।। सा विद्या या विमुक्तये ।।
स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड
"ज्ञानतीर्थ" परिसर, विष्णुपूरी, नांदेड - ४३१६०६ (महाराष्ट्र)
SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY NANDED
"Dnyanteerth", Vishnupuri, Nanded - 431606 Maharashtra State (INDIA)
Established on 17th September 1994 – Recognized by the UGC U/s 2(f) and 12(B), NAAC Re-accredited with 'A' Grade
25 1994 - 2019 SILVER JUBILEE YEAR
ACADEMIC (1-BOARD OF STUDIES) SECTION
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संलग्नित महाविद्यालयांतील विज्ञान व तंत्रज्ञान विद्याशाखेतील पदव्युत्तर स्तरावरील प्रथम वर्षाचे CBCS Pattern नुसारचे अभ्यासक्रम शैक्षणिक वर्ष २०१९–२० पासून लागू करण्याबाबत.

प रि प त्र क

या परिपत्रकान्वये सर्व संबंधितांना कळविण्यात येते की, **दिनांक ०८ जून २०१९ रोजी संपन्न झालेल्या ४४व्या मा. विद्या परिषद बैठकीतील ऐनवेळचा विषय क्र.११/४४–२०१९** च्या ठरावानुसार प्रस्तुत विद्यापीठाच्या **संलग्नित महाविद्यालयांतील विज्ञान व तंत्रज्ञान विद्याशाखेतील पदव्युत्तर स्तरावरील प्रथम वर्षाचे** खालील विषयांचे **C.B.C.S. (Choice Based Credit System) Pattern** नुसारचे अभ्यासक्रम शैक्षणिक वर्ष २०१९–२० पासून लागू करण्यात येत आहेत.

1. Bioinformatics
2. Biotechnology
3. Boichemistry
4. Botany
5. Chemistry
6. Computer Management
7. Computer Science
8. Dairy Science
9. Environmental Science
10. Herbal Medicine
11. Information Technology
12. M.C.A.
13. Microbiology
14. Physics
15. Software Engineering
16. System Administration & Networking
17. Zoology

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

'ज्ञानतीर्थ' परिसर,
विष्णुपुरी, नांदेड – ४३१ ६०६.
जा.क्र.: शैक्षणिक–१/परिपत्रक/पदव्युत्तर–सीबीसीएस अभ्यासक्रम/२०१९–२०/**४६४**
दिनांक : ११.०७.२०१९.

स्वाक्षरित/–
उपकुलसचिव
शैक्षणिक (१–अभ्यासमंडळ) विभाग

प्रत माहिती व पुढील कार्यवाहीस्तव :

१) मा. कुलसचिव यांचे कार्यालय, प्रस्तुत विद्यापीठ.
२) मा. संचालक, परीक्षा व मूल्यमापन मंडळ यांचे कार्यालय, प्रस्तुत विद्यापीठ.
३) प्राचार्य, सर्व संबंधित संलग्नित महाविद्यालये, प्रस्तुत विद्यापीठ.
४) साहाय्यक कुलसचिव, पदव्युत्तर विभाग, प्रस्तुत विद्यापीठ.
५) उपकुलसचिव, पात्रता विभाग, प्रस्तुत विद्यापीठ.
६) सिस्टम एक्सपर्ट, शैक्षणिक विभाग, प्रस्तुत विद्यापीठ.

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

CHOICE BASED CREDIT SYSTEM (CBCS)

SEMESTER PATTERN

Faculty of Science and Technology

Post Graduate (PG) Program

HERBAL MEDICINE- CURRICULUM

w. e. f. Academic Year 2019-2020

M. Sc. FIRST YEAR

SEMESTER I & II

HERBAL MEDICINE– CURRICULUM

JUNE, 2019

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

CHOICE BASED CREDIT SYSTEM (CBCS)

SEMESTER PATTERN

Faculty of Science and Technology

Post Graduate (PG) Program

HERBAL MEDICINE- CURRICULUM

w. e. f. Academic Year 2019-2020

Introduction:

Herbal medicine is the use of medicinal plant material which provides a safe and gentle treatment for a wide range of conditions. Herbal medicine is one of the oldest forms of medicine and is still used by 80% of the world's population. Herbal medicine is based on traditional uses of herbal remedies from many parts of the world, which have been confirmed and updated by scientific research. The proposed coursed will explore the maximum utilization of plant resources, extraction of active principles from medicinal plants in order to optimize a single chemical compound for treatment of diseases. The students enable to prepare different formulations from medicinal plants locally available. This course will provide a broader perspective to post graduate students intending to enter medicine or medically related fields including ethnobotany, herbal practice, medicinal chemistry, pharmacognosy etc.

M. Sc. (Herbal Medicine) a PG course sanctioned by UGC, New Delhi under Innovative Program from 2012 to 2017. As this course has tremendous potential in the herbal industries this course is still continued for the benefit of the students to build up their carrier in the field of Herbal Medicine.

Salient Features:

The syllabus of M. Sc. Herbal Medicine has been framed to meet the requirement of Choice based Credit System. The syllabus is framed as per the guidelines of UGC, New Delhi. The papers offered here in this syllabus will train and orient the students in the field of Herbal Medicine. In the First semester papers are introduced to enhanced preliminary knowledge of Herbal Medicines. In semester second papers based on Instrumentation, phytochemical analysis, human diseases, molecular biology and pharmacognosy. In semester third and fourth papers are based on applied aspects of herbal medicines in which the papers like Herbal Drug Technology, Herbal Cosmetics and Standardization of Drugs are more important in industrial point of view. Elective papers are introduced in each and every semester. Laboratory course work are based on respective theory papers.

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

CHOICE BASED CREDIT SYSTEM (CBCS)

SEMESTER PATTERN

Faculty of Science and Technology

Post Graduate (PG) Program

HERBAL MEDICINE- CURRICULUM

w. e. f. Academic Year 2019-2020

Learning Objectives:

1. To provide an updated education to the students at large in order to know the importance and scope of the Herbal Medicine.
2. To introduce recent advances in the subject and enable the students for current development in the subject.
3. To develop a scientific attitude among the students.
4. To develop an ability to work on their own and to make them fit for solving recent problems of society.
5. To develop skills and make them practical oriented to establish their own unit based on herbal medicine.
6. To aware the students for importance of medicinal plant species and their conservation.
7. To develop entrepreneurship among the students in the field of herbal medicines.
8. To develop the expertise in the field of herbal medicine in order to identify medicinal plant species and adulteration in herbal products.

Learning Outcomes:

This program will train and orient the students in the field of Herbal Medicine. The students will be placed in herbal based industries and research institutes. They can establish their own herbal industries. They can provide consultancy services for cultivation of medicinal plants, their processing and marketing. They can also get job in education institutes and universities.

Prerequisite:

Admissions to this Course are given as per the University rules.

