

M.Pharm.
Semester-I Examination, Winter-2010,
Semester-II Examination, Summer-2011

Prospectus No. 20111427

संत गाडगे बाबा अमरावती विद्यापीठ
SANT GADGE BABA AMRAVATI UNIVERSITY

आयुर्विज्ञान विद्याशाखा
(FACULTY OF MEDICINE)

अभ्यासक्रमिका
औषधिनिर्माण पदव्युत्तर परीक्षा
सत्र-१, हिवाळी-२०१० व सत्र-२, उन्हाळी-२०११

PROSPECTUS
OF
MASTER OF PHARMACY (PHARMACOGNOCY) EXAMINATIONS
SEMESTER-I, WINTER-2010
SEMESTER-II, SUMMER-2011



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Sant Gadge Baba Amravati University, Amravati

I N D E X

M.Pharm. (Pharmacognocny) Semester-I & II

(Prospectus No.20111427)

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SANT GADGE BABA AMRAVATI UNIVERSITY

SPECIAL NOTE FOR INFORMATION OF THE STUDENTS

(1) Notwithstanding anything to the contrary, it is notified for general information and guidance of all concerned that a person, who has passed the qualifying examination and is eligible for admission only to the corresponding next higher examination as an ex-student or an external candidate, shall be examined in accordance with the syllabus of such next higher examination in force at the time of such examination in such subjects, papers or combination of papers in which students from University Departments or Colleges are to be examined by the University.

(2) Be it known to all the students desirous to take examination/s for which this prospectus has been prescribed should, if found necessary for any other information regarding examinations etc. refer the University Ordinance Booklet the various conditions/provisions pertaining to examinations as prescribed in the following Ordinances-

- Ordinance No. 1 : Enrolment of Students.
- Ordinance No.2 : Admission of Students
- Ordinance No. 4 : National Cadet Corps
- Ordinance No. 6 : Examination in General (relevant extracts)
- Ordinance No. 18/2001 : An Ordinance to provide grace marks for passing in a Head of passing and Improvement of Division (Higher Class) and getting Distinction in the subject and condonation of defficiency of marks in a subject in all the faculties prescribed by the Statute NO.18, Ordinance 2001.
- Ordinance No.9 : Conduct of Examinations
(Relevant extracts)
- Ordinance No.10 : Providing for Exemptions and Compartments
- Ordinance No. 19 : Admission Candidates to Degrees
- Ordinance No.109 : Recording of a change of name of a University Student in the records of the University
- Ordinance No. 6/2008 : For improvement of Division/Grade.
- Ordinance No.19/2001 : An Ordinance for Central Assessment Programme, Scheme of Evaluation and Moderation of answerbooks and preparation of results of the examinations, conducted by the University, Ordinance 2001.

Dineshkumar Joshi

Registrar

Sant Gadge Baba Amravati University

SANT GADGE BABA AMRAVATI UNIVERSITY

DIRECTION

No.: 22 / 2010

Date : 21/06/ 2010

Subject : Examination Leading to the Degree of भेषजी पारंगत (Master of Pharmacy) (Two year - Four Semester Degree Course), Direction, 2010.

Whereas, the Sub-committee appointed by Board of Studies in Pharmaceutical Sciences have prepared and recommended the Schemes of Teaching and Examinations along with provisions to be incorporated in the Ordinance for M.Pharm. Semester-I to IV for the subjects (1) Pharmaceutics, (2) Pharmacology, (3) Pharmaceutical Chemistry, (4) Pharmacognosy, (5) Industrial Pharmacy, (6) Quality Assurance as per Semester Pattern and Credit Based Performance and Assessment System.

AND

Whereas, the Hon'ble Vice-Chancellor has accepted the aforesaid recommendations under sub-section (7) of Section 14 of the Maharashtra Universities, Act, 1994 on behalf of the Board of Studies in Pharmaceutical Sciences and faculty of Medicine on 27.5.2010.

AND

Whereas, the aforesaid recommendations were placed before the Academic Council in its meeting held on 28.5.2010 vide item No.45 and the Council resolved to accept the refer the Schemes/ provisions to be incorporated in the Ordinance to the Ordinance Committee for placing it directly before the Management Council.

AND

Whereas, the making of Ordinance/Regulation for M.Pharm. Semester-I to IV for the subjects (1) Pharmaceutics, (2) Pharmacology, (3) Pharmaceutical Chemistry, (4) Pharmacognosy, (5) Industrial Pharmacy, (6) Quality Assurance, is a time consuming process.

AND

Whereas, the Academic Session is starting from 14th June 2010 and it is necessary to provide the Schemes of examinations, eligibility criteria along with other details.

Now, therefore, I, Dr. Kamal Singh, Vice Chancellor of Sant Gadge Baba Amravati University, in exercise of powers conferred upon me under sub-section (8) of section 14 of the Maharashtra Universities Act., 1994, do hereby direct as under:

1. This Direction may be called "Examination Leading to the Degree of भेषजी पारंगत (Master of Pharmacy) (Two year - four Semester Degree Course), Direction, 2010".
2. This direction shall come into force from the date of its issuance.
3. In this Direction unless the context otherwise requires the expression "Department" shall mean the Department of Pharmaceutical Sciences and "College" shall mean affiliated college approved for conducting M.Pharm. course.
4. The several courses leading to the Degree of भेषजी पारंगत (Master of Pharmacy) shall be as follows, namely :
 - I) Pharmaceutics
 - II) Pharmaceutical Chemistry
 - III) Pharmacology
 - IV) Pharmacognosy & Phytochemistry
 - V) Biotechnology
 - VI) Quality Assurance
 - VII) Industrial Pharmacy
 - VIII) Bio pharmaceuticals

5. There shall be four examinations leading to the Degree of भेषजी पारंगत (Master of Pharmacy) namely the first semester examination at the end of first semester, second semester examination at the end of second semester, third semester examination at the end of third semester and Final semester examination at the end of final semester in each of the courses specified in paragraph 4 above. The duration of the course shall be of two Academic years (consisting of two semesters in each year).
6. The duration of each semester shall be of six months.
7. The Master of Pharmacy First, Third Semester Examination shall be held in November/December, and the Second and Fourth semester examination in April/May at such places and on such dates as may be fixed by the Board of Examination. Subject to the compliance with the provisions of this Direction and of other ordinance in force from time to time, an applicant for admission to -
 - A) The candidate appearing for Semester-I of First M.Pharm. shall have passed not less than one academic year previously the B.Pharm. examination of this University or of any other university recognised as equivalent thereto and shall have prosecuted a regular course of studies in the department/college as prescribed in this Direction.

