Lab 2** **[Total 30 Lectures]**

CurriculumDetails: SHMP 552: Based on theory Paper SHMC 552

Sr. No	Practical Exercises	Hrs. Required to cover the contents
1.	Processing of herbs	2
2.	Isolation and estimation of phytoconstituents by HPTLC listed in chapter III	4
3.	Spectroscopic analysis of some isolated compounds	2
4.	Estimation of phytoconstituents in mono and polyherbal formulations by HPTLC Technique	4
5.	Preparation of liquid orals and capsules	2
6.	Preparation of ointments and creams	2
7.	Estimation Of Andrographolides from Andrographis paniculata	2
8.	Estimation Of Alicin from Garlic	2
9.	Estimation Of Bacosides from Bacopa monnieri	2
10.	Estimation Of L-Dopa from Mucuna pruriens	2
11.	Preparation of some important extracts by using Pilot Scale Extraction Plant	2
12.	Evaluation of different dosage forms,	2
13.	Visit to Pharmaceutical industries, Department of Pharmacy in University, Research institutes.	2
	Total	**30**

National Education Policy 2020

M.Sc. Herbal Medicine, II Year (Semester - IV)

Elective Practical Course

Course Code – SHMEP 551

Title of the Course: Based on theory Paper SHME 551

[No. of Credits: 1 Credit] **Lab 3** **[Total 30 Lectures]**

Curriculum Details: SHMEP 551: Based on theory Paper SHME 551

Sr. No	Practical Exercises	Hrs. Required to cover the contents
1.	Formulation and standardization of some important herbal cosmetics	2
2.	Demonstration of various dosage forms available in each system.	2
3.	Simple preparations used in Ayurvedic System and their Standardization (with special emphasis on HPTLC).	2
4.	Simple preparations used in Siddha system and their Standardization (with special emphasis on HPTLC).	2
5.	Simple preparations used in Unani system and their Standardization (with special emphasis on HPTLC).	2
6.	Simple preparations used in Homeopathy system and their Standardization (with special emphasis on HPTLC).	2
7.	Imupurity profiling of drugs	2
8.	Calibration of glasswares	2
9.	Calibration of pH meter	2
10.	Calibration of UV-Visible spectrophotometer	2
11.	Calibration of FTIR spectrophotometer	2
12.	Calibration of GC instrument	2
13.	Calibration of HPLC instrument	2
14.	Cleaning validation of one equipment	2
15.	Visit to Pharma industries ,Research institutes etc.	**2**
	Total	**30**

Guidelines for Course Assessment:

A. Continuous Assessment (CA) (20% of the Maximum Marks):

This will form 20% of the Maximum Marks and will be carried out throughout the semester. It may be done by conducting **Two Tests** (Test I on 40% curriculum) and **Test II** (remaining 40% syllabus). Average of the marks scored by a student in these two tests of the theory paper will make his **CA** score (col 6).

B. End Semester Assessment (80% of the Maximum Marks):

(For illustration we have considered a paper of 04 credits, 100 marks and need to be modified depending upon credits of an individual paper)

1. **ESA Question paper will consists of 6 questions, each of 20 marks.**
2. **Students are required to solve a total of 4 Questions.**
3. **Question No.1 will be compulsory and shall be based on entire syllabus.**
4. Students need to solve **ANY THREE** of the remaining Five Questions (Q.2 to Q.6) and shall be based on entire syllabus.

Note: Number of lectures required to cover syllabus of a course depends on the number of credits assigned to a particular course. One credit of theory corresponds to 15 Hours lecturing and for practical course one credit corresponds to 30 Hours. For example, for a course of two credits 30 lectures of one hour duration are assigned, while that for a three credit course 45lectures.

%%%%