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

CHOICE BASED CREDIT SYSTEM (CBCS)

SEMESTER PATTERN

Faculty of Science and Technology

Post Graduate (PG) Program

HERBAL MEDICINE- CURRICULUM

w. e. f. Academic Year 2019-2020

M. Sc. FIRST YEAR HERBAL MEDICINE CURRICULUM

Semester-I

An Outline:

Paper number & Title	Credits (Marks)			Periods
	External: ESE	Internal: CA	Total Credits (Marks)	
Theory Paper-I: Indian System of Medicines	Credit: 03 (Marks:75)	Credit: 01 (Marks:25) (2 Tests: 20 marks , Assignment: 05 marks)	Credits: 04 (Marks:100)	60
Theory Paper-II: Taxonomy and anatomy of Medicinal Plants	Credit: 03 (Marks:75)	Credit: 01 (Marks:25) (2 Tests: 20 marks , Assignment: 05 marks)	Credits: 04 (Marks:100)	60
Theory Paper-III: Biochemistry and Plant Metabolism	Credit: 03 (Marks:75)	Credit: 01 (Marks:25) (2 Tests: 20 marks , Assignment: 05 marks)	Credits: 04 (Marks:100)	60
***Theory Paper-IV:** Cultivation, Properties and Utilization of Medicinal Plants **(Elective)**	Credit: 03 (Marks:75)	Credit: 01 (Marks:25) (2 Tests: 20 marks , Assignment: 05 marks)	Credits: 04 (Marks:100)	60
Theory Paper-V: Seminar/ MOOCs (SWAYAM/NPTEL)	-	Credit: 01 (Marks:25)	Credits: 01 (Marks:25)	-
Total	Credit: 12 (Marks: 300)	Credit: 05 (Marks:125)	Credits: 17 (Marks:425)	240

(**ESE:** End of Semester Examination, **CA:** Continuous Assessment, ***:** Elective paper)

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

CHOICE BASED CREDIT SYSTEM (CBCS)

SEMESTER PATTERN

Faculty of Science and Technology

Post Graduate (PG) Program

HERBAL MEDICINE- CURRICULUM

w. e. f. Academic Year 2019-2020

M. Sc. FIRST YEAR HERBAL MEDICINE CURRICULUM

Semester-II

An Outline:

Paper number & Title	Credits (Marks)			Periods
	External: ESE	Internal: CA	Total Credits (Marks)	
Theory Paper-VI: Instrumentation and Modern analytical techniques	Credit: 03 (Marks:75)	Credit: 01 (Marks:25) (2 Tests: 20 marks , Assignment: 05 marks)	Credits: 04 (Marks:100)	60
Theory Paper-VII: Microbiology and Pathology of Human Diseases	Credit: 03 (Marks:75)	Credit: 01 (Marks:25) (2 Tests: 20 marks , Assignment: 05 marks)	Credits: 04 (Marks:100)	60
Theory Paper-VIII: Molecular Biology and Genetic Engineering	Credit: 03 (Marks:75)	Credit: 01 (Marks:25) (2 Tests: 20 marks , Assignment: 05 marks)	Credits: 04 (Marks:100)	60
***Theory Paper-IX:** Fundamentals of Pharmacognosy **(Elective)**	Credit: 03 (Marks:75)	Credit: 01 (2 Tests: 20 marks , Assignment: 05 marks)	Credits: 04 (Marks:100)	60
Theory Paper-X: Seminar/ MOOCs (SWAYAM/NPTEL)	-	Credit: 01 (Marks:25)	Credits: 01 (Marks:25)	-
Total	Credit: 12 (Marks: 300)	Credit: 05 (Marks:125)	Credits: 17 (Marks:425)	240

(**ESE:** End of semester examination, **CA:** Continuous assessment, ***:** Elective paper)

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

CHOICE BASED CREDIT SYSTEM (CBCS)

SEMESTER PATTERN

Faculty of Science and Technology

Post Graduate (PG) Program

HERBAL MEDICINE- CURRICULUM

w. e. f. Academic Year 2019-2020

M. Sc. FIRST YEAR HERBAL MEDICINE
LABORATORY COURSE WORK
Annual Pattern

An Outline:

Paper number & Title	Credits (Marks)			Practicals
	External: ESE	Internal: CA	Total Credits (Marks)	
Laboratory Course Work-I: Based on theory paper-I&II	Credit: 03 (Marks:75)	Credit: 01 (Marks:25)	Credits: 04 (Marks:100)	15
Laboratory Course Work-II: Based on theory paper-III&IV	Credit: 03 (Marks:75)	Credit: 01 (Marks:25)	Credits: 04 (Marks:100)	15
Laboratory Course Work-III: Based on theory paper-VI&VII	Credit: 03 (Marks:75)	Credit: 01 (Marks:25)	Credits: 04 (Marks:100)	15
Laboratory Course Work-IV: Based on theory paper-VIII&IX	Credit: 03 (Marks:75)	Credit: 01 (Marks:25)	Credits: 04 (Marks:100)	15
Total	Credit: 12 (Marks: 300)	Credit: 05 (Marks:125)	Credits: 16 (Marks:425)	60

(**ESE:** End of semester examination, **CA:** Continuous assessment, ***:** Elective paper)

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

CHOICE BASED CREDIT SYSTEM (CBCS)

SEMESTER PATTERN

Faculty of Science and Technology

Post Graduate (PG) Program

HERBAL MEDICINE- CURRICULUM

w. e. f. Academic Year 2019-2020

M. Sc. SECOND YEAR HERBAL MEDICINE CURRICULUM

Semester-III

An Outline:

Paper number & Title	Credits (Marks)			Periods
	External: ESE	Internal: CA	Total Credits (Marks)	
Theory Paper-XI: Natural Plant Products	Credit: 03 (Marks:75)	Credit: 01 (Marks:25) (2 Tests: 20 marks , Assignment: 05 marks)	Credits: 04 (Marks:100)	60
Theory Paper-XII: Medicinal Plant Biotechnology	Credit: 03 (Marks:75)	Credit: 01 (Marks:25) (2 Tests: 20 marks , Assignment: 05 marks)	Credits: 04 (Marks:100)	60
Theory Paper-XIII: Herbal Drug Technology	Credit: 03 (Marks:75)	Credit: 01 (Marks:25) (2 Tests: 20 marks , Assignment: 05 marks)	Credits: 04 (Marks:100)	60
***Theory Paper-XIV:** Herbal Cosmetics **(Elective)**	Credit: 03 (Marks:75)	Credit: 01 (Marks:25) (2 Tests: 20 marks , Assignment: 05 marks)	Credits: 04 (Marks:100)	60
Theory Paper-XV: Seminar/ MOOCs (SWAYAM/NPTEL)	-	Credit: 01 (Marks:25)	Credits: 01 (Marks:25)	-
Total	Credit: 12 (Marks: 300)	Credit: 05 (Marks:125)	Credits: 17 (Marks:425)	240

(**ESE:** End of Semester Examination, **CA:** Continuous Assessment, ***:** Elective paper)

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

CHOICE BASED CREDIT SYSTEM (CBCS)

SEMESTER PATTERN

Faculty of Science and Technology

Post Graduate (PG) Program

HERBAL MEDICINE- CURRICULUM

w. e. f. Academic Year 2019-2020

M. Sc. SECOND YEAR HERBAL MEDICINE CURRICULUM

Semester-IV

An Outline:

