The Emblem of the Rajiv Gandhi University of Health Sciences is a symbolic expression of the confluence of both Eastern and Western Health Sciences. A central wand with entwined snakes symbolises Greek and Roman Gods of Health called Hermis and Mercury is adapted as symbol of modern medical science. The pot above depicts Amrutha Kalasham of Dhanvanthri the father of all Health Sciences. The wings above it depicts Human Soul called Hamsa (Swan) in Indian philosophy. The rising Sun at the top symbolises knowledge and enlightenment. The two twigs of leaves in western philosophy symbolises Olive branches, which is an expression of Peace, Love and Harmony. In Hindu Philosophy it depicts the Vanaspathi (also called as Oushadi) held in the hands of Dhanvanthri, which are the source of all Medicines. The lamp at the bottom depicts human energy (kundalini). The script “Devahitham Yadayahu” inside the lamp is taken from Upanishath Shanthi Manthram (Bhadram Karnebhi Shrunuyanadev...), which says “May we live the full span of our lives allotted by God in perfect health” which is the motto of the Rajiv Gandhi University of Health Sciences.
Revised Ordinance Governing

BACHELOR OF PHARMACY (B.Pharm)
Degree Course

RAJIV GANDHI UNIVERSITY OF
HEALTH SCIENCES KARNATAKA
4th T Block, Jayanagar, Bangalore 560041
Revised Ordinance Governing Bachelor of Pharmacy (B. Pharm) Degree Course


Published by: Registrar
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Bangalore - 560 003 Mobile: 9342237844
NOTIFICATION

SECTION I : Goals of Education and Training in Pharmaceutical Sciences i

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SECTION VI : Norms and Standards 114
NOTIFICATION


Date : 13/07/2004

Sub : Revised Ordinance pertaining to B.Pharm Degree course.

Ref : i) Minutes of Academic Council Meeting held on 27th the 44th Syndicate meeting held on 27th and 28th November 2003.
ii) Minutes of the 44th Syndicate meeting held on 22.6.2007,

In exercise of the powers conferred under sec. 35(1) of the RGUHS Act, the Syndicate at its meeting held on 22.03.2004 has been pleased to approve the revised Ordinances pertaining to B.Pharm Degree course given in schedule here to annexed.

The Revised Ordinance as above shall come into effect from the academic year 2004-05 onwards.

By Order,

Sd/-
REGISTRAR

To
1. The Principals of all Pharmacy Colleges affiliated to RGUHS.
2. All the Members of the Syndicate / Senate / Academic Council.

Copy to :
1. Secretary to Governor, Raj Bhavan, Bangalore - 560 001.
2. Secretary to Government, Medical Education, Health & Family Welfare Department, 3rd Stage, M.S. Building, Dr. B.R. Ambedkar Veedhi, Bangalore - 560 001.
3. PA to Vice Chancellor / Registrar / Registrar (Eva) / Finance Officer / Consultant, Curriculum Development, Computer Centre / PRO, RGUHS.
4. All Officers in the University
5. Guard file, Office Copy.
NOTIFICATION

Ref. No. : AUTH / B. Pharm / LES-316 / 2008-09
Date : 01/08/2008

Sub: Admission of lapsed seats of 1st year B.Pharm directly to 2nd year B.pharm under Lateral Entry system.

Ref: 1) Minutes of meeting of Principals of Pharmacy college at RGUHS dated: 28/07/2008.
3) Orders of Hon'ble Vice Chancellor dated 31/07/2008.

In Exercise of the powers conferred under section 13(1) of the RGUHS Act 1994, Hon'ble Vice-Chancellor is pleased to approve and notify the admission of lapsed seats of 1st year B.Pharm directly to 2nd year B.Pharm under Lateral Entry System in the affiliated colleges of RGUHS as shows below:

i) to approve 10% seats in B.Pharm second year and above the sanctioned intake of first year B.Pharm (vacancy due to unfilled seats, failure of candidates or any other reasons plus 10% of over and above the sanctioned intake) for persons holding D.Pharm qualification from an institution approved u/s 12 of the Pharmacy Act, 1948 irrespective of the fact as to whether the candidate has passed out D.Pharm under Education Regulations, 1991 or repealed Education Regulation 1953, 1972 and 1981.

ii) In addition persons holding D.Pharm qualification from an institution approved by the PCI u/s 12 of the Pharmacy Act irrespective of the fact as to whether the candidate has passed out D.Pharm course under Education Regulations, 1991 or repealed Education Regulations 1953, 1972 and 1981 shall be eligible for admission in the 2nd year B.Pharm against the vacant seats of 1st year B.Pharm.