Provided that, the first Semester examinee shall have passed the final B.Pharm. examination by securing not less than 50% marks for SC/ST category and 55% marks for others.”
 - B) The Final M.Pharm. (Semester-III & IV) Examinee shall have passed the First M.Pharm. Examination of this university, and shall have prosecuted a regular course of study in the Department/College as prescribed in this Direction. An applicant for the examination to the Final M.Pharm. (Semester-III & IV) shall not be allowed to take the examination if he/she fails to submit to his/her dissertation on or before the 20th December or 31st May of the calendar year in which he/she has to take the examination.
8.
 - A) Without prejudice to the other provision of Ordinance No.6 relating to the examination in general, the provisions of paragraphs 5,8,10,26 and 31 of the said ordinance shall apply to every collegiate candidate.
 - B) An unsuccessful examinee at the First M.Pharm. Examination (Semester-I & II), may be allowed to carry out his research work for dissertation for Final M.Pharm. (Semester-III & IV) Examination but shall not be permitted to appear for the Semester-IV of M.Pharm. Examination unless he/she passes in all the papers and practicals prescribed for first and second semester of M.Pharm. Examination.
9. The fee for each examination shall be as fixed by the University from time to time.
10. The sessionals, papers, practicals, dissertation, and viva-voce, and seminars if any, in which a candidate is to be examined, the maximum marks which each of the subject carries and the minimum marks which an examinee must obtain in order to pass the examination shall be as indicated in the **Annexures-I to VIII** appended with this Direction.
11. The scope of the subject shall be as indicated in the syllabus.
12. An examinee passing in a subject shall be exempted from appearing that subject at all subsequent examinations.
13.
 - i) An examinee for the Third and fourth semester of final year M.Pharm. examination shall carry out research for not less than six months under an approved guide who shall be the internal examiner. A person from industry or Research Institute possessing Post-Graduate qualification in Pharmaceutical Science in appropriate subject and not less than 5 yrs. experience in an industry or Research Institute in a responsible capacity may also be considered for appointment as guide/co-guide/Internal/External examiner
 - ii) The examinee shall submit three copies of his dissertation to the Head of the Department/Principal of the college not later than 30th December or 31st May of the calendar year in which he/she has to take the examination, duly certified by the guide that the work has been done satisfactorily under his guidance.
 - iii)
 - a) The examination based on the dissertation shall be carried out by
 - i) The Guide as Internal Examiner and
 - ii) One External Examiner out of University area
 - b) The examiners may after conducting the seminar, dissertation work and viva-voce examination shall award the marks, out of the marks prescribed for dissertation. In case of any dispute, the decision of the External examiner shall be final. The marks shall be sealed under the signature of the External examiner & shall be handed over to the Principal for sending it to the University
 - c) If the dissertation is not found up to the marks & if the candidate fails in the dissertation, the External examiner shall give his suggestions / recommendations for re-submission / modification in the dissertation to the Principal along with a copy to the Controller of Examination of University for information.
 - iv) An examinee who fails to submit his/her dissertation within the prescribed date or whose dissertation has not been accepted or fails to present himself for Viva-voce, may subject to other provisions of this Direction be readmitted to the examination at any subsequent examination provided,
 - a) he/she pays the prescribed fees as fixed by the University
 - b) his/her application is received by the Registrar not later than one month before the date of commencement of the examination.
 - c) he/she submits his dissertation on the same subject two weeks prior to the examination date. Examinee whose dissertation has not been accepted shall resubmit his/her work, with such additional work as may be directed at the next examination. However, an examinee wishing to submit dissertation on a fresh subject shall be required to join the department/college as a regular student.

14. Examinees who have passed in all the subjects prescribed for the first Year (semester I and semester II) and final M. Pharm. (Semester III and Semester IV) examinations shall be eligible for the degree of Master of Pharmacy. Those obtaining 75% or more marks in aggregate shall be placed in the first division with distinction; those obtaining 60% and above but less than 75% in the first division, and all other successful examinees in the second division, examinees passing all semester examinations leading to the Degree of मेषजी पारंगत (Master of Pharmacy) in the minimum prescribed period and obtaining the first place shall be placed in Merit list.
15. Provision of Ordinance no. 18 of 2001 relating to an ordinance to provide grace marks for passing in a Head of passing and improvement of division (Higher Class) and getting distinction in the subject and condonation of deficiency of marks in a subject in all the faculties prescribed by the Statute No.18, Ordinance 2001 shall apply to the examinations under this Direction.
16. An examinee who does not pass or who fails to present himself/herself for the examination shall be eligible for admission to the same examination on payment of a fresh fee and such other fees as may be prescribed.
 - i) A candidate who has passed the M. Pharm. Examination in any course specified in paragraph 4 may offer himself/herself in any other course as a candidate for the M. Pharm. Examination. Such a candidate may be exempted from appearing in papers in which he/she has already passed under this Direction at the first semester examination, if there is equivalence in the syllabus. However he/she is required to appear for the Semester-II, III & IV of respective specialization.
 - ii) An examinee passing the examination under subparagraph (i) shall not be eligible for the award of Division or for inclusion of his name in Merit List.
17. Notwithstanding anything to the contrary in this Direction, no person shall be admitted to an examination under this Direction if he has already passed the same examination in the course or an equivalent examination of any other statutory University.
18. The Degree in the prescribed form shall be signed by the Vice-Chancellor.

Amravati
Dated : 19/06/2010
Chancellor

Sd/-
(Dr.Kamal Singh)
Vice-

SYLLABUS PRESCRIBED FOR MASTER OF PHARMACY IN INDUSTRIAL PHARMACY

(Implemented from the Session 2010-11)

The several courses leading to the Master Degree of Pharmacy covers following subjects namely

1. Pharmaceutics
2. Pharmacology
3. Pharmaceutical chemistry
4. Pharmacognosy
5. Quality assurance
6. Industrial Pharmacy

1. There are four semester leading to Degree of Master in Pharmacy. **The theory syllabus for first semester shall be compulsory to all above M. Pharm courses.** Second semester syllabus covers in the field of above mention specialization.
2. In third semester examination the research envisage for dissertation and one seminar on recent trends in Pharmaceutical science shall be assigned to him/her by the Guide within one month from the date of the commencement of the third semester.
3. In forth semester examination the dissertation work shall be perform by him/her and at the end student shall deliver the seminar on dissertation work and viva voce examination.

