SANT GADGE BABA AMRAVATI UNIVERSITY

(FACULTY OF MEDICINE)

PROSPECTUS

OF

THE SECOND EXAMINATION FOR THE DEGREE OF
BACHELOR OF PHARMACY, 2009.
(FOUR YEAR INTEGRATED COURSE)

2008

Visit us at www.sgbau.ac.in

Price Rs. 8/-
Syllabus Prescribed for
B.Pharm Second Year

II.T.1

Physical Pharmacy

Theory (75 Hours)

1. **Intermolecular forces and states of matter**
   Binding forces between molecules: States of matter, gaseous, liquid and solid state, amorphous and crystalline states of solids; polymorphism; latent heat and vapor pressure, sublimation-critical point, phase equilibria and phase rule.

2. **Thermodynamics**
   Laws of thermodynamics and their applications in Pharmacy.

3. **Solubility and distribution phenomena**
   Solubility definitions, expressions, solvent solute interactions, polar solvents-non polar solvents-semipolar solvents, solubility of gases in liquids, effect of pressure-temperature-salting out-chemical reactions of solubility calculations, solubility of liquids in liquids, ideal and real solutions, complete and partial miscibility, influence of foreign substances-three component systems, dielectric constant and solubility, solubility of solids in liquids, solubility of salts in water-solubility of slightly soluble and weak electrolytes, calculating solubility of weak electrolytes as influenced by pH. Influence of co-solvents on the solubility of drugs, combined effect of pH and solvents, distribution of solutes between immiscible solvents, effect of ionic dissociation and molecular association on partition extraction, preservation action of weak acids in emulsion, distribution co-efficient.

4. **Diffusion and dissolution**

5. **Kinetics and drug stability**

6. **Surface and interfacial phenomenon**
   Surface and interfacial tensions, surface free energy, measurement of surface and interfacial tensions, spreading coefficient, complex films, adsorption at solid liquid-interfaces, surface activity, surface active agents, HLB classification, solubilization-micelle formation, determination of critical micelle concentration, detergency, and wetting agents. Contact angle, flocculating agents, deflocculating agents, foaming agents, anti-foaming agents. Medicinal and pharmaceutical applications.

7. **Colloids and macromolecular systems**
   Introduction and types, optical, kinetic and electrical properties of colloids, Stabilization of colloids, gels-structure, properties and applications in Pharmacy.

8. **Coarse dispersions and emulsions**

9. **Micrometers**

10. **Rheology**
    Fundamentals of rheology, type of flow, quantitative measurement of flow, mechanical models to illustrate flow on viscoelasticity, thixotrophy, measurement of thixotropy, thixotropy in formulation, rheology of disperse system, pharmaceutical application of rheology. Methods of viscosity measurements.

11. **Complexation**

**Recommended Books**:

1) Remington’s Pharmaceutical Sciences.
2) Elements of Physical Chemistry - Glasstone & Lewis
3) Theory & Practice of Industrial Pharmacy - Lachman, Libermann & Kanig.
4) Physical Pharmacy by Martin - Swarbrick & A.Cammarata
5) Bentley’s Text Book of Pharmaceutics by Rewilins.
6) Tutorial Pharmacy - Cooper & Gunn.

II.P.1

Physical Pharmacy

Practical (75 Hours)

1. Studies on polymorphs, their identification and properties.
2. Determination of particle size, particle size distribution and surface area using various methods of particle size analysis.
3. Determination of derived properties of powders like density, porosity, compressibility, angle of repose etc.
4. Determination of surface/interfacial tension, HLB value and critical micelle concentration of surfactants.
5. Study of rheological properties of various types of systems using different viscometers.
6. Studies of different types of colloids and their properties.
7. Preparation of various types of suspensions and determination of their Sedimentation parameters.
8. Stability studies of emulsions.
9. Studies on different types of complexes and determination of their stability constants.
10. Determination of half-life, rate constant and order of reaction.
11. Accelerated stability testing, shelf-life determination and expiration dating of pharmaceuticals.
12. Experiments involving tonicity adjustments.

Reference Books:
1) Physical Pharmacy by Martin - Swarbrick & A.Cammarata
2) Practical Physical Pharmacy by Dr.U.B.Hadkar, T.N.Vasudevan, K.S.Laddha,
3) Practical Pharmaceutical Technology by - Engene Parrot.