Paper number & Title	Credits (Marks)			Periods
	External: ESE	Internal: CA	Total Credits (Marks)	
Theory Paper-XVI: Industrial Pharmacognosy	Credit: 03 (Marks:75)	Credit: 01 (Marks:25) (2 Tests: 20 marks , Assignment: 05 marks)	Credits: 04 (Marks:100)	60
Theory Paper-XVII: Herbal Drug Development	Credit: 03 (Marks:75)	Credit: 01 (Marks:25) (2 Tests: 20 marks , Assignment: 05 marks)	Credits: 04 (Marks:100)	60
Theory Paper-XVIII: Drug Standardization and Validation	Credit: 03 (Marks:75)	Credit: 01 (Marks:25) (2 Tests: 20 marks , Assignment: 05 marks)	Credits: 04 (Marks:100)	60
***Theory Paper-XIX:** Regulatory affairs and IPR **(Elective)**	Credit: 03 (Marks:75)	Credit: 01 (2 Tests: 20 marks , Assignment: 05 marks)	Credits: 04 (Marks:100)	60
Theory Paper-XX: Seminar/ MOOCs (SWAYAM/NPTEL)	-	Credit: 01 (Marks:25)	Credits: 01 (Marks:25)	-
Total	Credit: 12 (Marks: 300)	Credit: 05 (Marks:125)	Credits: 17 (Marks:425)	240

(**ESE:** End of semester examination, **CA:** Continuous assessment, ***:** Elective paper)

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

CHOICE BASED CREDIT SYSTEM (CBCS)

SEMESTER PATTERN

Faculty of Science and Technology

Post Graduate (PG) Program

HERBAL MEDICINE- CURRICULUM

w. e. f. Academic Year 2019-2020

M. Sc. SECOND YEAR HERBAL MEDICINE
LABORATORY COURSE WORK
Annual Pattern

An Outline:

Paper number & Title	Credits (Marks)			Practicals
	External: ESE	Internal: CA	Total Credits (Marks)	
Laboratory Course Work-V: Based on theory paper-XI&XII	Credit: 03 (Marks:75)	Credit: 01 (Marks:25)	Credits: 04 (Marks:100)	15
Laboratory Course Work-VI: Based on theory paper-XIII&XIV	Credit: 03 (Marks:75)	Credit: 01 (Marks:25)	Credits: 04 (Marks:100)	15
Laboratory Course Work-VII: Based on theory paper-XVI&XVII Based on theory paper-XVIII&XIX	Credit: 03 (Marks:75)	Credit: 01 (Marks:25)	Credits: 04 (Marks:100)	15
Laboratory Course Work-VIII: Project Work	Credit: 03 (Marks:75)	Credit: 01 (Marks:25)	Credits: 04 (Marks:100)	15
Total	Credit: 12 (Marks: 300)	Credit: 05 (Marks:125)	Credits: 16 (Marks:425)	60

(**ESE:** End of semester examination, **CA:** Continuous assessment, ***:** Elective paper)

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

CHOICE BASED CREDIT SYSTEM (CBCS)

SEMESTER PATTERN

Faculty of Science and Technology

Post Graduate (PG) Program

HERBAL MEDICINE- CURRICULUM

w. e. f. Academic Year 2019-2020

M. Sc. FIRST YEAR

SEMESTER – I

HERBAL MEDICINE

JUNE, 2019

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

CHOICE BASED CREDIT SYSTEM (CBCS)

SEMESTER PATTERN

Faculty of Science and Technology

Post Graduate (PG) Program

HERBAL MEDICINE- CURRICULUM

w. e. f. Academic Year 2019-2020

M. Sc. FIRST YEAR

SEMESTER – I

HERBAL MEDICINE

THEORY PAPER – I: INDIAN SYSTEM OF MEDICINES

Periods: 60 Credits: 04

Learning Objectives

1. To study and impart knowledge about the different systems of medicines of India
2. To inspire students to know the importance of various systems

Learning outcomes:

1. Understand the different dosage forms, Methods of preparation of different types of medcines.
2. To know the difference between various systems of medicines

UNIT-I: AYURVEDIC SYSTEM OF MEDICINE (15 Periods)

Historical aspects, Principles with merits and demerits, Introduction on different dosage forms, Methods of preparation of Ayurvedic medicines, Standardization of Ayurvedic medicines, Problems in Standardization of ayurvedic medicines.

UNIT-II: UNANI SYSTEM OF MEDICINE (15 Periods)

Historical aspects, Principles with merits and demerits, Introduction on different dosage forms, Method of preparation of Unani medicines, Standardization of Unani medicines, Problems in Standardization of Unani medicine.

UNIT-III: HOMEOPATHY SYSTEM OF MEDICINE (15 Periods)

Historical aspects, Principles with merits and demerits, Introduction on different dosage forms, Method of preparation of Homeopathic medicines, Standardization of Homeopathic medicines, Problems in Standardization of Homeopathic medicine.

UNIT-IV: SIDDHA AND TRIBAL SYSTEM OF MEDICINES (15 Periods)

History, Principles with merits and demerits, Introduction on different dosage forms, Method of preparation of Siddha medicine. Principles, Importance, Merits and Demerits of Tribal Medicines, Rules and Regulations to Safeguard the Complimentary Medicines.

History, Principles, Introduction and Methods of Naturopathy.

M. Sc. FIRST YEAR
HERBAL MEDICINE

LABORATORY COURSE WORK: BASED ON THEORY PAPER – I
(Annual Pattern)

Practical Exercises:

1. Demonstration of various dosage forms available in each system (3 practicals)
2. Sample preparations used in Ayurvedic System and their Standardization (3 practicals)
3. Sample preparations used in Unani system and their Standardization (3 practicals)
4. Sample preparations used in Homeopathy system and their Standardization (3 practicals)
5. Sample preparations used in Siddha system and their Standardization (3 practicals)
6. Sample preparations used in Tribal and Naturopathy system and their Standardization (3 practicals)
7. Visit to Pharmaceutical industries, Ayurvedic, Homeopathic and Unani laboratories and research institutes.

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

CHOICE BASED CREDIT SYSTEM (CBCS)

SEMESTER PATTERN

Faculty of Science and Technology

Post Graduate (PG) Program

HERBAL MEDICINE- CURRICULUM

w. e. f. Academic Year 2019-2020

M. Sc. FIRST YEAR

SEMESTER – I

HERBAL MEDICINE

THEORY PAPER – II: TAXONOMY AND ANATOMY OF MEDICINAL PLANTS

Periods: 60 Credits: 04

Learning Objectives

1. To study and impart knowledge about the occurrence, distribution and characters of different families of Angiosperms
2. To inspire students to study diversity and anatomy of Angiospems

Learning outcomes:

1. Understand the morphology, characters and importance of the various families of angiospems.
2. Learn the skill for the Identification of plants
3. Understand the anatomical features of plants

UNIT-I: GENERAL PRINCIPLES OF TAXONOMY (15 Periods)

Introduction – Definition, aims and objectives of taxonomy, Typological, Taxonomical, Biological concept of species. Salient features of International Code of Botanical Nomenclature (ICBN), Principles, articles and recommendations

UNIT-II: TAXONOMIC EVIDENCES AND CLASSIFICATIONS (15 Periods)

Taxonomic evidence: morphology, cytology, palynology, phytochemistry, Taxonomic tools: herbarium, floras, botanical gardens, use of keys in plant identification. Systems of angiosperms classification: Broad outline of Bentham and Hooker, Engler and Prantl's and Hutchinson's system of classification with merits and demerits.