Seminar

Each candidate shall deliver 2 seminars per subject covering the current research interest as in journal in the field of pharmaceutical sciences. Evaluation of seminar shall be based on the communication, representation and skill in oral presentation

M.Pharm. Semester-I

COMMON TO ALL M. PHARM COURSES

Subject code: MC-101

Subject : RESEARCH METHODOLOGY & BIOSTATISTICS
THEORY

60 Hours (4 hrs. /week)

SECTION- A

I. Research

1. Meaning of research, purpose of research and types of research (clinical experimental, basic, applied and patent and oriented research) objects of research
2. Literature survey:
Using library, book and journals, MEDLINE- internet getting patents and reprints of articles as sources for literature survey.
3. Selecting a problem and preparing a research proposal for different types of research sources of procurements of grants.
4. Documentation:
Importance of documentation in case of research record and GMP/GLC
 - Techniques of documentation in case of research record and GMP and GLC
 - Uses of computer packages in clinical trials
 - Documentation in clinical trails
5. Research report/paper writing/thesis writing / poster presentation:
Different parts of research report or paper
 - Title-title of project with authors name
 - Abstract-statement of the problem, background list in brief, purpose and scope
 - Key words
 - Methodology-subject, apparatus/instrumentation and procedure
 - Results-tables, graphs, figures and statistical presentation
 - Discussion-support or non-support to hypothesis. Practical and theoretical implications
 - Acknowledgements
 - References
 - Errata
 - Importance of spell check
 - Use of foot notes

II. Methods and tools used in research:

- Research design (futures of good design, types of research designs, basic principles of experimental design).
- Qualitative studies, quantitative studies.
- Simple data organization, descriptive data organization.
- Limitations and sources of errors.
- Enquiries in forms of questionnaire, opinionnaire and interviews

III. Presentation:

- Importance, types, different skills
- Content of presentation format of model, introduction and endings.
- Posture, gesture, eye contact, facial expression, stage fright.
- Volume, pitch, speed, pauses and languages
- Visual aids and seating arrangements
- Question and answer session

SECTION- B

IV. Cost Analysis of Projects and Clinical Trials

V. Biostatistics

- Statistical analysis of data including variance, standard deviation, Parametric and Non-Parametric statistic test, correlation of data and its interpretation, computer data analysis, bio statistics for clinical trials.
- Scientific method in medicine
- Scientific equations of therapy

Reference Books

- (1) Research in education – John W. Best Jems V. Kahn
- (2) Research methodology – C. R. Kothari
- (3) Methodology and techniques of social research – Willkinson and Bhandarkar
- (4) Presentation skills – Michel Halton – Indian society for institute education
- (5) Practical introduction to copyrights – Gavin Mofariane
- (6) Thesis projects in sciences and engineering – Richard M. Devis
- (7) Scientist in legal system – Ann Labor Science
- (8) Thesis and assessment writing – Janolthon Anderson
- (9) Writing a technical paper – Donald Manzel
- (10) Effective business report writing – Lel and Brown
- (11) Protection of industrial property rights – Purshottam Das and Gokul Das
- (12) Spelling for millions – Edna Furness
- (13) Preparation for publications – King Edwards hospital foundation for London
- (14) Information technology – The hindu speaks
- (15) Documentation – genesis and development – 3792.
- (16) Ayurveda and modern medicine – R. D. Lele
- (17) How to write and publish a scientific paper – Robert A. Day Cambridge University Press 4th edition 1994
- (18) Lecture notes on patent TIFAC: DOC: 022, TIFAC July 2002.
- (19) Introduction to Statistical Methods- C. B. Gupta
- (20) A first course in Mathematical Statistics- C. E. Weatherborn
- (21) Introduction to Biostatistics-Mahajan

COMMON TO ALL M. PHARM COURSES

Subject code: MC-102

Subject : BIOTECHNOLOGY AND BIOINFORMATICS
THEORY

60 Hours (4 hrs. /week)

SECTION- A

1. **Genetics:** Structure and function of DNA replication & repair, expression of genetic information, structure and function of RNA, transcription, genetic code, translation, post translational modification.
2. **Recombinant DNA technology:** Constructing recombinant DNA molecules, restriction enzymes, vectors, gene cloning, genomic libraries, polymerase chain reaction based DNA cloning, restriction mapping, blotting technique, DNA sequencing, pharmaceutical applications of recombinant DNA.
3. **Gene therapy:** General introduction, potential target diseases for gene therapy, gene transfer methods, clinical studies, pharmaceutical production and regulation.
4. **Immunology:** Basics of immunology, Monoclonal antibodies & Hybridoma technology and its applications
5. **Vaccines-**conventional vaccines, modern vaccines technologies, genetically improved vaccines, genetically improved subunit vaccines, pharmaceutical considerations

SECTION- B

6. **Quality control testing methods of Biotech products:** Determining impurities/contamination (viral, bacterial endotoxins (in-vitro) rabbit Pyrogen, sterility, protein identification, finger prints by electrophoresis, isoelectric focusing immunogenicity, and partial sequential analysis.
7. **Immobilization of enzyme:** different techniques, effect on production of enzymes, applications.
8. **Plant Biotech products:** Substances produced by plant cell culture, Transgenic plants their application, Biotransformation with plant cell culture
9. **Molecular biology of cancer:** Causes of cancer and genetics of cancer, New strategy for combating cancer
10. **Introduction to Bioinformatics:** Biological databases, sequence analysis, protein structure, genetic and physical mapping, application of bioinformatics in pharmaceutical industries and in drug discovery.

Reference Books

1. Biotechnology-Applications and research-Paul N. Chermisinol (Technomic publishing co. Inc)
2. Molecular Biochemistry-Therapeutic applications and strategies (Salil D. Patel, John Wiley and sons).
3. Nelson, D.L, and Coy M.M. Lehninger's Principles of Biochemistry' Worth publishers, NewYork
4. Gene therapy: principle and Application by Thomas Blankenste in Bi""hausef Verlag Basel - Boston . Berlin
5. *Immunogenicity of Biopharmaceuticals* by Marco van de Weert, Eva Horn Møller (Springer)
6. Recombinant DNA technology by Watson and Trootze
7. Molecular biology of cell by Watson
8. Molecular biology of cell by Albert B, Johnson A, Lewin J.
9. Fundamental of Immunology by Paul W.E
10. Molecular biotechnology By Glick B.R and Pasternak J.J (ASM press)
11. Molecular biology and biotechnology by Walker J.M
12. Essential of genetics by Klug W.S. Cummings M.R
13. Bioinformatics by Baxevanis A.D, Frana, Duelette B.F.