II.T.2 Pharmaceutical Unit Operations
Theory (75 Hours)

5. Evaporation: Different types of evaporators, condensers, traps, entrainment, separators, evaporator capacity, Heat and material balance, Dahring's rule, factors influencing heat transfer coefficient. Rate of scale formation. Principle and operation of a multiple effect evaporator.
6. Distillation: Vapor-liquid equilibrium, boiling point diagram, Roul't's law, Henery's law, constant boiling mixture, equilibrium diagram, equilibrium distillation, differential distillation, rectification, fractionating column, heat and material balance, factors influencing plate efficiency.
7. Extraction: Extractors, flow sheet of extraction plant, liquid-liquid extraction, extraction towers, solid-liquid extractors, counter current multitage extractors.

Recommended Books:
1) Introduction to chemical Engineering by Badger & Banchero.
2) Unit operations of Chemical Engineering - McCabe & Smith.
3) Unit operations by Brown.
4) Hand book of Chemical Engineering - Perry
5) Unit operation in Pharmacy - D.Ganderton
6) Theory and practice of Industrial Pharmacy - Leon Lachman
7) Tutorial Pharmacy - Cooper & Gunn
II.T3  Pharmaceutical Analysis-I
Theory (50 Hours)

1. **Introduction**: Significance of quantitative analysis in quality control, different techniques of analysis, computation of analytical results, significant figures, concept of error, precision and accuracy, standard deviation, calibration of analytical equipments, fundamentals of volumetric analysis, methods of expressing concentration, primary and secondary standards.


4. **Precipitation titrations**: Principles of precipitation titrations; Titrations involving-mercuric nitrate, ammonium or potassium thiocyanate, argentometric titrations, adsorption indicators. Application to products as potassium chloride and sodium chloride injection.

5. **Gravimetric analysis**: Basic concepts, precipitation techniques, co-precipitation, post-precipitation, various steps involved in gravimetric analysis and their pharmaceutical applications. Sodium sulphate, assay of aluminium in alum by oxime reagent.


8. **Miscellaneous methods of analysis as**: Diazotization titration, kjeldahl method of nitrogen estimation, oxygen flask combustion, gasometry.

**Reference Books**:
2. Vogel Text Book of Practical Organic Chemistry
3. Vogeli Text Book of inorganic chemistry.
4. Instrumental methods of Analysis by Willard, Dean, merrit and Settle - Wordsworth Publication Co.
5. Instrumental methods of Analysis by eving.
7. Indian Pharmacopoea
9. U.S.P.

II.P2  Pharmaceutical Analysis-I
Practical (75 Hours)

1. Standardization of analytical weights and calibration of volumetric apparatus.

2. **Acid-base Titrations**: Preparation and standartization of acids and bases; Some exercises related with determination of acids and bases separately or in mixture form, some official assay procedures e.g. boric acid should also be covered.

3. **Oxidation reduction titrations**: Preparation and standardization of some redox titrants e.g. potassium permanganate, potassium dichromate, iodine, sodium thiosulphate etc. Some exercises related to determination of oxidizing and reducing agents in the sample shall be covered. Exercises involving potassium iodate, potassium bromate, iodine solution, titanous chloride, sodium 2, 6-dichlorophenol, indophenol and ceric ammonium sulphate.

4. **Precipitation titrations**: Preparation and standardization of titrants like silver nitrate and ammonium thiocyanate. Titrations according to Mohr’s Volhard’s and Fajan’s methods.

5. **Gravimetric analysis**: Preparation of gooch crucible for filtration and use of sintered glass crucible; Determination of water of hydration; Some exercises related to gravimetric analysis should be covered.

7. Preparation and Standardization of EDTA and some assays on it.

Reference Books:
1) Practical Pharmaceutical Chemistry, Part-I by Beccket & Stenlake
2) Indian Pharmacoepia
3) Practical Inorganic Chemistry by Vogel.