The above Ordinance shall come into effect from the academic year 2008-09 and onwards.

By Order,

(Dr. Yasantha Kumar S)
REGISTRAR

To
The Principals of Pharmacy Colleges affiliated to RGUHS.

Copy to:
01. The Secretary to Governor, Governor's Secretariat, Raj Bhavan, Bangalore - 560 001.
02. Secretary to Government, Health & Family Welfare Department, (Medical Education),
Vikasa Soudha, Bangalore - 560 001.
03. The Director, Department of Medical Education, Anand Rao Circle, Bangalore - 560 009.
04. PA to Vice-Chancellor / Registrar / Registrar (Eva.) / Finance Officer.
05. Director, Curriculum Development Cell.
06. Public Information Officer.
07. The Home Page of RGUHS Website.
08. Guard File / Office Copy.
Ref. No. : AUTH/Amend/B.Pharm-401/2009-10
Date : 03/08/2009

NOTIFICATION

Sub: Amendment to the Ordinance pertaining to B. Pharm Degree Course.

3. Minutes of meeting of Syndicate held on 05-06-2009.

In exercise of the powers conferred under section 35(1) of RGUHS Act 1994, the Syndicate in its meeting held on 30-07-2009, is pleased to notify the amendment to the Ordinance pertaining to B. Pharm Degree course notified by RGUHS Notification RGUHS Notification No. AUTH/Amend/B.Pharm-401/2009-10, dated: 08/06/2009 pertaining to Minimum qualification for admission to the course (1,2) as shown below:

<table>
<thead>
<tr>
<th>EXISTING</th>
<th>AMENDED</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Candidates who have passed two year P.U.C. examination of Karnataka P.U.C. Board or an equivalent examination of any other approved Board or university with not less than 40% marks in any combination comprising P.C.M. or P.C.B. (minimum eligibility should be based on the aggregate of P.C.M. or P.C.B.) or P.C.M.B., P.C. and Computer Sciences P.C. and Electronics.</td>
<td>1. Candidates who have passed two year P.U.C. examination of Karnataka P.U.C. Board or an equivalent examination of any other approved Board or university with not less than 40% marks in any combination comprising P.C.M. or P.C.B. (minimum eligibility should be based on the aggregate of P.C.M. or P.C.B.) or P.C.M.B., P.C. and Computer Sciences P.C. and Electronics.</td>
</tr>
<tr>
<td>Note: In respect of candidates who have taken P.C.M.B. combination, the aggregate of P.C.M. or P.C.B. whichever is higher shall be considered for the purpose of admission.</td>
<td>Note: In respect of candidates who have taken P.C.M.B. combination, the aggregate of P.C.M. or P.C.B. whichever is higher shall be considered for the purpose of admission.</td>
</tr>
<tr>
<td>2. In case of students belonging to SC/ST/ or Category-I, the minimum percentage of marks for admission to B. Pharm Course shall be not less than 35% in P.U.C. or its equivalent examination (P.C.B. or P.C.M. or P.C.M.B.), P.C. and Computer Science, P.C. and Electronics and D. Pharma.</td>
<td>2. In case of students belonging to SC/ST/Category-I /OBC, the minimum percentage of marks for admission to B. Pharm Course shall be not less than 35% in P.U.C. or its equivalent examination (P.C.B., or P.C.M. or P.C.M.B) PC and Computer Science, PC and Electronics and D. Pharma.</td>
</tr>
</tbody>
</table>
The above Amendment to Ordinance pertaining to B. Pharm Degree Course shall come into force with immediate effect.

By Order,

(Dr. Vasantha Kumar S)
REGISTRAR

To
The Principals of all Colleges affiliated to RGUHS conducting B. Pharm Degree Course.