COMMON TO ALL M. PHARM COURSES

Subject code: MC-103

Subject : QUALITY CONTROL OF PHARMACEUTICAL PRODUCTS

THEORY

60 Hours (4 hrs. /week)

SECTION- A

1. **Good manufacturing practices:** GMP in manufacturing processing and quality control of drugs, control of facility, personal, production and process controls, packaging and labeling controls, documents, WHO GMP guidelines. GMP for ayurvedic products, Good clinical practice (GCP), Good laboratory practice (GLP), Good Pharmacy practice (GPP)
2. **Validation:** Pharmaceutical process validation, equipment validation and sterile products validation.
3. **Quality control of pharmaceutical dosage forms:** Solid and semi-solid dosage forms, disperse systems and parenteral dosage forms.

SECTION- B

4. **ICH Stability Guidelines, Schedule M and Schedule Y**
5. **Spectroscopic methods:** Theory and applications of UV, IR, FTIR, NMR, Mass Spectrometry, ESR and Emission spectroscopy, XRD
6. **Separation techniques:** Introduction and applications of Gas-liquid chromatography, HPLC, Gel chromatography, gel electrophoresis, GC-MS, HPTLC, Ion Pair Chromatography.
7. **Safety into the laboratory**
Designing safety into the laboratory: Laboratory accident and First aid for chemical burns and accident, egress, hazard zoning, emergency facilities, Hazards: slippery spill of Hazardous substances and their handling. Laboratory design-safety aspect: storage of laboratory chemicals, laboratory design; Principle of chemical storage; inventory control; segregation.

Reference Books

- 1) Automation and Validation of information in Pharmaceutical Processing – J. F. Despautz, Marcel and Dekker
- 2) Validation of aseptic pharmaceutical processing – F. J. Carleton and J. P. Agalloco, Marcel and Dekker
- 3) Pharmaceutical process validation – J. R. Berry and R. A. Nash, Marcel and Dekker
- 4) Good Manufacturing Practices for pharmaceuticals – S. H. Will and J. R. Stoker, Marcel and Dekker
- 5) Design of Experiments for process improvement and quality Assurance – R. F. Brewer
- 6) Encyclopedia of pharmaceutical technology, Marcel and Dekker
- 7) Achieving sterility in medical and pharmaceutical products – N.A.Halls, Marcel and Dekker
- 8) Impurities Evaluation of Pharmaceuticals- Satinder Ahuja
- 9) Official and standardized methods of analysis by Colins Watson
- 10) Handbook of Quality Assurance for the analytical chemistry Laboratory by Jam Dux
- 11) Modern Instrumental Analysis, Vol 47(Comprehensive Analytical Chemistry) - Satinder Ahuja , Neil Jespersen
- 12) Instrumental Methods of Analysis– Willard, Merritt, Dean, CBS-Publishers and Distributors, Delhi
- 13) Pharmaceutical Analysis Modern Methods-Part A and Part B – J. W. Munson, Marcel and Dekker
- 14) Indian Pharmacopoeia-2007
- 15) Martindale: The complete Drug Reference – 2007

COMMON TO ALL M. PHARM COURSES

Subject code: MC -104

Subject : DRUG REGULATORY AFFAIRS

THEORY

60 Hours (4 hrs. /week)

SECTION- A

1. Aims, objects and salient features of following legislations affecting pharmaceutical industry.
 - Industrial Development and Regulation Act 1951.
 - Consumer Protection Act.
2. Australian TGA guidelines
3. US-FDA, CDER guidelines

4. New Drug Application
5. Pollution and Environmental Control Act

SECTION- B

6. Drug Master File
7. Intellectual Property Rights:
 - Protection of patents and trademarks and design and copy rights and patent system in India.
 - Present status of IPR future changes expected in Indian patents.
 - What may be patented
 - Who may apply for patent
 - Preparation of patent proposal
 - Registration of patent in India and foreign countries and vice versa
 - ICH guidelines for clinical trials, therapeutic drugs monitoring drugs and bioequivalence.
 - Exclusive marketing rights
 - Black box
 - IPR and IDMA views on patents
 - Human health and patent laws latent lethality
 - Indian patent act and copyright (Indian act)
8. Drug and Cosmetics Act 1940
9. Prevention of Food Adulteration Act 1954 (5 hrs)
10. Preparation of DMF, Site Master File, Master Formula Record. Procedure for filing of Patent.

Reference:

- (1) Guidelines of various countries like MCA, TGA, ICH.
- (2) Drug and cosmetic act 1940 and rules their under
- (3) IPR Lecture notes
- (4) GLP regulation by Alen Hirsch Vol 38 Marcel Decker series
- (5) GMP for pharmaceuticals forth edition by S. Willing, J. Stocker Marcel Decker series 1997.
- (6) I.P., B.P., U.S.P. International Pharmacopoeia
- (7) Pharmacokinetics, Regulatory, Industrial, academic prospective by P. G. Willing and F.T.S. Tse.

COMMON TO ALL M. PHARM COURSES

Subject code: MC -105

**Subject : PRODUCT DEVELOPMENT AND FORMULATION
THEORY**

60 Hours (4 hrs. /week)

SECTION- A

1. INTRODUCTION OF NEW DRUGS

Steps involved in the development of a new drug, obstacles to its evaluation, limitations of screening procedures, animal toxicity tests. Extrapolation of laboratory data to man, placebo, New drug application as per WHO norms and proforma. Requirement and guidelines on clinical trials for import and manufacture of new drugs in India.

2. PREFORMULATION STUDIES

Investigation of physical and chemical problems inherent in the development of new formulations.

3. PHYSICAL PROPERTIES

Organoleptic properties, microscopy, intrinsic solubility and dissolution rate; powder flow and compression, properties and physical stability.

4. CHEMICAL PROPERTIES

Chemical properties : Purity, physico-chemical parameters affecting absorption, solid state and solution-phase stability and compatibility with excipients. Formulation additives : Studies on all excipients to be incorporated in the development of liquid orals, solid dosage forms. Stability data : Advanced studies on stability and development of stability data on different formulations.

SECTION- B

5. PROCESS VALIDATION :

Development of validation data on different formulations, Quality assurance and GMP : A Detailed study of current good manufacturing practices in manufacturing, processing, packaging and holding of drug.

Product development approach on following formulations :

6. LIQUID ORALS :

Cough and multivitamin syrup, anti flatulant and laxative emulsions, antacid and antidiarrhoeal suspensions.

7. TOPICALS :

Antibiotic ointment, analgesic gels.

8. TABLETS :

Common cold, multivitamin, chewable antacid, soluble aspirin and dispersible/kid tablets.

