



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 2014-2015

M. Sc. FIRST YEAR

SEMESTER-I & II

HERBAL MEDICINE- CURRICULUM

JUNE, 2014



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Faculty of Science

Post Graduate (PG) Programmes

HERBAL MEDICINE- CURRICULUM

w. e. f. Academic Year 2014-2015

CURRICULUM DESIGNING COMMITTEE

- | | |
|--|----------|
| 1. Dr. Bodke S.S.
Yeshwant Mahavidyalaya, Nanded | Chairman |
| 2. Dr. Kadam A.S.
D.S.M. Mahavidyalaya, Jintur | Member |
| 3. Dr. Mandge S.V.
Shri. SGM College, Loha | Member |
| 4. Dr. Gawai D.U.
Science College, Nanded | Member |
| 5. Dr. Dakore H.G.
P.N.College, Nanded | Member |
| 6. Dr. Aithal S.V.
Vai. D.M.Mahavidyalaya, Degloor | Member |
| 7. Dr. Biradar S.D.
D.S.M.College, Parbhani | Member |
| 8. Dr. Bhadraiah B.
Osmania University, Hyderabad | Member |
| 9. Dr. Patil D.A.
SSVP's Dr. Ghogre Science College, Dhule | Member |
| 10. Dr. Mukadam D.S.
Green Gold seeds Ltd., Walunj | Member |
| 11. Dr. Gacche R.N.
SRTM University, Nanded | Member |





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INTRODUCTION

The SRTMUN is gearing up for several initiatives towards academic excellence, quality improvement and administrative reforms. In view of this priority and in-keeping with Vision and Mission; process was already initiated towards introduction of semester system, grading system and credit system. In the recent past, University had already implemented Credit based grading system to campus schools. Now University is going one step ahead to implement Cumulative Grade Point Average (**CGPA**) system for UG and Choice Based Credit System (**CBCS**) for PG in all the affiliated colleges from the academic year **2014-2015**. These regulations shall be called as Choice Based Course Credit System & Grading, 2014. In short it will be referred as **SRTMUN CBCS REGULATION**.

Revision and updating of the curriculum is the continuous process to provide an updated education to the students at large. Presently there is wide diversity in the curriculum of different Indian Universities which inhibited mobility of students in other universities or states. To ensure and have uniform curriculum at UG and PG levels as per the **SRTMUN CBCS REGULATION**, curriculum of different Indian Universities, syllabus of NET/SET, MPSC, UPSC, forest services and the UGC model curriculum are referred to serve as a base in updating the same.

The M.Sc. Herbal medicine (General) semester pattern course is running in different affiliated colleges of the SRTMUN. The course content has been designed on CBCS pattern. The course content of each theory paper is divided into 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-I&II are also provided at the end of the syllabus.

Dr. BODKE SHRIRANG SATWAJI

Chairman, BOS in Herbal medicine,
SRTMU Nanded



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OBJECTIVES

1. To provide an updated education to the students at large in order to know the importance and scope of the discipline and to provide mobility to students from one university or state to other.
2. To update curriculum by introducing recent advances in the subject and enable the students to face NET, SET, UPSC and other competitive examinations successfully.
3. To impart knowledge of Herbal medicine as the basic objective of Education
4. To develop a scientific attitude to make students open minded, critical and curious
5. To develop an ability to work on their own and to make them fit for the society
6. To expose the students to contribute in different pharmaceutical industries and research institutes.
7. To develop skill in practical work, experiments, equipments and laboratory use along with collection and interpretation of herbal products and their utilization.
8. To make aware of natural resources and environment and the importance of conserving the same.
9. To develop ability for the application of the acquired knowledge in the fields of life so as to make our country self reliant and self sufficient.
10. To appreciate and apply ethical principles to herbal medicine research and studies.