II.T.4   Pharmaceutical Chemistry-III
(Heterocyclic & Natural Products)
Theory (75 Hours)

1. Heterocyclic Compounds: Chemistry, preparation and properties of some important mono-heterocyclics containing 3,4,5 and 6 atoms with one or two heteroatoms like N,O, S and fused systems like indole, benzimidazole, quinoline, isoquinoline, acridine, phenothiazine.


4. Classification, chemistry and pharmacological activity of medically important monoterpenes, sesquiterpenes, diterpenes and triterpenoids.


7. Alkaloids: Classification and general methods of structural elucidation excluding individual structure, elucidation, chemistry and pharmacological activity of atropine and related compounds, quinine, reserpine, morphine, papaverine, ephedrine, ergot and vinca alkaloids.

8. Chemistry of medically important lignins and quassanoids, flavonoids, purines and xanthines.


Books Recommended:
3) Logowaski and Katritzki, Heterocyclic Chemistry.
4) K.B.G. Torsell, Natural Product Chemistry, John Wiley and Sons N.Y.

ILP.3   Pharmaceutical Chemistry-III
(Heterocyclic and Natural Products)
Practical (75 Hours)

1. Five exercises in synthesis involving various heterocyclic ring system.

2. Demonstration on molecular modelling of primary, secondary and tertiary structures of proteins, molecular modelling on double helical structure of nucleic acid showing hydrogen bonding.

3. Analysis of oils and fats as given in I.P.

4. Estimation of functional groups as hydroxyl, amino and carbonyl.

Reference Books:
1) Vogels textbooks of Practical Organic Chemistry.
3) Qualitative analysis in Organic Chemistry by Prof.V.V.Nadkarni and Dr.P.S.Fernandes.

II.T.5   Biochemistry
Theory (50 Hours)

1. Biochemical organisation of the cell and transport processes across cell membrane.

2. Bioenergetics: Introduction, concept of free energy, role of high energy nucleotide phosphates, production of ATP and its biological significance.


4. Co-enzymes: Vitamins as co-enzymes and their biological significance, metals as coenzymes.

5. Carbohydrate metabolism: Glycolysis, fermentation, glucogenesis, glycogenolysis, glycogen formation, metabolism
of galactose and galactosemia, pentose phosphate pathway, uronic acid pathway, citric acid cycle—significance, abnormalities of carbohydrate metabolism.

6. **Lipid metabolism**: Oxidation of fatty acids (Beta, Alpha, Omega oxidations), Ketone bodies and their significance, Biosynthesis of saturated and unsaturated fatty acids, phospholipids, sphingolipids, control of lipid metabolism, essential fatty acids, biosynthesis of eicosanoids (prostaglandins, prostacyclines, thromboxanes and leukotrienes), Abnormalities of lipid metabolism.


9. **Metabolism of ammonia and nitrogen containing monomers**: Nitrogen balance, biosynthesis and catabolism of amino acids, assimilation of ammonia; Urea cycle; metabolic disorders of urea cycle, metabolism of sulphur containing amino acids; porphyrin biosynthesis, formation of bile pigments, porphyrias, hyperbilirubinemia.

10. Nucleic acid metabolism, Purine and pyrimidine metabolism, disorders of purine metabolism, purine and pyrimidine biosynthesis, purine pyrimidine nucleotides interconversion, inhibition of nucleotide biosynthesis, Biosynthesis of DNA and RNA, Abnormalities of nucleic acid metabolism, genetic disorders.


12. Regulation of gene expression.

13. Brief account of genetic engineering and polymerase chain reaction.

**Reference Books**:

2. Biochemistry by A. Lenninger.
4. Text Book of Biochemistry by Daginawala
5. Hand Book of Biochemistry by Siddiqui

**II.P.4 Biochemistry**

**Practical (75 Hours)**

1. Preparation of standard buffers (citrate, phosphate and carbonate) and measurement of pH.
2. Study of amino acids by paper chromatography.
3. The determination of glucose by means of the glucometer.
4. Estimation of SGOT, SGPT in the serum.
5. Estimation of cholesterol, creatinine, urea and uric acid in biological fluids.
7. Estimation of serum alkaline phosphatase and acid phosphatase levels.
9. Estimation of serum Na+, K+, Ca2+ levels.
12. Isolation of caseins from milk.