9. STERILE DOSAGE FORMS :

B-complex injection, antibiotic eye and ear drops, antihistaminic nasal drops.

Reference Books:

1. Gennaro, Remingtons Pharmaceutical Sciences, Mack Publishing Co.
2. Lachman, Theory and practice of Industrial pharmacy, Lea and Febiger.
3. Ansel.,Pharmaceutical Dosage Forms & Drug Delivery Systems, Lea & Febiger.
4. Banker, Modern Pharmaceutics, Marcel Dekker Inc.
5. Racz, Drug Formulation, John Wiley and Sons.
6. Aulton, Pharmaceutics : The Science of Dosage Forms Design, ELBS, London
7. Wells, Pharmaceutical preformulation: The physico-chemical properties of Drug Substance, Ellis Horwood Ltd.
8. Florence, Atwood, physico-chemical Principles of pharmacy, Chapman and Hall NY.
9. Welling and Tuckerman, Good Manufacturing practices : A plan for Total Quality Control, Bhalani Publishing House, Bombay.
10. Connors, Chemical stability of pharmaceuticals : A Handbook for pharmacists, Wiley Inter-Science.
11. Carstensen, Drug Stability : Principles and practices, Marcel Dekker Inc.

COMMON TO ALL M. PHARM COURSES

Subject code : MC-106

Subject : Laboratory course -1

Practical 8 hrs. /week

(Minimum 20 practicals should be conducted)

1. Combination Drug Analysis (any two)

Vitamins, Sulphas, Analysis of Antipyretics and Analgesics, Steroidal anti-inflammatory drugs, Antihistamins.

2. Illustrations of theoretical principles using assay of drugs form in various pharmacopoeias (any five).

This should cover titrimetric, gravimetric, spectro-photometric (including flame photometric) methods. HPLC etc. The titrimetric methods should include argentometric, conductometric, and potentiometric end point determination. The students should be exposed to handling of as many instruments as possible by themselves or under the guidance of a teacher.

Validation of equipments: Autoclave, hot air oven, membrane filter

(Minimum two practical).

Validation of an analytical method: Calibration of instruments as per official procedure (UV, FTIR, Conductivity meter, fluorimeter, Digital pH meter, Digital balance, Potentiometer, HPLC, Gas chromatography) (Minimum two practical).

3. Interpretation of UV, IR, NMR, C¹³ NMR spectra and Mass Spectroscopy of some chemicals and drugs. (Minimum three combined spectra).

Reference Books

- (1) Pharmaceutical Analysis – Modern methods – Part A and Part B – J. W. Munson, Marcel – Dekker
- (2) Quantitative Analysis of Drugs in Pharmaceutical formulations – P. D. Sethi, VBS Publishers, Delhi
- (3) Pharmacopoeia of India.
- (4) Practical Pharmaceutical Chemistry, Part I and Part II – A. H. Beckett, J. B. Stenlake, CBS Publishers, Delhi
- (5) Colorimetric Methods of Analysis – F. D. Snell and C. T. Snell, Van Nostrand Reinhold Company, N. Y.
- (6) Chemical Applications of Infrared spectroscopy – C. N. R. Rao, Academic Press N. Y.
- (7) Applications of Absorption Spectroscopy of Organic Compound – J. R. Dyer, Prentice Hall Englewood

M. Pharm. (Pharmacognoc)
Semester – II

Subject code : MPG-201

Subject : PHYTOTHERAPEUTIC MATERIALS

THEORY 60 Hours (4 hrs. /week)

SECTION- A

1. Chemistry of herbal medicines - Study of extraction, isolation, chemical properties, structure and biosynthesis of chemical components in herbal medicines with the objective to use modern science and technology to study the relationship between chemical components and properties of herbal medicines.
2. Problems encountered in and prospects of discovering new drugs from plants. Natural substance as raw materials in drug synthesis, Biomedicinals of recent discovery.
3. Emerging plant Drugs - A review of medicinal plant with antiprotozoal, antihepatotoxic anticancer, antihypertensive, antidiabetic, anti-inflammatory CNS affecting and antiviral drugs, antioxidants & immunomodulating agents.
4. Recent trends in utilization of vegetable laxative bitters and sweeteners natural coloring materials. A comparative study of principles of Ayurvedic, Unani, Siddha and Chinese and Kampo medicines. A review of current status of plants in alternative system of medicine.

SECTION- B

5. Information and applications of herbs and herbal formulations available in Indian and International market Profile of important herbs for their Phytoconstituents analytical profile and marker components.
6. Technologies for the processing of medicinal plant for dosage forms.
7. Application of chromatographic techniques such as column, paper, TLC, HPTLC, GLC, HPLC, and DCCC in isolation and purification of phytopharmaceuticals.
8. Application of UV, IR, NMR, ¹³CNMR and mass spectroscopy for structural elucidation of phytopharmaceuticals. Standardization and assay procedures for assay of plant products.

REFERENCE BOOKS

01. Trease and Evans "Pharmacognosy", W.B. Saunders Publication - 2002.
02. Varro, E. Tyler, "Pharmacognosy", 9th Edition, Lea & Febiger - 1998.
- 03 Wallis, T.E. "Text Book of Pharmacognosy", 5th Edition, CBS Publishers and Distributors- 2002
04. Sim, Medicinal Plant Alkaloids
05. Sim, Medicinal plant Glycosides
06. Wagner, Economics and Medicinal Plants Vol- I to IV
07. Wagner, Pharmacognosy, Phytochemistry and Medicinal plants
08. Schwartz, Screening methods in Pharmacognosy
09. Harbone Phytochemical screening.
10. Cutler, G. Horace "Biologically active Natural Products Agrochemicals" < CRC Press, New York.

Subject code: MPG-202

Subject : HERBAL DRUG TECHNOLOGY

THEORY 60 Hours (4 hrs. /week)

SECTION- A

1. Herbal remedies philosophy concepts and bases of herbal medicine, WHO guideline regarding efficacy safety and toxicity of herbal medicines regulatory requirements as per European community, other regulatory authority, Indian Scenario and US Potential of exploiting Indian herbal medicines.
2. Evaluation and standardization of herbal drugs / formulation and Ayurvedic preparation. Factor effecting herb quality, An overview for procurement and storage of drugs. WHO guidelines for standardization and evaluation of plant drugs and extract.
3. Quantitative microscopy as applied drugs evaluation and procedures of microtome sectioning procedure, preparations of biological materials for examination by electronic microscope.
4. Herbal formulations - Quality assurance in new materials, manufacturing of important herbal powders, granules, capsules, tablets, liquids formulations, gel, creams, ointments and other dosage forms. Stability and Biopharmaceutics considerations drug interactions and therapeutic incompatibilities of herbal constituents / formulations.