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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 Test: 15 marks, Assignments: 10marks)	Credits: 04 (Marks:100)	60
Theory Paper-II: Systematics of Plants	Credit: 03 (Marks:75)	Credit: 01 (Marks:25) (2 Test: 15 marks, Assignments: 10marks)	Credits: 04 (Marks:100)	60
Theory Paper-III: Cell and Molecular Biology	Credit: 03 (Marks:75)	Credit: 01 (Marks:25) (2 Test: 15 marks, Assignments: 10marks)	Credits: 04 (Marks:100)	60
*Theory Paper-IV: Modern Analytical Techniques (Elective)	Credit: 03 (Marks:75)	Credit: 01 (Marks:25) (2 Test: 15 marks, Assignments: 10marks)	Credits: 04 (Marks:100)	60
Theory Paper-V: Seminar	-	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)



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Semester-II

An Outline:

Paper number & Title	Credits (Marks)			Periods
	External: ESE	Internal: CA	Total Credits (Marks)	
Theory Paper-VI: Fundamentals of Pharmacognosy	Credit: 03 (Marks:75)	Credit: 01 (Marks:25) (2 Test: 15 marks, Assignments: 10marks)	Credits: 04 (Marks:100)	60
Theory Paper-VII: Plant Biochemistry	Credit: 03 (Marks:75)	Credit: 01 (Marks:25) (2 Test: 15 marks, Assignments: 10marks)	Credits: 04 (Marks:100)	60
Theory Paper-VIII: Plant Metabolism and Development	Credit: 03 (Marks:75)	Credit: 01 (Marks:25) (2 Test: 15 marks, Assignments: 10marks)	Credits: 04 (Marks:100)	60
*Theory Paper-IX: Immunology and Microbiology (Elective)	Credit: 03 (Marks:75)	Credit: 01 (Marks:25) (2 Test: 15 marks, Assignments: 10marks)	Credits: 04 (Marks:100)	60
Theory Paper-X: Seminar	-	Credit: 01 (Marks:25)	Credits: 01 (Marks:25)	-
Total	Credit: 12 (Marks: 300)	Credit: 05 (Marks:125)	Credits: 17 (Marks:425)	240

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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

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JUNE, 2014



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SEMESTER – I

HERBAL MEDICINE

THEORY PAPER – I: INDIAN SYSTEM OF MEDICINES

Periods: 60

Credits: 04

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

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)

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)

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: TRIBAL MEDICINES (15 Periods)

Medicinal sources—Herbal sources, Mineral sources, Animal sources, their collection, purification and processing, Principles, Importance, Merits and Demerits of Tribal Medicines, Rules and Regulations to Safeguard the Complimentary Medicines.

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**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. Simple preparations used in Ayurvedic System and their Standardization (with special emphasis on HPTLC) (4 practicals)
3. Simple preparations used in Unani system and their Standardization (with special emphasis on HPTLC) (3 practicals)
4. Simple preparations used in Homeopathy system and their Standardization (with special emphasis on HPTLC) (3 practicals)
5. Visit to Pharmaceutical industries, Ayurvedic, Homeopathic and Unani laboratories and research institutes.



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SEMESTER – I

HERBAL MEDICINE

THEORY PAPER – II: SYSTEMATICS OF PLANTS

Periods: 60

Credits: 04

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

Introduction – Definition, aims and objectives of taxonomy, Morphological, taxonomical, biological, concept of species, categories of classification and rules regarding their nomenclature, Salient features and development of International Code of Botanical Nomenclature (ICBN), Principles, articles and recommendations

UNIT-II: TAXONOMIC EVIDENCES, TOOLS AND CLASSIFICATION SYSTEMS (15 Periods)

Taxonomic evidence, morphology, anatomy, embryology, 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-

- Magnoliaceae
- Ranunculaceae
- Brassicaceae
- Rosaceae
- Fabaceae
- Malvaceae
- Asclepiadaceae
- Euphorbiaceae

UNIT-IV: STUDY OF FAMILIES-II (15 Periods)

Comparative account of following Angiospermic families as per Engler and Prantl's system-

- Verbenaceae
- Solanaceae
- Rubiaceae
- Cucurbitaceae
- Asteraceae
- Liliaceae
- Poaceae
- Orchidaceae