UNIT-III: STUDY OF FAMILIES-I (15 Periods)

Comparative account of following Angiospermic families as per Bentham and Hooker's system-

- Meliaceae
- Malvaceae
- Verbenaceae
- Asteraceae
- Lamiaceae
- Solanaceae
- Zingiberaceae
- Liliaceae

UNIT-IV: ANATOMY OF MEDICINAL PLANTS (15 Periods)

Introduction, importance and scope of anatomy of plants. Organization of root apical meristem (RAM), Lateral root and root hairs. Organization of shoot apical meristem (SAM). Cytological and molecular aspects of SAM. Vascular tissue differentiation- Xylem and phloem. Secretary tissues: types and importance, Structure and types of stomata and trichomes. Role of anatomy in taxonomy.

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

CHOICE BASED CREDIT SYSTEM (CBCS)

SEMESTER PATTERN

Faculty of Science

Post Graduate (PG) Programmes

HERBAL MEDICINE- CURRICULUM

w. e. f. Academic Year 2019-2020

M. Sc. FIRST YEAR

HERBAL MEDICINE

LABORATORY COURSE WORK: BASED ON THEORY PAPER – II
(Annual Pattern)

Practical Exercises:

1. Description and identification of at least two plant species belonging to Meliaceae with their floral formulae and floral diagrams
2. Description and identification of at least two plant species belonging to Malvaceae with their floral formulae and floral diagrams
3. Description and identification of at least two plant species belonging to Verbenaceae with their floral formulae and floral diagrams
4. Description and identification of at least two plant species belonging to Asteraceae with their floral formulae and floral diagrams
5. Description and identification of at least two plant species belonging to Lamiaceae with their floral formulae and floral diagrams
6. Description and identification of at least two plant species belonging to Solanaceae with their floral formulae and floral diagrams
7. Description and identification of at least two plant species belonging to Zingiberaceae with their floral formulae and floral diagrams
8. Description and identification of at least two plant species belonging to Liliaceae with their floral formulae and floral diagrams
9. Study of RAM & SAM with the help of models/ Photographs
10. Study of Vascular tissues using maceration technique
11. Study of Secretary tissues with the help of permanent slides.
12. Study of Structure and types of stomata and trichomes
13. Botanical excursion for onsite study of medicinal plants

Note: *Students must attend one long and two short Botanical excursions arranged by the department and submit detail report on medicinal plant diversity at the time of practical examination.*

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

CHOICE BASED CREDIT SYSTEM (CBCS)

SEMESTER PATTERN

Faculty of Science

Post Graduate (PG) Programmes

HERBAL MEDICINE- CURRICULUM

w. e. f. Academic Year 2019-2020

M. Sc. FIRST YEAR

SEMESTER – I

HERBAL MEDICINE

THEORY PAPER – III: BIOCHEMISTRY AND PLANT METABOLISM

Periods: 60 Credits: 04

Learning Objectives

1. To study and impart knowledge about the biochemical basis of plant life.
2. To inspire students to know different metabolic activities of plants

Learning outcomes:

1. Understand the mechanism of biosynthesis of different metabolits of plants.
2. Learn about the importance of nitrogen, amino acids, proteins and enzymes.

UNIT-I: CARBOHYDRATES AND LIPID METABOLISM (15 Periods)

Carbohydrates in Biosphere, properties, functions and importance Carbohydrate Metabolism: - Biosynthesis of starch and sugars, catabolic pathways, interaction between Hexose Pentose Phosphate and Triose phosphate pools. Lipid Metabolism: Classification, structure and function of lipids, biosynthesis of fatty acids, membrane lipids, structural lipids and storage lipids. Catabolism of storage lipids, phospholipids and derived lipids (steroids).

UNIT-II: SECONDARY METABOLITES (15 Periods)

Study of following secondary plant metabolites with respect to their chemistry, Biosynthesis, and biological activity- Flavonoids, Simple Phenolics, Phenolic Glycosides, Tannins, Anthroquinones, Saponins, Steroids, Alkaloids, Pigments (anthocyanin and betacyanin), Resins, Gums and Volatile oils.

UNIT-III: NITROGEN AND SULPHUR METABOLISM (15 Periods)

Nitrogen Metabolism: Overview of nitrogen fixation, ammonia uptake and reduction, nitrite reduction. Sulphur Metabolism: Sulphur chemistry and fixation, uptake and transport, reductive sulphate assimilation pathways, synthesis and function of glutathione and its derivatives.

UNIT-IV: AMINO ACIDS AND ENZYMES (15 Periods)

Amino Acids: Structure, Classification and various physicochemical properties. Essential and non essential amino acids. Transamination, Deamination. Structure of proteins (Primary, secondary, tertiary, quaternary and domain structure), Enzymology: Introduction, Classification, properties and structure of enzyme, active site, Enzyme kinetics, Michelies Menton equation, Significance of Km and V-max Enzyme inhibition, allosteric enzymes, Coenzymes, relation between co-enzymes and vitamins, co-factors.

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LABORATORY COURSE WORK: BASED ON THEORY PAPER – III
(Annual Pattern)

Practical Exercises:

1. Effect of time on the rate of reaction of enzyme (2 practicals)
2. Estimation of total fats in fatty seeds. (2 practicals)
3. Estimation of proteins by Lawerys method (2 practicals)
4. Estimation of carbohydrates by Anthrone method (2 practicals)
5. Effect of substrate concentration on enzyme kinetics for determination of Km value.
6. Seperation of amino acids by Paper/ TLC chromatography technique
7. Effect of pH and temperature on enzyme kinetics.
8. Separation of Alkaloids/Phenols by TLC. (2 practicals)
9. Qualitative Detection of secondary metabolites mentioned in theory (4 practicals)
10. Spectrophotometer estimation of secondary metabolites. (2 practicals)
11. Field visits/ Laboratory visit of national repute

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***THEORY PAPER – IV: CULTIVATION, PROPERTIES AND UTILIZATION OF MEDICINAL PLANTS**

Periods: 60 (Elective) Credits: 04

Learning Objectives

1. To study and impart knowledge about the method of cultivation of different medicinal plants.
2. To inspire students for cultivation and marketing of medicinal and aromatic plants

Learning outcomes:

1. Understand the nutritional requirement of medicinal plant cultivation.
2. Learn the pharmacognostic properties of medicinal plants to avoid adulteration.

UNIT-I: Cultivation of medicinal plants (15 Periods)

Origin and methods of Cultivation, Storage, Marketing and utilization of Safed Musali, Turmeric, Awala.. Cultivation of Plants: Soil and Climate, Field preparation, Propagation: (a) Raising of Nursery (b) Planting, Irrigation, Fertilizer Application, Intercultural, Harvesting and Yield Studies. Export of medicinally important plants (General aspects).