Copy to:
1. The Secretary to Governor, Governor's Secretariat, Raj Bhavan, Bangalore - 560001.
2. Secretary to Government, Health & Family Welfare Department, (Medical Education), Vikasa Soudha, Bangalore - 560001.
3. The Director, Department of Medical Education, Anand Rao Circle, Bangalore - 560009.
4. PA to Vice-Chancellor / Registrar / Registrar (Eva.) Finance Officer.
5. Director, Curriculum Development Cell.
6. Public Information Officer.
7. The Home Page of RGUHS Website http://www.rguhs.ac.in/Authoritysection/Fellowship.html.
GOALS OF EDUCATION & TRAINING IN PHARMACEUTICAL SCIENCES OF RGUHS

The pharmacy curriculum shall be oriented towards educating students of B.Pharm course to:

1. Imbibe the concept of better patient health care at every face of Health related activities.
2. Should be capable of functioning independently in both rural and urban environment.
3. Appraise fellow professionals in Hospitals, Community and Industry of newer developments in Pharmacy.
4. Be a part of all National & International sponsored health education programmes.
5. Educate the community about disease prevention measures, community hygiene and better health.
6. Inculcate critical thinking, clarity of expression, independent thinking and scientific temperament.
7. Encourage active learning methods like Group discussions, Seminars, Peer interactions etc., which would enable students to develop discipline, personality, communicating skills, and other qualities, which are necessary.
8. Be able to produce and market dosage forms and be responsible in minimizing the pollution hazards, by using proper scientific and logical techniques.

Regular periodic assessment shall be done throughout the course. Examinations shall be designed with a view to assess not merely the knowledge but also practical skills, habits and values which are necessary for a pharmacy graduate to carry out the professional obligations competently.

Toward achieving these goals every Pharmacy College should:

- Evolve institutional objectives, which would be in consonance with the national goals and health policies.
- Shift the role of Pharmacy teachers from merely imparting knowledge to that of facilitator and motivator of student learning.
- Establish an institution for faculty development, preparation of learning resource materials and for improving evaluation methods.
- Encourage and facilitate for Industry-Academic interaction.
AIMS & OBJECTIVES OF B. PHARM COURSE

Aims:

Pharmacy graduates are required to learn and acquire adequate knowledge, necessary skills to practice the profession of pharmacy including thorough and exhaustive knowledge of synthesis and assay of Medicinal agents including mode of action, drug interactions and Patient counseling and professional information exchange with Physicians and other paramedicos. The graduates are required to acquire an in-depth knowledge of formulation, storage and analysis of various pharmaceutical dosage forms including herbal medicines required for both large scale commercial production & research. The graduates should understand the concept of Community Pharmacy and be able to participate in rural and urban health care projects of State and Central government. The graduate is also required to detail the physicians and community and market the medicinal agents for diagnosis, prevention and therapeutic purposes. The pharmacist should act as bridge between Physicians and Patients and strive for better health care.

Objectives:
The objectives are covered under three headings namely:

(a) Knowledge and understanding
(b) Skills and
(c) Attitude

(a) KNOWLEDGE & UNDERSTANDING

The graduate should acquire the following during their four-year B.Pharm course.

1. Adequate knowledge and scientific information regarding basic principles of Pharmaceutical chemistry, Pharmaceutics including cosmetics, Pharmacology and Pharmacognosy including Herbal drugs.

2. Adequate knowledge of practical aspects of synthesis, formulation and analysis of various pharmaceutical and Herbal medicinal agents.

3. Adequate knowledge of practical aspects of delivering a quality assured product as per pharmacopoeia, WHO and ISO standards.

5. Adequate knowledge of clinical studies for patient counseling leading to physical and social well being of patients.

6. Adequate knowledge of practical aspects of product detailing and marketing of Pharmaceutical products.

**(B) SKILLS**

A graduate should be able to demonstrate the following skills necessary for practice of a pharmacy.

1. Able to synthesize, purify, identify and analyze medicinal agents.

2. Able to formulate, store, dispense, analyze the prescriptions and / or manufacture the medicinal agents at commercial level.