**II.T.6 Pharmacology-I**

**Theory (75 Hours)**

1. a) **General and basic principles of Pharmacology**: Definition, scope and various branches of pharmacology, historico development of pharmacological thought with special reference to development of pharmacology in India, Routes of drug administration.

b) **Pharmacokinetics**: Mechanisms of principles of absorption, distribution, biotransformation and excretion of drugs.

c) **Pharmacodynamics**: Principles of drugs action, molecular mechanism of drug action, concept of receptors, theories of drug receptor interaction, agonist, partial agonist, antagonist, synergism, various types of antagonism, brief description of cellular signaling systems, factors modifying drug action, tolerance and tachyphylaxis.
2. a) Pharmacology of drugs acting on autonomic nervous system: Organisation and function of autonomic nervous system, autonomic transmission, cotransmission.

b) Cholinergic system and drugs: Cholinergic transmission, cholinergic receptors, parasympathomimetic agents, anticholine sterases and anticholinergic drugs.

c) Adrenegic system and drugs: Adrenergic transmission, biosynthesis, storage, release, re-uptake and metabolism of endogeneous catecholamines, adrenergic receptors, adrenergic drugs, alpha & beta adreno receptors blockers, adrenergic neuron blockers.

d) Drugs acting on autonomic ganglia: Ganglionic transmission, ganglionic stimulants, ganglion blocking agents. Neuromuscular blocking agents.

3. a) Drugs acting on central nervous system: Synaptic transmission in central nervous system.

b) General anesthetics: Theories of anesthesia, stages of anesthesia, inhalation anesthetics, intravenous anesthetics, pre-anesthetic medication.

c) Sedative-hypnotics: Barbiturates, benzodiozepines and non-barbiturate hypnotics. Antiepileptic drugs and antiparkinsonian drugs.

d) Drugs used in mental illness: Antipsychotic agents, antianxiety drugs, antidepressants, antiamnestic drugs, hallucinogens.

e) Opioid analgesics and antagonists: Non-opioid analgesics and non steroidal anti-inflammatory agents and other drugs for arthritis, drugs used in gout.

f) Central nervous system stimulants and cerebroactive drugs.

4. Drug abuse and its management.


6. Local Anesthetics

7. Harmones and related drugs: Introduction to endocrine pharmacology, pituitary hormones oxytocic and tocolytic agents, thyroid hormones and anti thyroid agents, hormones of pancreas and hypoglyacaemic agents, adrenal corticosteroids and corticoestroid antagonists, gonadal hormones and their inhibitors, oral contraceptives, drugs regulating calcium homeostasis.

Reference Books:
1. Pharmacological basis of Therapeutics by Goodman and Gilman.
3. Pharmacology and Therapeutics by Grollman.
4. Pharmacology and Therapeutics by Satoskar R.S. and Bhandarkar.
5. Lewis Pharmacology by Crossland.

II.P.5 Pharmacology-I

Practical (75 Hours)

1. Introduction to experimental pharmacology: Introduction to commonly used instruments used in experimental pharmacology, laboratory animals, anaesthetics employed to anaesthetise laboratory animals, physiological solutions, drug solution and use of molar solutions. Stunning, Pitting and euthanesia. Care and handling of laboratory animals.

2. ADME studies: Study of various routes of administration i.e. intravenous, intramuscular, subcutaneous and intragastic administration. Blood sample collection from experimental animals. Study of various routes of administration on sleeping time.


4. Pharmacological techniques: Common evaluation techniques of analgesics, anticonvulsants, local anaesthetics, drugs affecting muscle rigidity and ciliary movements.

Reference Books:
1. H.B. of Experimental Pharmacology by S.K.Kulkarni

II.T.7 Basic Electronics and Computer Applications

Theory (50 Hours)

1. Basic Electronics: Semiconductors, p-n junction diode, LED, Photodiode and its uses. Rectifiers (half wave, full wave/with filters), Transistors, configurations, transistors, amplifiers. Introduction to integrated circuits, photo cells and photomultiplier tubes.
2. **Computers**: History of computers, simple model of computer and its working, parts of computers. CPU, memory, input/output devices, computer languages and their hierarchy machine language, assembly language, high level language, comparison of high level and low level languages especially C, Pascal, FORTRAN etc., Introduction to microcomputers, concepts of operating systems. Elements of DOS, UNIX etc. introduction of computer networks, spread sheets especially LOTUS 1-2-3, Concepts of data base and data base managements system: Objectives of data base management system, advantages and disadvantages of data base management system, examples of DBMS package (DBASE III)

3. **Flow charting and algorithm development**: Definition and properties of algorithm, Flow chart symbols and their use, Examples of efficient algorithm and flow-chart, Conversion of algorithm/flow chart to high level language.