UNIT-II: Study of Aromatic plants (15 Periods)

Studies of following aromatic plants: (Classification, Chemical properties, Uses, Adultrants, cultivation, Storage and Marketing) Mentha, Coriander, *Ocimum*, *Cymbopogon citrates,* Eucalyptus, Cardamom

UNIT-III: Study of Medicinal Plants (Dicotyledones) (15 Periods)

Studies of following drug plants: (Classification, Chemical properties, Uses, Adultrants, cultivation, Storage and Marketing) *Commiphora weightii, Withania somnifera. Justicia adhatoda. Rauwolfia surpentina,Terminalia arjuna.*

UNIT-IV: Study of Medicinal Plants ((Monocotyledones)) (15 Periods)

Pharmacognostic studies of following drug plants: (Classification, Chemical properties, Uses, Adultrants, Cultivation, Storage and Marketing) *Aloe vera, Asparagus racemosus Gloriosa superba, Curcuma longa, Cyperus rotundus,*

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LABORATORY COURSE WORK: BASED ON THEORY PAPER – IV
(Annual Pattern)

Practical Exercises:

1. Study of different soil types for cultivation of medicinal plants.
2. Effect of temperature and humidity on storage of herbal products.
3. Effect of different fertilizers on the growth of medicinal plants
4. Study of Techniques of growing medicinal plants in nursery.
5. Detection of adulterant in herbal drugs by using chemical method.
6. Detection of adulterant in herbal drugs by using microscopic method.
7. Detection of adulterant in herbal drugs by using analytical techniques.
8. Study of cultivation methods of medicinal plants mentioned in theory
9. Study of cultivation methods of aromatic plants mentioned in theory
10. Visit to medicinal plant nursery

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HERBAL MEDICINE

PAPER-I

SELECTED READINGS:

1. Ayurvedic Pharmacopoeia.
2. Ayurvedic Formulary of India, the Indian Medical 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. Unani Pharmacopoeia.

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SEMESTER – I

HERBAL MEDICINE

PAPER-II

SELECTED READINGS:

1. Davis P. H. and Heywood V.H. (1993) – Principles of Angiosperms Taxonomy Tobert E. Kreigher Pub. Co. New York
2. Grant. V. (1971) – Plant Speciation – Columbia University Press New York.
3. Harrison, H.J. (1971) – New concepts in flowering plant Taxonomy – Hieman Educational Books Ltd. London
4. Heslop – Harrison J. (1967) – Plant Taxonomy- English Language Book Soc. and Edward Arnold Pub. Ltd. UK.
5. Hey wood. V.H. and Moore D.M. (1984) – Current concepts in plant Taxonomy, Academic press, London.
6. Jones A.D. and Wilbins, A.D. (1971) – Variation and adaptations in plant species. Hieman & Co-Educational Books Ltd. London.
7. Jones S.B. Jr. and Luchsinger, A.E. (1986) – Plant systmatics (2nd edition) Mc Graw Hill Book Co., New York.
8. Nordenstam, B.EL Gazaly, G. and Kassas, M. Zoo – Plant systematic for 21st Century. Portland press Ltd. London.
9. Radford, A.E. (1986) – Fundamentals of plant systematics – Harper & Row Publications, USA.
10. Stebbins G.L. (1974) – Flowering plant Evolution Above species level – Edward Arnold Ltd., London.
11. Plant Taxonomy and Bio Systematics (2nd, edition) – Edward Arnold Ltd. London

12. Takhtajan A.L. (1997) Diversity and classification of flowering plant – Colubia University, press New York.
13. Woodland, D.W. (1991) – Contemporary plant systematics : Pentice Hall, New Jersey.
14. Flora of Osmanabad – V. N. Naik.
15. Flora of Marathwada – Chief Ed. By Dr. V.N. Naik.
16. Plant Anatomy – B. P. Pande
17. Plant Anatomy – M. S. Tayal
18. Plant Anatomy – Essau

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SEMESTER – I
HERBAL MEDICINE
PAPER-III

SELECTED READINGS:

1. Plant Physiology, Fourth Edition (1991) F. Salisbury and C. Ross, Brooks Cole Publisher.
2. Plant Physiology, Fourth Edition (2006) L. Taiz and E. Zeiger, Sinauer Associates Inc.
3. Plant Physiology, Biochem,istry and biotechnology – Jain and Jain
4. Plant Physiology – Williams Hopkins
5. Plant Physiology – Teiz and Jiegger
6. Plant Physiology – Devlin
7. Plant Physiology – Salisburry and Ross.
8. Chemistry of Organic Natural Products (Vol.-1 & 2) by O.P. Agarwal.
9. Organic Chemistry of Natural Products (Vol.-1 & 2) by Gurdeep Chatwal.
10. Organic Chemistry (Vol.-2) by I.L. Finar.
11. Lehninger's Principles of Biochemistry – Nelson and Cox
12. Biochemistry – Satyanarayan
13. Biochemistry – A. C. Deb
14. Fundamentals of Biochemistry – J. L. Jain

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***PAPER-IV (Elective)**

SELECTED READINGS:

1. Chadha, K.L. 2001. Hand Book of Horticulture. ICAR Publication, Krishi AnusandhanBhavan, Pusa, New Delhi.
2. Farooqi, A.A. and B.S. Sreeramu. 2001. Cultivation of Medicinal and Aromatic Crops. Universities Press (India) Ltd.3-5-819, Hyderguda, Hyderabad - 29.
3. H. Panda.Aromatic Plants Cultivation, Processing and Uses, Asia Pacific Business Press Inc.
4. Handa, S.S. and M.K. Kaul. 1987. Cultivation and Utilization of Medicinal Plants. RRL, Jammu.
5. Kumar, N., J.B. Md. Abdul Khadar, P. Rangaswamy and I. Irulappan. 1982. Introduction to spices, plantation crops, medicinal and aromatic plants. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
6. Kumar, N., J.B. Md. Abdul Khadar, P. Rangaswamy and I. Irulappan. 1982. Introduction to Spices, Plantation Crops, Medicinal and Aromatic Plants. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
7. Planters Chronicle. Monthly Publication. UPASI, Coonoor.
8. Shanmugavelu, K.G., N. Kumar and K.V. Peter. 2002. Production Technology of Spices and Plantation Crops. Agrobios Publications, Bikenar, Rajasthan.

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HERBAL MEDICINE

THEORY PAPER – VI: INSTRUMENTATION MODERN ANALYTICAL TECHNIQUES

Periods: 60 Credits: 04

Learning Objectives

1. To know working hazards and safety measures in laboratory
2. To know principles and applications of various laboratory equipments

Learning outcomes:

1. Understand the actual working and applications of different laboratory equipments
2. Learn the various techniques used in life sciences and their utility.

Unit-I: MICROSCOPY (15 Periods)

Safety in laboratory - Safe use of laboratory equipments, Personal protection, Hazards and waste disposal. Microscopy – Working and application of simple microscope, compound microscope, Dark field microscope, phase contrast microscope, fluorescence microscope, scanning and transmission electron microscope, flow cytometry, Micrometry, fixation and staining, Sterilization methods.(Autoclave, Hot air oven and Filtration).