3. Able to learn and apply the quality assurance principles including legal and ethical aspects involving drugs.

4. Able to extract, purify, identify and know the therapeutic value of herbal / crude / natural products.

5. Able to screen various medicinal agents using animal models for pharmacological activity.

**(C) ATTITUDES**

The graduate should develop the following attitudes during their four-year B.Pharm course.

1. Willing to apply the current knowledge of Pharmacy in the best interest of patients and the community.

2. Maintain a high standard of professional ethics in discharging professional obligations.

3. Continuously upgrade professional information and be conversant with latest advances in Pharmacy field to serve the community better.

4. Willing to participate in continuing education programmes of PCI and AICTE to upgrade knowledge and professional skills.

5. To help and to participate in the implementation of National Health Programmes.
REGULATIONS

1. Minimum qualification for admission to the course

1. Candidates who have passed two year P.U.C. examination of Karnataka P.U.C. Board or an equivalent examination of any other approved Board or university with not less than 50% marks in any combination comprising PC.M. or PC.B. (minimum eligibility should be based on the aggregate of PC.M. or PC.B.) or PC.M.B, PC. and Computer Sciences, PC. and Electronics.

Note: In respect of candidates who have taken PC.M.B. combination the aggregate of PC.M. or PC.B. whichever is higher shall be considered for the purpose of admission.

2. In case of students belonging to SC/ST or Category-I, the minimum percentage of marks for admission to B.Pharm Course shall be not less than 40% in P.U.C. or its equivalent examination (PC.B., or PC.M. or PC.M.B.), PC and Computer Science, PC and Electronics and D.Pharma.

3. Candidates who have scored less than 50% marks in (10+2) but who have completed B.Sc. Degree with Chemistry as one of the compulsory subjects in combination with any two of the following subjects, namely, Physics or Mathematics, or Microbiology, or Botany, or Zoology, or Bio-technology, or Computer Sciences or Electronics securing not less than 50% marks in aggregate are eligible for admission to first year B.Pharm course.

4. Candidates who have scored less than 50% marks in 10+2 but who have completed D.Pharm course securing more than 50% marks in aggregate in D.Pharm are eligible to admitted to I B.Pharm course.

5. Candidates who have passed D.Pharm course with not less than 60% aggregate approved by Pharmacy Council of India shall also be eligible to this course and shall be admitted directly to II B.Pharm course 10% over and above the sanctioned intake and shall have to study Mathematics, Computer science & Statistics of I B.Pharm in addition to the II B.Pharm subjects.

II Duration of the course

The course of study for B.Pharm shall extend over a period of four academic years and three academic years for those admitted to second B. Pharm directly. The curricula and syllabi for the course shall be prescribed from time to time.

III Medium of Instruction and Examinations

Medium of Instruction and Examination shall be English.

IV Attendance and Progress

A candidate is required to put in at least 80% attendance in theory and practical subjects separately in a recognized institution approved by and affiliated to Rajiv Gandhi University of Health Sciences, Karnataka. The candidate shall complete the prescribed course satisfactorily to be eligible to appear for the respective examinations.

V Course of study

The course of study for B.Pharm I, II, III and IV year shall include the respective Theory & Practical subjects as given in Table-1, II, III and IV respectively. The number of hours to be devoted to each theory and practical subject in an academic year shall not be less than that shown in Table-1, II, III and IV.

VI Approval of institution conducting the course of study

The regular course for B.Pharm I, II, III & IV year under clause V shall be conducted by an institution approved by All India Council for Technical Education and affiliated to Rajiv Gandhi University of Health Sciences, Karnataka. The approval and affiliation will be granted only if adequate arrangements for teaching- infrastructural facilities, accommodation, equipments, chemicals, glassware, library, teaching and non-teaching staff are provided as required under the norms of Rajiv Gandhi University of Health Sciences, Karnataka (as prescribed in Section V1).

VII Academic Work

A regular record of attendance both in Theory and Practicals shall be maintained by the teaching staff of respective subjects.