SECTION- B

5. Dosage forms in Indian system of medicines. Method of preparations of various Ayurvedic dosage forms, Scope of developing modern manufacturing techniques, approaches for stability and quality control, comparative study of Ayurvedic technology for formulation of dosage forms with modern technology of herbal formulations.
6. Herbal cosmetics- The Principles, rationales and technology involved in the production of herbal formulation and herbal cosmetics. Quality control of Herbal formulations as per international Standards. Study of cosmetic materials of herbs, hair dyes, sunscreen, shampoo, lotion, creams etc.
7. Natural flavour and flavour constituents- Use of natural flavours and flavoring agents. Concept of aromatherapy, important essential oils in aromatherapy.

8. Nutraceuticals, cosmeceuticals and functional foods- Health benefits of food supplements and functional foods.

REFERENCE BOOKS:

1. Patykar, K.D. "Herbal Cosmetics & Ancient India: With Treatise on Planta Cosmetic, Indian Book Centre & Publishers.
2. Asharam Vaidhya, "Herbal Indian Perfumes & Cosmetics", Indian Books Centre & Publishers.
3. Herbal Cosmetics and Ayurvedic Medicines (EOU) .
4. Paranjpe P., Herbs for Beauty: Revealing Ayurvedic Treasures.
5. Ayurvedic Pharmacopoeia, Vol. I, .II & III, Gowthom Medicone Pvt. Ltd., Chennai.
6. Choud.hary R.D., "Practical Approach to Industrial Pharmacognosy, Herbal Drug Industry, Eastern Publishers, New Delhi - 1996.
7. Karnik P., Pharmaceutical Standard of Herbal Plants, Syndicate Publishing Co.
8. Sambamurthy et al "Medicinal Plants in Industry", Question Bank, CBS Publishers & Distributors.
9. C.K. Atal, Cultivation of Medicinal Plants.
10. C.K.Atal, Cultivation of Aromatic Plants.

Subject code : MPG-203

Subject : CULTIVATION OF MEDICINAL PLANTS

THEORY 60 Hours (4 hrs. /week)

SECTION- A

1. WHO guidelines on good agricultural and collection practices (GACP) for medicinal plants.
2. Exogenous and endogenic factors influencing production of crude drugs, plant growth regulators and their application in pharmacy. Pest and pest management of medicinal and aromatic plants. Natural pesticides.
3. Profiles for commercial cultivation technology and post harvest care of following medicinal plants- Ashwagandha, Periwinkle, Ergot, Guggal, Belladonna, Senna, Rauwolfia, Opium Poppy, Psyllium, Steroid bearing Solariums Ammimajus, Ipecac, Datura, Aloe, Henbane, Digitalis, Saffron, Senna.

SECTION- B

4. Technology for commercial scale cultivation and processing for commercial exploitation aromatic plants Lemongrass, Geranium, Basil, Palmrosa, Vetiver, Patchouli, Japanese Mint, Rose, Hops, Jasmine, Sandal, Dill, Celery, Anise, Davana ,mentha..
5. Extraction and cultivation of Biomedicinal, Occurrence methodology for extraction and chemistry of sennosides, digoxin, ginsenoside, solasodine, berberine, quinine, ergot alkaloids, taxol, withanolides, podophylotoxin, emetine, atropine.
6. Profile for Manufacture and commerce of pharmaceutical aids - Papain, Pectin, pharmaceutical gums and their derivatives, starch and its derivatives.
7. An overview of poisonous plants and their mode of toxicity with special emphasis to indigenous poisonous plants.

REFERENCE BOOKS:

01. Jackson, P. Betty, "Atlas of Microscopy of Medicinal Plants: Culinary Herbs and Spices, CBS Publisher and Distributor.
02. Harbourne, Phytochemical Methods.
03. Handa H,S., Indian Herbal Pharmacopoeia.
04. Bilgrami et al, "Phytochemistry & Plant Taxonomy, CBS Publisher & Distributor, New Delhi.
05. Wagner H, and Baldts, "Plant Drug Analysis: A Thin Layer Chromatography",
06. Karnik "Pharmaceutical Standard of Herbal Plants".
07. Rajpal V, "Standardization of Botanicals" Gowtham Medicone Pvt. Ltd., Chennai.
08. Thin Layer Chromatography by Stahl.

Subject code : MPG-204

Subject : BIOGENESIS & CHEMISTRY OF NATURAL PRODUCTS

THEORY 60 Hours (4 hrs./week)

SECTION- A

- 1) Detailed study of plant physiology and plant Biochemistry, Study of techniques employed in the elucidation of Biosynthetic pathways and the study of important Biosynthetic pathways of plants like photosynthesis, Carbohydrate utilization, Aromatic Biosynthesis, Isoprenoid Biosynthesis with special importance to active principles.
- 2) A detailed study of the following classes of Natural products with special importance to occurrence, chemistry, Biosynthesis, isolation, purification and estimation by Physical, Chemical and Biological methods.
 - a) Alkaloids- Atropine, Ergometrine, Reserpine and Vinblastine, morphine and its synthetic analogues. Hypericin, Ginkobiloba, Forskolin.

- c) Steroids –Cholesterol, Preparation and Chemistry of corticosteroids.
- d) Glycosides – Cardiac glycosides like Digoxin, Scillaren-A, Ovabain and Peruvoside.
- e) Antibiotics – Penicillin, semisynthetic penicillins and Tetracyclines.
- f) Vitamins – Vitamin A, Folic acid, Vitamin-B12 and Vitamin C.

SECTION- B

- 3) Industrial methods of isolation and estimation of the following natural products
 - a) Digoxin b) Sennosides c) Diosgenin d) Hesperidin e) Tannic acid f) Pectin g) Atropine h) Quinine i) Emetin j) Hydroxycitric acid k) Forskolin
- 4) General methods of screening natural products for the following Biological activities and their structural activity
 - a) Anti-inflammatory Activity. b) Hypoglycemic. c) Diuretic. d) Cardiac Activity. e) Antiviral & Antibacterial Activity. f) Antineoplastic Activity. g) Psychopharmacological Activity. h) Antifertility Activity. i) Screening of Invitro Antioxidant Activity. j) Antiulcer Activity. k) Hepato protective Activity.