UNIT-II: SPECTROSCOPY (15 Periods)

The theoretical aspects, basic instrumentation, elements of interpretation of spectra, and applications of the following analytical techniques, Colorimetry, Ultraviolet and visible spectrophotometry; Fluorimetry; Infrared spectrophotometry; Flame Photometry; Mass Spectrometry.

UNIT-III: CHROMATOGRAPHIC TECHNIQUES (15 Periods)

Classification of chromatographic methods based on mechanism of separation: paper chromatography, thin layer chromatography, column chromatography and affinity chromatography – techniques and applications, Gas Chromatography : Theory and principle, column operation, instrumentation, derivatisation methods and applications in Pharmacy, High Performance Liquid Chromatography : Principle, instrumentation, solvents used, elution techniques, HPTLC: Theory and Principle, instrumentation, elution techniques and pharmaceutical applications.

UNIT-IV: ELECTROPHORESIS & CENTRIFUGATION TECHNIQUES (15 Periods)

Theory, principles, and instrumentation of paper electrophoresis, gel electrophoresis-SDS-PAGE, 2D-PAGE, DIGE, moving boundary electrophoresis, Zone Electrophoresis (ZE), Isoelectric focusing (IEF) and applications; Centrifugation- Theory, principles, instrumentation, applications, types

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LABORATORY COURSE WORK: BASED ON THEORY PAPER – VI

(Annual Pattern)

Practical Exercises:

1. Study the principle and working of compound microscope.
2. Sterilization of Media/Glassware with the help of autoclave and hot air oven.
3. Calibration of Microscope and measurement of microorganisms.
4. Use of colorimeter for analysis of herbal compounds and their formulations (2 practicals)
5. Use of Spectrophotometer for analysis herbal compounds and their formulations
6. Use of fluorimeter for analysis of herbal compounds.
7. Experiments based on Paper chromatography.
8. Experiments based on Gel Electrophoresis
9. Experiments based on TLC Chromatography.
10. Experiments based on HPTLC for herbal
11. Experiments based on IR Spectroscopy
12. Estimation of Na+, K+, Ca++ ions using flame photometer.
13. Visit to Instrumentation laboratory of national repute.

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THEORY PAPER – VII: MICROBIOLOGY AND PATHOLOGY OF HUMAN DISEASES

Periods: 60 Credits: 04

Learning Objectives

1. To know basics of microbiological aspects and immunology
2. To know symptoms of human diseases

Learning outcomes:

1. Understand the techniques of culturing and handling microorganism
2. Learn the herbal remedies of human diseases.

UNIT-I: INTRODUCTION OF MICROBIOLOGY (15 Periods)

Introduction to microbiology, Historical developments (Spontaneous generation, Germ theory of disease and Koch's postulates). General characters of microorganisms; Bacteria, fungi, viruses, Protozoa, Actinomycetes, Rickettsiae, Mycoplasms, Spirochetes.

Bacteria: Size, Shape, Colony Characteristics and Classification of bacteria. Gram positive & Gram negative bacteria. Ultrastucture of bacterial cell.

UNIT-I: MICROBIOLOGICAL TECHNIQUES (15 Periods)

Cultivation of microorganisms; pure culture, isolation of pure culture, Media; type of media, composition and preparation of media, maintenance and preservation of culture, sterilization processes. Type of staining: simple staining, differential staining- gram staining, endospore staining. Methods of Enumeration of microorganisms- Microscopic method and SPC.

UNIT-I: IMMUNOLOGY (15 Periods)

Immunity- Definition and classification. Innate immunity- Species, Racial, Individual, Herd immunity. Acquired immunity- Active and passive immunity, Immune response and hypersensitivity. Immunoglobulins- basic structure, classes and subclasses of immunoglobulins, antigenic determinants; Phagocytosis; primary and secondary lymphoid organs; Antigens - immunogens, haptens; Major Histocompatibility Complex - MHC genes. Precipitation, agglutination and complement mediated immune reactions;

UNIT-IV: HUMAN DISEASES (15 Period)

Symptamology, Etiology and herbal remedies of following Human diseases: Typhoids, Cholera, Malaria, Common cold, Diabetes, Jaundice, Piles, Kidney stone.

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LABORATORY COURSE WORK: BASED ON THEORY PAPER – VII
(Annual Pattern)

Practical Exercises:

1. Isolation of bacteria by streak plate technique.
2. Identification of microorganisms by simple staining
3. Identification of microorganisms by gram staining
4. Enumeration of microorganisms with serial dilution techniques
5. Growth curve, measure of bacterial population by turbidometry.
6. Assay of antibiotics production and demonstration of antibiotic resistance.
7. Estimation of Haemoglobin (Hb)
8. Heme agglutination tests for identification of human blood groups
9. Study of symptoms, causative agents and herbal remedies of human diseases mentioned in theory (5 practicals).

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THEORY PAPER- VIII: MOLECULAR BIOLOGY AND GENETIC ENGINEERING

Periods: 60 Credits: 04

Learning Objectives

1. To understand basic aspects of cell, cell organelles.
2. To know various basic aspects and techniques used in molecular biology and genetic engineering.

Learning outcomes:

1. Understand the structural organization and functions of cell and cell organelles.
2. Able to understand Gene structure, expression and manipulation with the help of various tools of genetic engineering.

UNIT-I: CELL AND CELL ORGANELLES (15 Periods)

Prokaryotic and eukaryotic cell structure, Endoplasmic reticulum: Structure, types and functions, Golgi apparatus: Structure, chemical composition and functions, Mitochondrion: Structure, chemical composition, and functions, genomic organization, Chloroplast: Structure, functions and genomic organization, Ribosomes: Structure, types and functions, Nucleus: Structure and Function, Cell cycle: Process and significance of mitosis, Process and significance of meiosis

UNIT-II: GENOME ORGANIZATION (15 Periods)

Organization of bacterial genome; Structure of eukaryotic chromosomes; Heterochromatin and Euchromatin; Structure of DNA - A-,B-, Z- DNA; Satellite DNA; DNA methylation, DNA Replication in prokaryotes and eukaryotes; Mutation- mutagenic agents and types. DNA repair Mechanism- Photoreactivation; Nucleotide excision, repair; Mismatch correction; SOS repair.

UNIT-III: REGULATION OF GENE EXPRESSION (15 Periods)

Regulation of transcription - Operons, repressors and inducers, positive and negative control, regulation of lytic and lysogenic cycles in phages. Transcription factors in eukaryotes, response elements. Post-transcriptional regulation. Regulation of gene expression at higher levels of enome organization. Genetic Code; Mechanism of initiation, elongation and termination; Translation machinery; Regulation of protein synthesis, post-translational regulation. Post-translational modifications.

UNIT-IV: GENETIC ENGINEERING (15 Periods)

Basic techniques (Restriction digestion, production of recombinant DNA molecules, amplification using vectors, construction of genomic libraries, cDNA libraries and screening DNA libraries for genes of interest); The manipulation of cloned DNA sequences: in vitro, using phagemid vectors, Restriction and nucleic acid modifying enzymes; Vectors in gene cloning and their choice; plasmids, phages, cosmids, plant viruses, synthetic DNA vectors; Isolation of specific genes from bacteria and higher plants; cloning. Transgenic plants.