Internal Assessment Marks:

A. Theory: Three sessional examinations evenly spread during the academic year shall be conducted by the affiliated colleges. The average marks of the best two examinations shall be computed out of a maximum of 30 marks and shall constitute the sessional award in theory. Provided further the colleges may conduct one special theory sessional examination towards the end of the academic session for those who might have missed any one of the regular sessional examination on genuine grounds. For special theory sessional examination, the portion prescribed shall be the entire syllabus of the subject.
B. Practical: Students are expected to perform the number of experiments listed in the respective syllabus. The number of experiments are also listed. Marks shall be awarded out of a maximum of 10 to each of the practical exercise and an average of those shall be computed out of maximum of 10 marks. In addition, three practical sessional examinations evenly spread during each academic year shall be conducted. The average marks of the best two practical examinations shall be computed out of a maximum of 20 marks. A total of 30 marks shall constitute the sessional award in practical. While awarding the sessional marks for practical experiments, the following considerations should be taken into account.

1. Preparation of the candidate.
2. Manipulative skills.
3. Results of the experiment.
4. Knowledge of the experiment
5. Viva voce pertaining to the experiments only.

The college shall maintain the sessional books of the students and the record of sessional award of the students.

A regular record of both theory and practical class work and sessional examinations conducted in an institution imparting the course shall be maintained for each student in the institution. Marks shall be awarded as per the schemes given in Table-V, VI, VII and VIII.

III Examinations

There shall be four examinations namely, First Year, Second Year, Third Year and Final Year B.Pharm examination. The details regarding the duration of papers, maximum marks for each paper including the sessional marks allotted to each subject is given in Table-V, VI, VII and VIII.

IV Criteria for Pass

a) Candidates who have secured a minimum of 50% marks in the Theory (including sessionals) and Practical (including sessionals) separately in any subject or subjects shall be declared to have passed in that subject/s and exempted from appearing in that subject/s at subsequent examination.

b) Theory and Practical of a particular subject are considered as individual subjects for the purpose of pass criteria.

V Conditions under which candidates are permitted to proceed to next higher class:

a) Out of seven subjects to be studied at I.B.Pharm course, there shall be an examination conducted by the college in respect of the following three subjects.
i. Mathematics-theory.
ii. Biology-theory and practical.
iii. Computer Science & Statistics for the candidates admitted on PUC / 12th Standard / Equivalent qualifications and for the candidates admitted to II.B.Pharm, admitted on the basis of D.Pharm.

b) The candidates are required to score a minimum of 40% marks of the total marks prescribed for pass in all the above three subjects both in theory and practical separately including their sessional marks for a pass.

c) Candidates of I B.Pharm are permitted to carryover all the failed subjects to II B.Pharm and appear for II B.Pharm examination concurrently along with failed subjects of I B.Pharm. However, these candidates have to pass all the failed subjects of I B.Pharm to become eligible to proceed to III B.Pharm.

d) Similarly, candidates of II B.Pharm who have completely passed all the subjects of I B.Pharm but have failed in II B.Pharm are permitted to carryover all the failed subjects of II B.Pharm to III B.Pharm and appear for III B.Pharm concurrently along with failed subjects of II B.Pharm. However, these candidates have to pass all the failed subjects of II B.Pharm to become eligible to proceed to IV B.Pharm.

e) Candidates of III B.Pharm who have completely passed all the subjects of II B.Pharm but have failed in III B.Pharm are permitted to carryover all the failed subjects of III B.Pharm and appear for IV B.Pharm examination concurrently along with failed subjects of III B.Pharm.

The carryover facility as above shall be applicable to B.Pharm students of 1998-99 batch and onwards.

f) The final B.Pharm candidates can appear for all the subjects of IV B.Pharm along with the failed subjects of III B.Pharm. However they have to pass all the subjects of III B.Pharm before the announcement of IV B.Pharm results.

g) However in case of In-service candidates (those who are Registered Pharmacists and have put in minimum of 5 years working experience in either Government or Private sector), they are permitted to take admission into Final year B.Pharm even if he/she is having a carryover of II year and III year B.Pharm subjects but he/she cannot appear for final B.Pharm examination till he/she passes all the subjects of II year B.Pharm.

h) A candidate who has passed in all the subjects of IV B.Pharm will be eligible for the award of A. Pharm Degree, provided he/she has passed in all the III B.Pharm subjects also in the case of carryover and he/she has satisfactorily completed the practical training as mentioned under clause XIII.
XI  Improvement of sessional marks

Candidates who wish to improve the sessional marks only in theory subjects can do so by appearing in the special resessional examinations conducted by the college. A minimum of two and maximum of three sessional examinations shall be conducted by the college out of which the average marks of the best two of the three special resessional examination shall be forwarded to the university at least 15 days prior to the commencement of the next university Examination. In case the marks scored by the students in the resessional examination are less than regular sessional examination, the Head of the Institution shall forward the marks whichever is higher (Resessional/Regular sessional). The resessional/regular sessional marks shall be sent to the university at least 15 days prior to the next university examination.