REFERENCE BOOKS:

- 1. Pharmacognosy by G.E. Trease, W.C. Evans, ELBS.
- 2. Pharmacognosy by Varro E.Tyler, Lynn. R.Brady, James E.Robbers.
- 3. Text Book of Pharmacognosy by T.E. Wallis, CBS Pub. Delhi.
- 4. Plant Physiology of Frank B.Salisburry, Cleon. W.Ross, CBS Pub. Delhi
- 5. Diosgenin and other steroid drug precursors by Asolkar,CSIR.
- 6. Antibiotics,Isolation&Seperationby Weinsted.M.I.Wagman,G.H.
- 7. Hormone Chemistry by W.R.Butt.
- 8. Quantitative analysis & Steroids by Gorog.S.
- 9. Steroids by Feiry & Feisher.
- 10. Alkaloids Chemical & Biological by S.W.Pelletier.
- 11. Biotechnology of Industrial antibiotics by E.vardemme.
- 12. Chromatography of Alkaloids by Vapoorte, Swendson.
- 13. Elements of chromatography by P.K.Lala.
- 14. Introduction to chromatography theory & Practicals by V.K. Srivastava, K.Kishore.
- 15. Principles of Biotechnology by Leininger.
- 16. Jenkins Quantitative Pharmacuetical Chemistry by A.N.Knevell.
- 17. Handbook of vitamins by L.J.Machlein.
- 18. Clerk's Isolation & Identification of drugs by A.C.Mottal.
- 19. Selected Topics in Exp-Pharmacology by Seth.V.K.
- 20. Burger's Medicinal Chemistry by wolff.M.I.
- 21. Wilson & Gisvolds Text Book of organic Medicinal and Pharmacuetical Chemistry by Deorge.R.F.
- 22. Phytochemical methods of chemical analysis by Harbone.
- 23. Organic chemistry vol.II by I.L.Finar.
- 24. The Essential oil by Gunther.E.
- 25. The use of Pharmacological techniques for the evaluation of natural products by B.N.DhavanR.C.Srimal. CDRI, Lucknow.
- 26. Physical methods in organic chemistry by J.C.P.Schwartz.
- 27. Techniques in organic chemistry by Weiss Creger.
- 28. Practical Pharmacognosy by Dr.C.K. Kokate.
- 29. Practical Pharmacognosy by Dr.P.K.Lala.
- 30. Herbal medicines – Janne Barnes, Linda. A.Anderson.
- 31. Chinese materia medica – Yaru – PingZhu.
- 32. Natural products from plants – Peter.B.Kanfman.
- 33. Selection, Preparation and pharmacological evaluation of plant material – M.Williamson, David T.Okpako, J.Evans.

Subject code : MPG-205

Subject : SELECTED TOPICS IN PHARMACOGNOSY

THEORY 60 Hours (4 hrs./week)

SECTION- A

- 1. Historical perspectives, prospects, for development of plant biotechnology as source of medicinal agents. Biotechnology of micropropagation of medicinal and aromatic plants, Application in pharmacy and allied fields.
- 2. Plant tissue culture-
 - a) Types, techniques, nutritional requirement and growth of plant tissue culture.
 - b) Organogenesis and embryogenesis.
 - c) Protoplast fusion and cultures
 - d) Genetic stability of tissue cultures.
 - e) Secondary metabolism in tissue cultures with emphasis on production of medicinal agents and its impact.
 - f) Screening and selection of high yielding cell lines. Effect of cultural practices, precursors and elicitors on production of biomedicinals.
 - g) Hairy roots and multiple shoots culture and their applications. Industrially potential cell systems of different types. Development of transgenic plants.

- h) Biotransformation, bioreactors for pilot and large scale cultures of plant cells, Cellular totipotency, cryopreservation and retention of biosynthetic potential in cell cultures.

SECTION- B

5. Genetics and comparative phytochemistry in pharmacognosy. Relationship in between phytochemistry and taxonomy.
6. Chemotaxonomic significance in medicinal plants- Artificial and natural system of classification, Principles of classification, Rules of plant nomenclature, herbaria and modern trends in taxonomy, Chemotaxonomy in higher and lower plants, Distribution of certain chemotaxonomic group of constituents in plant kingdom like alkaloids, glycoside, flavonoids.
7. Herbal Drug Regulatory Affairs.
8. Natural allergens, photosensitizing agents and fungal toxins
9. Novel medicinal agents from marine sources.
10. Problem and prospects of discovering new drugs from higher plants.

REFERENCE BOOKS:

1. Khan, A Irfan, "Role of Biotechnology in Medicinal and Aromatic Plants, Vol. I to VIII., Ukaaz Publication - 2002.
2. Vyas & Dixit, "Pharmaceutical. Biotechnology", CBS Publisher -1998.
3. Doyle, Alan & Griffith, J, "Cell & Tissue Culture: Laboratory Procedures in Biotechnology. John Willey & Sons.
4. Gamborg, O.L. & Philip G.C, "Plant Cell, Tissue & Organ Culture: Fundamental Methods, Narosa Publication - 1998.
5. Purohit S.S. "Biotechnology: Fundamentals & Application" Agro Bios India - 2001. 6. Scheepler, A. Judith and Gambier M Rossa "Biotechnological Explorations: Applying the Fundamentals" ASM Press, Washington D.C.
7. Pullock Mackaryee, Quality Control of Herbal Drugs.
8. Cultivation and Utilization of Medicinal & Aromatic Plants by C.K. Atal and B.M. Kapur, R.R.L. Jamnu.
9. New Natural Products and Plant Drugs with Pharmacological, Biological or Therapeutics Activity, Proceeding of the first International Congress on Medicinal Plant research ED. Wagner and Wolff, Springer- Verlag 1977.
10. Marine Pharmacognosy, by D.F. Martin and G.M. Padilla. Academic Press
11. Pharmacognosy and Photochemistry Ed. Wagner and Horhammer, Spinger Verlag.
12. Phytochemistry Vol I and II and III by Miller Reinhold.
13. Recent Advances in Phytochemistry, Vol 9 by V.C. Runeckles, Plenum press.