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LABORATORY COURSE WORK: BASED ON THEORY PAPER – VIII
(Annual Pattern)

Practical Exercises:

1. Study of different stages of mitosis and determine mitotic index.
2. Study of mitotic abnormalities by using chemical mutagens
3. Study of different stages of meiosis and meiotic irregularities in
4. Isolation of Mitochondria from plant material.
5. Isolation of Chloroplasts from plant material.
6. Study of cellular organelles by ultramicroscopic Photographs.
7. Isolation of DNA/RNA from bacteria/Yeast.
8. Estimation of DNA/ RNA.
9. Study of DNA repair mechanism by photoreactivation.
10. Isolation of plasmids from bacteria.
11. Visit to National Research Institute/ University/ Research Laboratory.

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***THEORY PAPER – IX: FUNDAMENTALS OF PHARMACOGNOSY**

(Elective)

Periods: 60 Credits: 04

Learning Objectives

1. To understand basic aspects of pharmacognosy.
2. To know various types of nutraceuticals.

Learning outcomes:

1. Understand the detail pharmacognostic study of different drug plants.
2. Able to understand the importance of nutraceuticals in healthcare benefits.

UNIT-I: INTRODUCTION (15 Periods)

Definition, history, scope and development of Pharmacognosy, Sources of drugs: Biological, marine, mineral. Classification of natural drugs: Alphabetical, Morphological, Taxonomical, Chemical, Pharmacological/ Therapeutical and Chemotaxonomical. Types of Drug adulteration and adulterants. Adulteration of crude drugs and their detection by organoleptic, microscopic, physical, chemical and biological methods of evaluation.

UNIT-II: NUTRACEUTICALS (15 Periods)

Nutraceuticals: Scope, herbal sources of food supplements, taste enhancers and Colours.

Phytochemicals as Neutraceuticals: Occurrence and Characteristic features (Chemical nature, uses in pharmacy, medicinal and health benefits) of following- Carotenoids – i) α and β – Carotene, ii) Lycopene, iii) Xanthophyll (Lutein. Saponins – i) Glycyrrhizin ii) Shatavarins d) Flavonoids – i) Resveratrol ii) Rutin iii) Hesperidin v) Quercetin e) Anthocyanins f) Phenolic acids:- Ellagic acid and Tocopherols.

UNIT-III: PHARMACOGNOSTIC STUDY OF PLANT DRUGS (15 Periods)

Laxatives- Aloes, Castor oil, Senna. **Cardiotonics**- Digitalis, Arjuna. **Carminatives** - Fennel, Cardamom, **Astringents**- Catecheu. **Drugs acting on nervous system**- Ashwagandha, Opium, Cannabis, **Antirheumatics**- Guggal, Colchicum. **Antitumour**- Vinca. **Antidiabetics**- Pterocarpus, Gymnema sylvestre. **Diuretics**- Gokhru, Punarnava.

UNIT-IV: PHARMACOGNOSTIC STUDY OF BIOMOLECULES (15 Periods)

Carbohydrates and derived products: Agar, Guar gum, Acacia, Honey, Isabgol, Pectin, Starch and Tragacanth. **Lipids**: Bees wax, Castor oil, Cocoa butter, Cod-liver oil, Hydnocarpus oil, Kokum, butter, Lard, Linseed oil, Shark liver oil and Wool fat. **Enzymes**- Papain.

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LABORATORY COURSE WORK: BASED ON THEORY PAPER – IX
(Annual Pattern)

Practical Exercises:

1. Determination of drug adulteration using analytical techniques
2. Determination of drug adulteration using microscopic techniques
3. Determination of drug adulteration using chemical techniques
4. Estimation of Lycopene from plant sample
5. Estimation of caretenoids from plant sample
6. Estimation of Rutin and Quercetin from plant sample by using HPTLC
7. Identification of crude drugs belonging to carbohydrates (morphological and chemical) Mentioned in theory
8. Identification of crude drugs belonging to Lipids (morphological and chemical) Mentioned in theory
9. Pharmacognostic study of plant drugs mentioned in theory.
10. Field visit to identify and study of drug plants.

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HERBAL MEDICINE

PAPER-VI

SELECTED READINGS:

1. Biophysical Chemistry. M. Sataske, Y. Hayashi, M.S. Sethi, S A Iqbal, Discovery Publishing House (1997) New Delhi – 110002.
2. Practical Microbiology. R. C. Dubey, D K Maheshwari S Chand and company Ltd. New Delhi
3. Instrumental Methods of Chemical Analysis 5th Ed. Galen W Ewing. Mc Graw Hill International
4. Biotechniques Theory and Practice S Y S Rana Rastogi Publications, Meerat 250002
5. A manual of laboratory experiments in cell biology C Edward Gasque Universal book Stall, New Delhi.
6. Modern experimental biochemistry 3rd ed. Rodney Boyer Pearson education Inc.
7. Research Experiences in plant physiology.-A Laboratary Mannual Thomas C. Moore Spinger-Verlag,Berlin.
8. Biochemical methods 2nd ed. S. Sadasivam, A. Manickam. New Age International Publisher (P) Ltd, New Delhi.
9. Experiments in Microbiology, Plant Pathology and Tissue Culture K.R. Aneja, Wishwa Prakashan, New Delhi.
10. Frontiers in Applied Microbiology K.G. Mukerji, N C Pathak, Vedpal Sing Print Hall, Lucknow
11. Practical Microscopy Martin and Johnsen Blackie and Sen Limited, London

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HERBAL MEDICINE

PAPER-VII

SELECTED READINGS:

1. Basic and clinical immunology – Stites et al., 4th edn. Lange 1982.
2. The immunosystem, Mc Connell et al., Blackwell scientific 1981.
3. Fundamentals of Immunology – William C. Boyed (Wiley Toppan).
4. Introduction to Immunology – John W.Kinball.
5. Fundamentals of Immunology – Otto S. View and others.
6. Immunology – D.M. Weir.
7. Immunology – Janis Kuby.
8. Cellular and Molecular Immunology 3rd, Abul K. Abbas Andrew K. Kich man Jordan S. Pober.
9. Microbiology by Pelczar, Chan and Krieg 5th edn. 1995 Mc Grew- Hill.