XII  Declaration of Class

Class shall be awarded at the end of I, II, III and final year of B.Pharm examination as shown below:

1) Distinction 75% and above
2) First Class 60% and above and less than 75%
3) Second class 50% and above and less than 60%

Pass Class shall be awarded to such of the candidates who would have passed the examination in more than one attempt. However, this shall not be applicable to candidates who are exempted in Introductory Biology and Introductory Mathematics by the RGUHS Karnataka, Bangalore.

XIII  Every candidate shall undergo practical training in Pharmaceutical Manufacturing House/Approved Hospital/CSIR research labs for a period of not less than one hundred and fifty hours to be covered in not less than 45 days after completing III B.Pharm or IV B.Pharm course.

Candidate should submit two copies of the training report duly certified by the authorities of the training center in which he/she has undergone training duly accepted and certified by the Head of the Institution.

XIV  Industrial Tour

Candidates studying in final year of the course shall visit several pharmaceutical manufacturing houses as a supplement to their academic training and submit a report to the satisfaction of the Head of the institution where he/she has studied.

XV  Award of Ranks

Ranks and Medals shall be awarded on the basis of aggregate of all the four university examinations of Rajiv Gandhi University of Health Sciences, Karnataka, Bangalore. However, candidates who fail in one or more subjects during the B.Pharm courses shall not be eligible for award of ranks.
8. Lipids:
   a) Definition, method of extraction, chemistry and method of analysis
   b) Study of method of production, chemical constituents, tests, uses and adulterants of the following oils:
      i) Castoroil   ii) Shark Liveroil   iii) Chaulmoograoil   iv) Woolfat
      v) Beeswax   vi) Spermaceti   vii) Cocabutter   viii) Oliveoil

9. Proteins:
   a) Definition, Classification, Chemistry, method of analysis
   b) Study of collagen, gelatin and its products.

10. Study of plant fibers used in surgical dressing and related products.

11. Different methods of adulteration of crude drugs and general methods for detection of adulterants.

PHARMACOGNOSY (Practicals)

1. Study of cell wall constituents and cell inclusions*.

2. General morphological study of different parts of the plants including surgical fibers*.
   a) Leaf    Datura, Senna
   b) Bark    Cinnamon (Cassia), Cinchona
   c) Stem    Ephedra
   d) Wood    Quassia
   e) Flower  Clove
   f) Fruits  Fennel, Coriander
   g) Seeds   Isaggoi, NuxVomica
   h) Root    Rauwolfia, Liquorice
   i) Rhizome : Ginger, Podophyllum

3. Transverse sections of drugs mentioned in 2**

4. Test for identification of adulterants in*:
   a) Castoroil b) Shark Liveroil c) Woolfat d) Beeswax e) Sesame oil

5. Chemical tests for identification of the following drugs and adulterants in them*.
   a) Acacia b) Agar c) Tragacanth d) Starch e) Honey f) Gelatin.

6. Analysis of fats and oils - Iodine values, Saponification values, Acid values and Ester values* *
1. Structure and physical properties:
   a) Polarity and dipole moment: Hydrogen bonding and its applications and protic and aprotic solvents.
   b) Tautomerism, Kets enol tautomerism.
   c) Reaction intermediates - carbocations, carbanions and free radicals.
   d) Attacking reagents-electrophiles, nucleophiles.
   e) Acids and bases: Lowry Bronsted and Lewis theories.
   f) An introduction to isomerism.