Subject code : MPG – 206

Subject : LABORATORY COURSE-2

Practical 8 hrs. /week (Minimum 20 practical should be conducted)

1. Isolation of Rutin from fagopyrum species. Hesperidin from orange peel, Aloin from Aloes, Rhein from rhizome of Rheum species, Piperine from Piper nigrum Quinine from Cinchona bark. Berberine from Berberis aristata, Caffeine from Tea leaves, Menthol from Mentha species, Diosgenin from Dioscorea and Trigonella species.
2. Estimation of piperine in pepper by UV, HPTLC, and HPLC Analysis.
3. Determination of Anthracene derivatives in Senna by spectrophotometric method (Fair Buarian 1975), Reserpine in Rauwolfia by photometric method, Quinine in Cinchona bark. Thevetia seeds / bark calculated in terms of digitoxogenin by Photometric method.
4. Estimation of Total phenolic compounds from plant drugs.
5. Determination of Antioxidant potential of some plant drugs by DPPH and Nitric oxide methods.
6. UV and IR analysis of the following isolated phytochemicals and determination of their purity. a) Caffeine b) Piperine c) Quinine. d) Andrographolide e) Curcumin.
7. Study on the Micro wave assisted extraction technique of plant drugs.
8. Analysis of extracts obtained from micro wave assisted technique by modern techniques like UV, HPLC and HPTLC and comparison with the extracts obtained from conventional method.
9. Determination of total andrographolides from Kalmegh.
10. Determination of total bitters from the following plant drugs.
a) Kalmegh. b) Eclipta alba. c) Picrorhiza. d) Tinospora cordifolia.
10. Estimation of total saponins from
a) Bacopa monnieri. b) Tribulus terrestris.
11. Estimation of withanolides from Withania Somnifera.
12. HPTLC estimation of Gugulosterones in Guggul.
13. Estimation of Boswellic acid from Boswellia serrata by nonaqueous titration.
14. Estimation of Berberine from plant drugs by HPTLC.
15. Estimation of flavanoids in Liquorice.
16. Estimation of Glycyrrhizin in Liquorice by spectrophotometric method.
17. Determination Carvone content of Umbelliferous fruits, Citral content in lemon grass oil, Bitter principles of Chirata, Solanaceous drugs, Tropane alkaloids using Vitali Morin reaction, quantitative Estimation of Saponin as per W.H.O. protocol in suitable plant material, Resin content in Sample of Podophyllum by B.P.C. method.

18. Preliminary phytochemical screening and detection of various plant constituents such as-
a. Carbohydrates.b. Alkaloids.c. Anthraquinones.d. Flavanoids.e. Polyphenolic compounds.
f. Lipids.g. Proteins and Aminoacids.
19. Moisture content of Acacia by toluene distillation method.
20. Iodine values of Arachis oil, TLC of volatile oil samples, Antimicrobial activity of some volatile oils, Phytohaematoglutinin activity of extract of some seeds. .
21. Examination of Rhubarb for the presence of Rhapontic Rhubarb by the use of paper chromatography and ultraviolet light.
22. Separation of Solanaceous alkaloids from Belladonna leaves by TLC using hyoscyne and hyoscyamine as reference compound, anthracene glycosides of Senna leaf by paper chromatography.
23. Isolation of Solanaceous alkaloids over alumina column
24. To develop callus culture of Senna on Wood and Brauin's medium , the root culture of Trigonella foenum graecum on Street & McGroger medium.
25. Determination of Ascorbic acid (Vitamin c) by UV spectroscopic method in crude drugs.
26. Quantitative estimation of Reserpine in Rauwolfia serpentine, quinine in cinchona bark, Ephedrine in ephedra extracts by HPLC method.
27. Quantitative estimation of Glycyrrhizine in Glycynhiza glabra by HPLC.
28. Exercise on interpretation of at list 5 different known compounds of natural origin by using spectroscopic data (NMR & MASS)
29. Preparation of permanent microscopic slides and section cutting by microtome
30. Determination of microbial load in crude drug.
31. Preparation of detailed 'monograph of at least one medicinal plant covering taxanomy, phytochemical and pharmacological investigation and its use in traditional system of medicine

Reference Books

1. Pharmacognosy by G. E. Trease, W.C. Evans, ELBS.
2. Pharmacognosy by Varro E. Tyler, Lynn R. Brady, James E. Robbera.
3. Plant Physiology by Frank B. Salisbury, Cleon. W. Rose, CBS Pub. Delhi.
4. Antibiotics Isolation & Separation by M.L. Wenisten, G.H. Wagman.
5. Introduction to Biotechnology by Bullock, John.
6. Biotechnology of Higher plants by Gorden E. Russel
7. Modern Biotechnology by S.B. Primrose.
8. Plant cell culture – A practical approach by R.A. Dixon.
9. Plant cell culture technology by M.M. Yeoman.
10. Plant tissue culture by Dennis N. Butcher, David. S. Ingram.
11. Plant tissue culture by Pitman.
12. Plant tissue culture – theory & practice by S.S. Bhajwani, M.K. Razdan.
13. A Laboratory guide to Organic Natural Products by R. Ikan
14. Environmental Chemistry by Anil Kupur. D.
15. Basic gas chromatography by Menair, Bondhi.
16. Quantitative thin layer chromatography & its industrial application by Trieber. L.R.
17. Biotechnology of Industrial antibiotics by E.J. Vardamme.
18. Chromatography of alkaloids by Verpoorte Swendson.
19. Elements of chromatography by P.K. Lala.
20. Introduction to chromatography – theory & practice by V.K. Srivastava, K. Kishore.
21. Principles of Biotechnology by Leininger.
22. Handbook of Vitamins by L.S. Machlein.
23. Industrial Microbiology by L.E. Cassida.
24. Microbial Technology by Pepler, Perlman.
25. Burger's Medicinal Chemistry by M.I. Wolff.
26. Wilson and Gisvolds Text Book of Organic Medicinal and Pharmacuetical Chemistry by Deorge. R.F.
27. Phyto chemical methods of chemical analysis by Harbone.
28. Cytogenetics and evolution of plant Breedings by R.S. Shukla.
29. Introduction to organic laboratory techniques by Pavia Lampman.
30. Drug analysis by chromatography by Egon stahl0.
31. Secondary plant metabolism by Margaret L. Vikery, Brian Vikery.
32. Practical Pharmacognosy by Dr. C.K. Kokate.
33. Practical Pharmacognosy by Dr. P.K. Lala.
34. The review of Natural products – Ara Dermarderosia.
35. Phytochemical Dictionary – Jestorey. B. Harbone. FRS.
36. PDR for Herbal medicines.
37. Methods in plant tissue culture – U. Kumar.
38. Plant cell and tissue culture – Angela Stafford and Grahamwarren.
39. Phytochemicals – R. Bidlack, Tomaye, s. Meskin.
40. Propagating plants – Alan too good.
41. Modern methods of plant analysis – High performance Liquid chromatography in plant science – H.F. Linskens and J.F. Jacksons.
42. Indian Herbal Pharmacopiea -Regional Research Laboratory.
43. Principles and practice of phytotherapy - Simon Mills & Kerry Bo