4. **Introduction to Computer Programming**: BASIC language: BASIC character set, constants variables, expression, Statements and system commands in BASIC, Entering and editing BASIC program, control structures, repetition statements (loops), nested loop, definite and indefinite loops, selection statements, array functions and subroutines. Concepts of files: Programme files and data files, Sequential files and random access files. Elementary BASIC programmes to numeric & string processing.

5. **Computer applications in pharmaceutical and clinical studies.**

**Reference Books**:
2. Computer Applications in Pharmacy by William and Fassett.

**ADDITIONAL BOOKS RECOMMENDED**

IT IS UNDERSTOOD THAT THE TEACHER WOULD FOLLOW AND RECOMMEND LATEST EDITION OF THE BOOK, HENCE THE SPECIFIC EDITION AND YEARS OF PUBLICATION ARE OMITTED.

1. **Pharmaceutics (including Pharmaceutical Microbiology and Pharmaceutical Biotechnology)**
   02) A Pecile and A Resigno Pharmacokinetics, Plenum Press, NY.
   03) Aiba Suichi, Humphrey and Millis, Biochemical Engineering, University of Tokyo Press.
   09) Banker G S and Rhode C T, Modern Pharmaceutics, Marcel Dekker Inc., NY.
   12) Bharati H K, Drugs and Pharmacy Laws in India, Sadhana Mandir, Indore.
   13) Bolton Sanford, Pharmaceutical Statistics, Marcel Dekker Inc NY.
   16) Brock T D, Madigen M T, Biology of Micro-organism Prentice Hall, New Jersey USA.
19) Carstensen J T, Drug Stability, Marcel Dekker Inc. NY.
20) Chittion HM and Witcofski RL, Nuclear Pharmacy, Lea and Febiger, Philadelphia.
22) Davis, Dulbetco, Eisen Microbiology.
24) C G Brown, Unit operations (Indian Ed) Asia Publishing House, Bombay.
25) Giladi M & Perrier D, Pharmacokinetics, marcel Dekker Inc NY.
26) Remington's, the science and Practice of Pharmacy, Mack Publishing Co. Easton, Pennsylvania.
27) Hassan Willman E, Hospital Pharmacy, Lea & Febiger, Philadelphia.
31) Jain N K A Text Book of Forensic Pharmacy, Vallabh Prakashan, Delhi.
34) Kielslich K, Ed Biotechnology Vol 6a, Verlag Chemie, Switzerland.
38) Lewin Benjamin, Gene V Microbiology.
41) Loftus B T and Nash Robert, Pharmaceutical Process Validation, Marcel Dekker Inc., NY.
44) Martin E.W. Dispensing of Medication, Mack Publishing Co., Eastern PA.
48) Notari R E, Biopharmaceutics and Pharmacokinetics - an Introduction Marcel Dekker Inc NY.
49) Parry R H & Chilton C H Chemical Engineers Handbook, McGraw Kogakusha Ltd.
50) Peppler, Microbial Technology, Vol I & II.
54) Rawlins EA Bentley's Textbook of Pharmaceutics ELBS Bacilliere Tindall.
60) Salle A J, Fundamental Principles of bacteriology.
61) Schroff M L, Professional Pharmacy, Five Star Enterprises, Calcutta.
II. PHARMACOGNOSY:


03) Brain K R and Turner T D the Practical Evaluation of Phytopharmaceuticals, Wright - Scientechica, Bristol.


08) Export Potential of Selected Medicinal Plants, prepared by Basic Chemicals, Pharmaceuticals and Cosmetic Export Promotion Council, Bombay, and other reports.


12) Gibbs R Darneley, Chemotaxonomy of Flowering Plants, 4 Volumes, McGill University Press.