10. General Microbiology: Boyd, R.F., Times Mirror/ Mosby college, 1984.
11. Review of Medical Microbiology: Jawetz et al., 16th edn. Maruzen Asian, 1984. 4.
12. A Textbook of Microbiology, R.C.Dubey and D.K.Maheswari, S.Chand Co (2001).
13. Pharmaceutical Microbiology, By Hugo and Russell, Blackwell Scientific (1987).
14. Microbial World (5th Edn, 1987) RY. Stanier, Hamshire-Macmillan Press
15. Microbiology 4th edition, Prescott, Harley, Klein (Mc grew Hill)
16. Principles of Microorganisms – Brocks.
17. Fundamentals of Microbiology – M. Frebisher.
18. Text book of Microbiology – William Burrows.
19. Biology of Microorganisms – Sandes T. Lyles
20. Instant notes in Microbiology- Nicklin *et al* (2001)
21. Microbiology – Anantnarayan
22. General Microbiology Vol- I & II, Pawar and Daginawala,

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PAPER-VIII

SELECTED READINGS:

9. Molecular Biology of Gene- J.D. Watson, T.A. Baker, S.P. Bell, Alexander Gann, Richard Losick, Michael Levine. Pearson Education Singapore, Pvt. Ltd. Delhi 110 092.
10. Genes – Vol. V, VI & VII Benjamin Lewin Oxfor University Press, New York.
11. Basic Human Genetics Elaine Johansen, Mange & Arthur Mange, Rastogi Publication. Shivaji Raod, Meerut.
12. Principles of Genetics- E.J. Gardner, M.J. Simmons, D.P. Snastad, John Willy and Sons New Delhi. 110 002.
13. Genetics Vol. I & II C.B. Powar, Himalaya Publication, New Delhi.
14. Gentics- B.D. Singh, Kalyani Publishers, Ludhiana – 141 008.
15. Genetics P.K. Gupta Rastogi Publication, Shivaji Raoad, Meerut – 250 002.
16. Genetics Analysis & Principles, Robert J. Brooker, Addison Wesley Longman Inc. New York.
17. Molecular Genetics- Gunther S. Stent, Richard Calendar, CBS Publishers Distributors, New Delhi. – 110 002.
18. Text Book of Molecular Biology K. Sivarama Sastry. Padmanaban, C. Subramanayam, MacMillan India Ltd. Delhi.
19. Cell Biology, Genetics, P.S. Verma S. Chand Publisher
20. Molecular Biology, V.K. Agarwal New Delhi.
21. Genetic Engineering- P. K. Gupta
22. Biotecnology – B. D. Singh

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CHOICE BASED CREDIT SYSTEM (CBCS)

SEMESTER PATTERN

Faculty of Science

Post Graduate (PG) Programmes

HERBAL MEDICINE- CURRICULUM

w. e. f. Academic Year 2019-2020

M. Sc. FIRST YEAR

SEMESTER – II

HERBAL MEDICINE

PAPER-IX

SELECTED READINGS:

1. Text Book of Pharmacognosy by Kokate C K, Purohit A P, Gokhale S B (Nirali Prakashan, Pune)
2. Trease G.E. and Evans W.C., Pharmacognosy (Balliene Tindall, Eastbourne)
3. Text Book of Pharmacognosy by T.E.Wallis.(CBS Publishers & Distributors, NewDelhi)13
4. Tyler V.E., Brady L.R. and Robbers J.E., Pharmacognosy (Len & Febiger, Philadelphia)

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HERBAL MEDICINE- CURRICULUM

w. e. f. Academic Year 2019-2020

SKELETON QUESTION PAPER

M. Sc. FIRST YEAR, SEMESTER – I & II

HERBAL MEDICINE

Maximum Marks: 75

Credits: 03

Time: 03 Hours

Note:

1. Attempt all questions
2. All question carry equal marks
3. Draw neat and well labeled diagrams wherever necessary

Q1. Long answer type question (Based on Unit-I) (15)

OR

a. Short answer type question (Based on Unit-I) (08)

b. Short answer type question (Based on Unit-I) (07)

Q2. Long answer type question (Based on Unit-II) (15)

OR

a. Short answer type question (Based on Unit-II) (08)

b. Short answer type question (Based on Unit-II) (07)

Q3. Long answer type question (Based on Unit-III) (15)

OR

a. Short answer type question (Based on Unit-III) (08)

b. Short answer type question (Based on Unit-III) (07)

Q4. Long answer type question (Based on Unit-IV) (15)

OR

a. Short answer type question (Based on Unit-IV) (08)

b. Short answer type question (Based on Unit-IV) (07)

Q5. Write short notes on any three of the following (15)

1. (Based on Unit-I)
2. (Based on Unit-II)
3. (Based on Unit-III)
4. (Based on Unit-IV)

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SKELETON OF PRACTICAL QUESTION PAPER

M. Sc. FIRST YEAR, SEMESTER – I

HERBAL MEDICINE

LABORATORY COURSE WORK-I: BASED ON THEORY PAPER – I & II

Maximum Marks: 75

Credits: 03

Time: 06 Hours

Note: (i) Attempt all questions
(ii) Draw neat and well labelled diagrams wherever necessary

Q1.	Major question		20
Q2.	Minor question		10
Q3.	Major question		20
Q4.	Minor question		10
Q5.	i)	Record book	07
	ii)	Viva voce	05
	iii)	Submission	03

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SEMESTER PATTERN

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Post Graduate (PG) Programmes

HERBAL MEDICINE- CURRICULUM

w. e. f. Academic Year 2019-2020

SKELETON OF PRACTICAL QUESTION PAPER

M. Sc. FIRST YEAR, SEMESTER – I

HERBAL MEDICINE

LABORATORY COURSE WORK-II: BASED ON THEORY PAPER – III & IV

Maximum Marks: 75

Credits: 03

Time: 06 Hours

Note: (i) Attempt all questions

(ii) Draw neat and well labelled diagrams wherever necessary

Q1.	Major question		20
Q2.	Minor question		10
Q3.	Major question		20
Q4.	Minor question		10
Q5.	i)	Record book	07
	ii)	Viva voce	05
	iii)	Submission	03

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CHOICE BASED CREDIT SYSTEM (CBCS)

SEMESTER PATTERN

Faculty of Science

Post Graduate (PG) Programmes

HERBAL MEDICINE- CURRICULUM

w. e. f. Academic Year 2019-2020

SKELETON OF PRACTICAL QUESTION PAPER

M. Sc. FIRST YEAR, SEMESTER – II

HERBAL MEDICINE

LABORATORY COURSE WORK-III: BASED ON THEORY PAPER – VI & VII

Maximum Marks: 75

Credits: 03

Time: 06 Hours

Note: (i) Attempt all questions

(ii) Draw neat and well labelled diagrams wherever necessary

Q1.	Major question		20
Q2.	Minor question		10
Q3.	Major question		20
Q4.	Minor question		10
Q5.	i)	Record book	07
	ii)	Viva voce	05
	iii)	Submission	03

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CHOICE BASED CREDIT SYSTEM (CBCS)

SEMESTER PATTERN

Faculty of Science

Post Graduate (PG) Programmes

HERBAL MEDICINE- CURRICULUM

w. e. f. Academic Year 2019-2020

SKELETON OF PRACTICAL QUESTION PAPER

M. Sc. FIRST YEAR, SEMESTER –II

HERBAL MEDICINE

LABORATORY COURSE WORK-IV: BASED ON THEORY PAPER – VIII & IX

Maximum Marks: 75

Credits: 03

Time: 06 Hours

Note: (i) Attempt all questions

(ii) Draw neat and well labelled diagrams wherever necessary

Q1.	Major question		20
Q2.	Minor question		10
Q3.	Major question		20
Q4.	Minor question		10
Q5.	i)	Record book	07
	ii)	Viva voce	05
	iii)	Submission	03