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

Practical Exercises:

1. Description and identification of at least three plant species belonging to different families of order – Ranales with their floral formulae and floral diagrams
2. Description and identification of at least three plant species belonging to different families of order – Geraniales with their floral formulae and floral diagrams
3. Description and identification of at least three plant species belonging to different families of order – Myrtales with their floral formulae and floral diagrams
4. Description and identification of at least three plant species belonging to different families of order – Centrospermae with their floral formulae and floral diagrams
5. Description and identification of at least three plant species belonging to different families of order – Rubiales with their floral formulae and floral diagrams
6. Description and identification of at least three plant species belonging to different families of order – Tubiflorae with their floral formulae and floral diagrams
7. Description and identification of at least three plant species belonging to different families of order – Scitaminae with their floral formulae and floral diagrams
8. Description and identification of at least three plant species belonging to different families of order – Glumiflorae with their floral formulae and floral diagrams
9. Field trips within and around the campus
10. At least one Botanical excursion, compilation of field notes and preparation of wild and cultivated plants as are abundant

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



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THEORY PAPER – III: CELL AND MOLECULAR BIOLOGY

Periods: 60

Credits: 04

UNIT-I: CELL AND CELL ORGANELLS (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, biogenesis, 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; Repetitive and unique sequences, Structure of DNA - A-,B-, Z- and triplex DNA; Satellite DNA; DNA methylation & Imprinting, DNA Replication: initiation, elongation and termination in prokaryotes and eukaryotes; Gene stability and DNA repair- enzymes; Photoreactivation; Nucleotide excision, repair; Mismatch correction; SOS repair;

UNIT-III: PROKARYOTIC AND EUKARYOTIC TRANSCRIPTION (15 Periods)

Prokaryotic Transcription; Transcription unit; Promoters- Constitutive and Inducible; Operators; Regulatory elements; Initiation; Attenuation; Termination-Rho-dependent and independent; Transcriptional regulation-Positive and negative; Operon concept-lac, trp, Processing of RNA ,Eukaryotic transcription and regulation; RNA polymerase structure and assembly; RNA polymerase I, II, III; Activators and repressors.

UNIT-IV: POST TRANSCRIPTIONAL MODIFICATIONS(15 Periods)

Processing of tRNA, rRNA; 5'-Cap formation; 3'-end processing and polyadenylation; Splicing; RNA editing; Translation machinery; Ribosomes; Composition and assembly; Genetic Code; Mechanism of initiation, elongation and termination; Post-translational modifications.





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

Practical Exercises:

1. Study of different stages of mitosis and determine mitotic index in *Allium*/ *Aloe*/
Chlorophytum/*Pisum sativum* (2 practicals)
2. Induction of mitotic abnormalities in *Allium* cells by chemical treatments
3. Study of different stages of meiosis and meiotic irregularities in *Allium* and *Rhoe* (2 practicals)
4. Isolation and observation of Mitochondria
5. Isolation and observation of Chloroplasts
6. Study of cellular structures by ultramicroscopic Photographs (Golgi apparatus and E.R.)
7. Study of fluctuation test
8. Isolation and quantitation of DNA from bacteria/Yeast.
9. Effect of UV radiation on Yeast/ Bacteria.
10. study of DNA repair mechanism by photoreactivation



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***THEORY PAPER – IV: MODERN ANALYTICAL TECHNIQUES**

(Elective)

Periods: 60

Credits: 04

UNIT-I: 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-II: 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-III: ELECTROPHORESIS AND CENTRIFUGATION (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

UNIT-IV: STATISTICAL ANALYSIS (15 Periods)

Introduction, significance of statistical methods, normal distribution, degree of freedom, standard deviation, variance, accuracy, precision, classification of errors, reliability of results, confidence interval, Test for statistical significance – students T-test, F-test, correlation and regression.