17) Kokate C K, Practical Pharmacognosy, Vallabh Prakashan, Delhi.


19) Manitto P, The Biosynthesis of Natural Products, Ellis Horwood, Chichester.


22) Medicinal Plants of India, 1. Indian Council of Medical Research, New Delhi.

23) Miller L P, Phytochemistry, 1-3 Van Nostrand Reinhold Co.,
40) Ross M S F, and Brain K R., An Introduction to Phytopharmacy, Pitman medical, Kent.
41) Schellard E J., Practical Plant Chemistry for Pharmacy Students, Pitman Medical, London.

III PHYSIOLOGY ANATOMY & HEALTH, PHARMACOLOGY AND CLINICAL PHARMACY:
01) Applied Therapeutics : The Clinical Use of Drugs, Applied Therapeutics, Inc.
02) Barar F S K, Text Book of Pharmacology, Interprint, New Delhi.
03) Best and Taylor's Physiological Basis of Medical Practice, William & Wilkins, Baltimore.
07) Davidson's Principles and Practice of Medicine, ELBS/Churchill Livingstone.
11) Goodman and Gilman's, the Pharmacological basis of Therapeutics; Editors : J G Hardman, L E Limbird, P B Molinoss, R W Rudden and A G Gil, Pergamon Press.
13) Herfindal E T and Hirschman J L., Clinical Pharmacy and Therapeutics, Williams and Wilkins.
14) Human Physiology, C C Chatterjee, Medical Allied Agency, Calcutta.
22) Paul L., Principles of Pharmacology, Chapman and Hall.
26) Ranade V.G. Text Book of Practical Physiology, Pune Vidyarthi Griha Prakashan, Pune.
28) Tortora GJ, and Anagnodokos NP, Principles of Anatomy and Physiology Harper & Row Publisher N.Y.
29) Theoharides T C, Pharmacology, Little Brown and Co.

IV. PHARMACEUTICAL ANALYSIS, PHARMACEUTICAL CHEMISTRY, BIOCHEMISTRY.


26) Lehninger A L, Biochemistry, Worth Publisher, Inc.,


31) Wallwork SC, Physical Chemistry for Students of Pharmacy and Biology, Longman.


34) Mussay RK, Granner DK, Mayos PA and Rodwell VW., Harpers Biochemistry, Prentice-Hall International, INC.


<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Subject</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Special note for the information of the students</td>
<td>1 to 2</td>
</tr>
<tr>
<td>2</td>
<td>Ordinance No.153</td>
<td>3 to 8</td>
</tr>
<tr>
<td>3</td>
<td>Regulation No. 24 of 2003</td>
<td>8 to 12</td>
</tr>
<tr>
<td>4</td>
<td>Physical Pharmacy</td>
<td>13 to 15</td>
</tr>
<tr>
<td>5</td>
<td>Pharmaceutical Unit Operation</td>
<td>15 to 16</td>
</tr>
<tr>
<td>6</td>
<td>Pharmaceutical Analysis-I</td>
<td>17 to 19</td>
</tr>
<tr>
<td>7</td>
<td>Pharmaceutical Chemistry-III (Heterocyclic and Natural Products)</td>
<td>19 to 20</td>
</tr>
<tr>
<td>8</td>
<td>Biochemistry</td>
<td>20 to 22</td>
</tr>
<tr>
<td>9</td>
<td>Pharmacology-I</td>
<td>22 to 24</td>
</tr>
<tr>
<td>10</td>
<td>Basic Electronics &amp; Computer Applications</td>
<td>24 to 25</td>
</tr>
<tr>
<td>11</td>
<td>Additional Books Recommended</td>
<td>26 to 37</td>
</tr>
</tbody>
</table>

### V BASIC ELECTRONICS & COMPUTER APPLICATIONS:

01) Grogona P, Programming in Pascal, Addison Wesley, Reading, M.A.


### VI MATHEMATICS:


02) Boltons, Pharmaceutical Statistics, Practical and Clinical Applications, Marcel Dekker, N.Y.

03) Daniel W W, Biostatistics. A Foundation for Analysis in Health Sciences, John Wiley, N.Y.


05) Gupta S P, Statistical Methods, Sultan Chand & Co., New Delhi.