2. Nomenclature of organic compounds belonging to the following classes: alkanes, alkenes, dienes, alkynes, alcohols, aldehydes, ketones, amides, amines, phenols, alkyl halides, carboxylic acids, esters, acid chlorides and cycloalkanes. Concept of aromaticity, Hückel's rule nomenclature of aromatic compounds.

3. Free radical chain reactions of alkanes - mechanism, relative reactivity and stability.


5. Nucleophilic aliphatic substitution mechanism: nucleophiles, and leaving groups, kinetics of second and first order reaction. Mechanism and stereochemistry of SN2 reaction, Mechanism and stereochemistry of SN1 reaction. Rearrangement of carboxilation, SN2 versus SN1 reactions, Reactivity of alkyl halides in SN1 and SN2, Factors Affecting SN1 and SN2.

6. Dehydrohalogenation of alkyl halides: 1,2 elimination, kinetics, E2, E1 mechanisms, E2 versus E1, elimination versus substitution. Dehydration of alcohols and its mechanism, orientation and reactivity in E2 E1, Saytzeff's and Hoffmann's elimination.

8. Theory of resonance: allyl radical as a resonance hybrid, stability, and orbital picture. Resonance stabilization of allyl cations: hyper conjugation, stability of conjugated dienes, mechanisms of 1,2 and 1,4-additions with examples, effect of temperature on 1,2 and 1,4 addition.

9. Electrophilic aromatic substitution; Effect of substituent groups, determination of orientation, determination of relative reactivity, classification of substituent groups, mechanism of nitration, sulphonation, halogenation, Friedel craft alkylation and Friedel craft's acylation, Reactivity and orientation, activating and deactivating (o, m, p, directing) groups, orientation and synthesis, orientation in disubstituted benzenes, theory of reactivity, theory of orientation, effects of halogens.


11. Nucleophilic acyl substitution in carboxylic acid derivatives, comparision with nucleophilic addition reaction, ionization of carboxylic acids, acidity of acids, structure of carboxylate ion, effect of substituents on acidity. Conversion of acids to acid chloride, amide, ester, anhydrides.

PHARMACEUTICAL ORGANIC CHEMISTRY I (Practicals)

75 hours

1. Introduction to the various laboratory techniques through demonstrations involving synthesis of the following compounds (atleast 8 compounds to be synthesized). *

   1. Acetanilide/Aspirin (acylation)
   2. Benzamiide/Phenylbenzoate(Benzoylation)
   3. p-Bromo acetanilide/2,4,6Tribromoaniline. (Bromination)
   4. Dibenzyldene acetone (condensation)
   5. 1-Phenylazo-2-napthol (Diazolisation)
   6. Benzoicacid/Salicylicacid (hydrolysis of ester)
   7. m-Dinitro benzene (nitrulation)
   8. 9,10- Anthraquinone (oxidation of anthracene) / preparation of benzoic acid from toluene or benzaldehyde.
   9. m-Phenylenediamine (reduction of m-dinitrobenzene)/aniline from nitrobenzene
   10. Benzophenone oxime (oxime formation)
   11. Nitrilation of salicylic acid
   12. Preparation of picric acid
   13. Preparation of o-chloro benzoic acid from o-chloro toluene
   14. Preparation of cyclohexanone from cyclohexanol.

2. Identification of organic compounds belonging to the following classes by systematic qualitative organic analysis including preparation of derivatives* *.

   1. Phenols
   2. Amides
   3. Carbohydrates
   4. Amines
   5. Carboxylicacids
   6. Aldehydes and ketones
   7. Alcohols
   8. Esters
   9. Hydrocarbons
   10. Anilides
   11. Nitrocompounds

3. Introduction to the use of stereo models

   1. Methane
   2. Ethane
   3. Ethylene
   4. Acetylene
   5. cis-Alkene
   6. trans-Alkene
   7. Inversion of configuration
4. Determination of melting point and boiling point for some important pharmaceutical Organic compounds.