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

Practical Exercises:

1. Use of colorimeter for analysis of herbal compounds and their formulations (2 practicals)
2. Use of Spectrophotometer for analysis herbal compounds and their formulations
(2 practicals)
3. Effect of pH and solvent on UV Spectrum of certain drugs.
4. Use of fluorimeter for analysis of herbal compounds.
5. Experiments on Paper/ Gel Electrophoresis (2 practicals)
6. Experiments of Paper/TLC Chromatography.
7. Experiments based on HPLC & GC (2 practicals)
8. IR, NMR and Mass Spectroscopy – Interpretation of spectra & Structural elucidation
9. Estimation of Na⁺, K⁺, Ca⁺⁺ ions using flame photometry.
10. Use of centrifuge for the preparations and analysis of herbal compounds
11. Problems based on mean, mode, median, SD, correlation, normal distribution, degree of freedom
12. Problem based on student T-test, F-test, regression



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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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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. Zooo – Plant systematic for 21st
Century. Portland press Ltd. London.



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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 – Columbia 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.

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PAPER-III

SELECTED READINGS:

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|----|--------------------------------|--|---|
| 1. | Molecular Biology of Gene | J.D. Watson
T.A. Baker
S.P. Bell
Alexander Gann
Michael Levine
Richard Losick | Pearson Education
Singapore, Pvt.Ltd.
Indiam Branch
482 FIE Patporganj
Delhi 110 092. |
| 2. | Genes – Vol. V, VI & VII | Benjamin Lewin | Oxford University
Press New York. |
| 3. | Molecular Genetics | Gunther S. Stent
Richard Calendar | CBS Publishers
Distributors – 4596/1-A
DaryaGanj,
New Delhi. – 110 002. |
| 4. | Text Book of Molecular Biology | K.Sivarama Sastry | MacMillan India Ltd. |



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		G. Padmanaban C. Subramanayam	Delhi.
5.	Cell Biology, Genetics, Molecular Biology, Evolution and Ecology	P.S. Verma V.K. Agarwal	S. Chand Publisher New Delhi.
6.	Cytology Genetics & Evolution.	P.K. Gupta	Rastogi Publication, Meerut.
7.	Cell Structure and Function	Ariel. G. Loewy Philip Siekevitz	Oxford & IBH Publishing Cor. Pvt. Ltd., Delhi.
8.	Cell Physiology	Arthur Giese	W.B. Saunders Company, London.
9.	Cell Biology	E.J. Ambrose Dorothy M. Easty	Vikas Publication, Bombay.
10.	Introduction to Cell Biology	S. Sundara Rajan	Vikas Publishing House Pvt. Ltd. Delhi.
11.	Cell Biology	C. B. Powar	Himalaya Publishing House. Delhi
12.	Cell Biology	Johnson Lewys	Sarup & Sons New Delhi. – 110 002.
13.	Genetic Engineering	Sandhya Mitra	Mac. Millan India, Ltd. New Delhi
14.	Cytology	P.S. Verma V.K. Agarwal	S. Chand New Delhi.
15.	The Living Cell	Donald Kennedy	W.H. Freeman and Company, San Francisco.
16.	The Science of Genetics	William Hexter	Prentice-Hall of India



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		H.T. Yost	India Pvt. Ltd. New Delhi
17.	Studies on Genetics	H.J. Muller	Oxford & IBH Publisher New Delhi.
18.	Genetics	A.M. Winchester	Oxford & IBH Publisher New Delhi.
19.	Genetics	B. guttman, a. Griffiths d. Suzuki t. Cullis.	Oxford Publisher England, London
20.	Fundamentals of Genetics	M.P. Arora	Himalaya Publishing House. Delhi.
21.	The Biology of Cells	Herbert Sterm David L. Nanney	Willey Eastern Pvt. Ltd. New Delhi
22.	Genetic Engineering & its Application.	P. Joshi	Agrobios India Ltd.
23.	Cell and Molecular Biology	S.C. Rastogi	New Age International Publisher. New Delhi.
24.	Cell Biology, Fundamentals and Applications	M.L. Gupta M.L. Jangir	Student Edition India Ltd. , Jodhpur





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PAPER-IV

SELECTED READINGS:

1. Spectrometric identification of Organic Compounds, Robert. M. Silverstein et al, 7th Edition, 1981.
2. Fundamentals of Mathematical Statistics, S.C. Gupta and V.K. Kapoor.
3. Principles of Instrumental Analysis by Douglas A. Skoog, James, J. Leary, 4th Edition.
4. Pharmaceutical Analysis – Modern Methods – Part A, Part B, James W. Munson – 2001.
5. Vogel's Text Book of Quantitative Chemical Analysis, 6th Edition, 2004.
6. Chromatographic Analysis of Pharmaceuticals, John A. Adamovics, 2nd Edition.
7. Practical Pharmaceutical Chemistry, Part two, A. H. Beckett & J. B. Stenlake – 4th Edition.
8. Instrumental Methods of Chemical Analysis – B. K. Sharma - 9th Edition.
9. Instrumental Methods of Analysis – Hobert H. Willard, 7th Edition.
10. Organic Spectroscopy – William Kemp, 3rd Edition.
11. Techniques and Practice of Chromatography – Raymond P. W. Scott, Vol. 70.
12. Identification of Drugs and Pharmaceutical Formulations by Thin Layer Chromatography – P. D. Sethi, Dilip Charegaonkar, 2nd Edition.
13. HPTLC – Quantitative Analysis of Pharmaceutical Formulations – P. D. Sethi.
14. Liquid Chromatography – Mass Spectrometry, W. M. A. Niessen, J. Van Der Greef, Vol. 58.
15. Stereo Chemistry – Conformation and Mechanism by P. S. Kalsi, 2nd Edition.
16. Spectroscopy of Organic Compounds by P. S. Kalsi.
17. Organic Chemistry by I. L. Finar Vol. II – 5th Edition.





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HERBAL MEDICINE

THEORY PAPER – VI: FUNDAMENTALS OF PHARMACOGNOSY

Periods: 60

Credits: 04

UNIT-I: INTRODUCTION (15 Periods)

Definition, history, scope and development of Pharmacognosy, Sources of drugs: Biological, marine, mineral and plant tissue culture as sources of drugs, Classification of natural drugs: Alphabetical, Morphological, Taxonomical, Chemical, Pharmacological/ Therapeutical and Chemotaxonomical classification of drugs.

UNIT-II: CULTIVATION OF DRUG PLANTS (15 Periods)

Cultivation, collection, processing and storage of plant drugs: Factors influencing, cultivation of medicinal plants. Types of soils and fertilizers of common use, Pest management and natural pest control agents. Plant hormones and their applications, Polyploidy, mutation and hybridization with reference to medicinal plants.

UNIT-III: QUALITY CONTROL OF CRUDE DRUGS (15 Periods)

General methods only, Adulteration of crude drugs, and their detection by organoleptic, microscopic, physical, chemical and biological, methods of evaluation, General introduction to secondary metabolites of plant origin with their properties.

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

Systematic Pharmacognostic study of the following :

(a) Carbohydrates and derived products: Agar, Guar gum, Acacia, Honey, Isabgol, Pectin, Starch and Tragacanth.

(b) Lipids : Bees wax, Castor oil, Cocoa butter, Cod-liver oil, Hydnocarpus oil, Kokum, butter, Lard, Linseed oil, Shark liver oil and Wool fat.

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

Practical Exercises:

1. Determination of leaf constants (Stomatal number and stomatal index, Palisade ratio, veinlet and veinlet termination number) (5 practicals)
2. Microscopic measurements of cells and cell contents – starch grains and phloem fibres. (5 practicals)
3. Identification of crude drugs belonging to carbohydrates (morphological and chemical) (5 practicals)
4. Identification of crude drugs belonging to lipids (5 practicals)



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THEORY PAPER – VII: PLANT BIOCHEMISTRY

Periods: 60

Credits: 04

UNIT-I: STEREOISOMERISM OF NATURAL PRODUCTS (15 Periods)

Chemical and spectral approaches to simple molecules of natural origin, Application of I.R., N.M.R. and Mass spectroscopy in the structural elucidation of organic compounds, Concept of stereoisomerism taking examples of natural products (citral, menthol, camphor, ephedrine and atropine).

UNIT-II: CHEMISTRY OF PLANT DRUGS (15 Periods)

Cardiac Glycosides: Source, structures, Pharmacological properties and study of interrelationship between cardenolides and bufadienolides (Chemistry of digoxin & digitoxin). Introduction to Scillaren A and ouabain, Terpenes : Classification, General methods of extraction and separation (Mono and sesquiterpenes), Special isoprene rule and Structural elucidation of citral, carvone, menthol & camphor.

UNIT-III: VITAMINS & ALKALOIDS (15 Periods)

Vitamins: Classification, Chemistry of vitamin A, B1, Folic acid and vitamin C, Alkaloids: Classification, isolation, structural elucidation of atropine, ephedrine, reserpine and morphine.

UNIT-IV: ANTIBIOTICS AND FLAVONOIDS (15 Periods)

Chemistry and therapeutic activity of penicillin (includes structural elucidation), streptomycin and tetracyclines, Flavonoids: Classification, pharmacological properties and chemistry of quercetin .



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

Practical Exercises:

1. Analysis of fixed oils including acid value, saponification value, iodine value (4 practicals)
2. Determination of hydroxyl compounds (phenolic and alcoholic) (4 practicals)
3. Isolation of active principles from natural sources (at least four) (4 practicals)
4. Determination of aldehydes and ketones in essential oils (4 practicals)
5. Exercises on paper and thin layer chromatographic evaluations of herbal drug constituents (4 practicals)



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THEORY PAPER – VIII: PLANT METABOLISM AND DEVELOPMENT

Periods: 60

Credits: 04

UNIT-I: PLANT WATER RELATIONSHIP (15 Periods)

Physical and chemical properties of water, diffusion, osmosis, plasmolysis, stress physiology, Whole Plants and Inorganic Nutrients, theories of absorption of mineral salt ions – contact exchange theory, carbonic acid exchange theory, mechanism of active absorption, Nutrient Uptake –Transport Systems - Translocation in the Phloem,

UNIT-II: PHOTOSYNTHESIS AND RESPIRATION (15 Periods)

The Light Reactions - Mode of Action of Some Herbicides - Dark Reactions - Oxidative Photosynthetic Carbon Cycle –C₃, C₄ and CAM pathway, Respiration: Mitochondrial electron transport; Glycolysis; synthesis of ATP, respiratory pathways- PPP; regulation of Respiration; Photorespiration: Glyoxylate pathway.

UNIT-III: LIGHT AND HORMONAL CONTROL OF PLANT GROWTH (15 Periods)

Photoperiodism - Phytochrome Regulation of Gene Expression - Blue-Light Responses - Guard Cell Osmoregulation – Auxin - Growth Hormone – Gibberellins - Regulators of Plant Height – Cytokinins - Regulators of Cell Division – Ethylene - Gaseous Hormone - Abscisic Acid - A Seed Maturation and Anti stress Signal - Circadian Rhythms.

UNIT-IV: PLANT DEVELOPMENT (15 Periods)

Stamen and Androecium - Pollen Development - Carpel and Gynoecium - Ovule and Embryo Sac - Pollination and Pollen-Stigma Interaction – Pollen tube germination, growth and Fertilization - Endosperm- Embryo





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LABORATORY COURSE WORK: BASED ON THEORY PAPER – VIII

(Annual Pattern)

Practical Exercises:

1. Experiment based on osmosis
2. Experiment based on plasmolysis
3. Effect of time on the rate of reaction of enzyme (2 practicals)
4. Estimations of proteins (2 practicals)
5. Study of pollen germination by hanging/seating drop method(2 practicals)
6. Estimation of different plant hormones from plants(2 practicals)
7. Study of different Photosynthetic Inhibitors(2 practicals)
8. Study of Pollen viability(2 practicals)
9. Study of different types of Ovules(2 practicals)
10. Separations of photosynthesis pigments(2 practicals)
11. Study of Respiratory Quotient (R.Q.) (2 practicals)



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***THEORY PAPER – IX: IMMUNOLOGY AND MICROBIOLOGY**

(Elective)

Periods: 60

Credits: 04

UNIT-I: IMMUNOLOGY-I (15 Periods)

Components of innate and acquired immunity; Phagocytosis; primary and secondary lymphoid organs; Antigens - immunogens, haptens; Major Histocompatibility Complex - MHC genes.

UNIT-II: IMMUNOLOGY-II (15 Periods)

Immunoglobulins-basic structure, classes and subclasses of immunoglobulins, antigenic determinants; B-cell receptor; Immunoglobulin super family; Principles of cell signaling; B cell maturation, activation and differentiation; T-cell maturation, activation and differentiation and T-cell receptors; Cytokines-properties, receptors and therapeutic uses.

Precipitation, agglutination and complement mediated immune reactions; Advanced immunological techniques - RIA, ELISA, Western blotting, ELISPOT assay, immunofluorescence, flow cytometry and immunoelectron microscopy.

UNIT-III: MICROBIOLOGY-I (15 Periods)

Microorganisms and their place in the living World; Historical developments of microbiology (Spontaneous generation, Germ theory of disease and Koch's postulates). Nomenclature and broad classification of bacteria as per Bergey's manual of systematic bacteriology.

UNIT-IV: MICROBIOLOGY -II (15 Periods)

General characteristics of Actinomycetes, Rickettsiae, Mycoplasmas, Spirochetes. Difference between prokaryotic and eukaryotic cells. Ultra structure of bacterium. Bacterial cell wall, capsule, cyst, external appendages, cytoplasmic inclusions, nuclear material, ribosomes, and endospore.



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

Practical Exercises:

1. Sterilization, disinfection, safety in microbiological laboratory (2 practicals)
2. Staining of microorganisms (2 practicals)
3. Growth curve, measure of bacterial population by turbidometry and studying the effect of temperature, pH, carbon and nitrogen (2 practicals)
4. Assay of antibiotics production and demonstration of antibiotic resistance (2 practicals)
5. Isolation and screening of industrially important microorganisms (2 practicals)
6. Determination of thermal death point and thermal death time of microorganisms(2 practicals)
7. Estimation of Haemoglobin (Hb) (2 practicals)
8. Osmotic fragility of RBC (2 practicals)
9. Detection of HCG by latex agglutination inhibition test (2 practicals)
10. Hemeagglutination tests for identification of human blood groups (2 practicals)
11. Detection by viral fever by slide agglutination tests (2 practicals)



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HERBAL MEDICINE

PAPER-VI

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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PAPER-VII

SELECTED READINGS:

1. Chemistry of Organic Natural Products (Vol.-1 & 2) by O.P. Agarwal.
2. Organic Chemistry of Natural Products (Vol.-1 & 2) by Gurdeep Chatwal.
3. Organic Chemistry (Vol.-2) by I.L. Finar.
4. Lehninger's Principles of Biochemistry – Nelson and Cox
5. Biochemistry – Satyanarayan
6. Biochemistry – A. C. Deb
7. Fundamentals of Biochemistry – J. L. Jain

M. Sc. FIRST YEAR

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HERBAL MEDICINE

PAPER-VIII

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, Biochemistry and biotechnology – Jain and Jain
4. Plant Physiology – Williams Hopkins
5. Plant Physiology – Teiz and Jiegger
6. Plant Physiology – Devlin
7. Plant Physiology – Salisbury and Ross.



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PAPER-IX

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, Biochemistry and biotechnology – Jain and Jain
4. Plant Physiology – Williams Hopkins
5. Plant Physiology – Teiz and Jiegger
6. Plant Physiology – Devlin
7. Plant Physiology – Salisbury and Ross.





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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)
5. (Based on Unit-I/II/III/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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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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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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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