SCHEME OF EXAMINATION: Practical and Viva Voce

1. Synopsis - 10 Marks
2. Major Experiment (Experiments indicated by**) - 35 Marks
   (Systematic Qualitative Analysis)
3. Minor Experiment-I (Experiments indicated by*) - 15 Marks
   (Preparation of Simple Organic Compound)
4. Practical viva - 10 Marks

Total - 70 Marks

PHARMACEUTICAL ORGANIC CHEMISTRY I REFERENCE BOOKS (Theory)

PHARMACEUTICAL ORGANIC CHEMISTRY I REFERENCE BOOKS (Practical)


2. Mann and Sounders, Practical Organic Chemistry-, ELBS and Longman group Ltd.,


LIST OF MINIMUM EQUIPMENTS REQUIRED

1. Melting Point Apparatus 10
2. Triple beam balances 10
3. Physical balances 05
4. Suction Pumps 01
5. Water Baths 10
6. Hot Plates 01
7. Oven 01
8. Refrigerator 01
9. Distillation Unit 01
Course Contents

1. **B.Pharm**
   1. **HUMAN ANATOMY AND PHYSIOLOGY (Theory)**
      75 hours
        1. Scope of Anatomy and Physiology, basic terminologies used in this subject.  
        2. Structure of cell-Its components and their functions  
        3. Elementary tissues of the human body: epithelial, connective, muscular and Nervous tissues-their sub-types and characteristics  
        4. a) Osseous system—structure, Classification of Bones, composition of Bones, functions of the skeleton.  
           b) Classification of joints, types of movements of joints and  
           c) Disorders of joints (definitions only)  
        5. Haemopoietic system  
           a) Composition and functions of blood  
           b) Haemopoiesis and disorders of blood & its components (Definition of Disorders)  
           c) Blood groups  
           d) Clotting factors and mechanism  
           e) Platelets and disorders of coagulation  
        6. Lymph  
           a) Lymph and lymphatic system; composition, formation and circulation  
           b) Disorders of Lymph and lymphatic system (Definitions only)  
           c) Spleen: Physiology and function  
        7. Cardiovascular system  
           a) Anatomy of heart  
           b) Blood vessels and circulation  
           c) Pulmonary and systemic circulation  
           d) ECG  
           e) Cardiac cycle and Heart Sounds  
           f) Blood Pressure maintenance and regulation  
           Definitions of the following disorders  
           i) Hypertension  
           ii) Hypotension  
           iii) Arteriosclerosis  
           iv) Atherosclerosis  
           v) Angina  
           vi) Myocardial infarction  
           vii) Congestive Heart failure and  
           viii) Cardiac arrhythmias
8. Respiratory System
   a) Anatomy of respiratory organs and functions 1
   b) Mechanism and regulation of Respiration 1
   c) Physiology of respiration: transport of respiratory gases 2
   d) Respiratory volumes and vital capacity 1
   e) Definitions of: Hypoxia, Asphyxia, Dysbarism, Oxygen therapy and Resuscitation

9. Digestive System
   a) Anatomy of Gastro Intestinal Tract (GIT) 1
   b) Secretions functions and anatomy of 3
      i) Salivary glands  ii) Stomach  iii) Liver  iv) Pancreas  v) Intestine
   c) Disorders of GIT (definitions only) 1
   d) Digestion and absorption 2

10. Nervous Systems
    a) Definitions and classification of Nervous system 1
    b) Functional areas and functions of cerebrum 2
    c) Cerebellum 1
    d) Pons and Medulla 1
    e) Thalamus and Hypothalamus 1
    f) Basal ganglion 1
    g) Spinal cord: Structure and reflexes-Mono-Poly-Plantar 2
    h) Cranial Nerves-Names and functions 1
    i) ANS-anatomy and functions of sympathetic and parasympathetic nervous system 2

11. Urinary System
    a) Parts of Urinary system and Gross structure of the kidney 1
    b) Structure of Nephron 1
    c) Formation of Urine 2
    d) Rennin Angiotensin System- Juxta -Glomerular apparatus, Acid Base balance. 1
    e) Clearance tests and Micturition 1

12. Endocrine System
    a) Pituitary gland 1
    b) Adrenal gland 1
    c) Thyroid and parathyroid gland 1
    d) Pancreas and gonads 2

13. Reproductive System
    a) Male and female reproductive systems 1
    b) Their hormones - physiology of menstruation 2
c) Spermatogenesis and Oogenesis 1

14. Sense Organ-Structure and functioning of
   a) Eye 2
   b) Ear 2
   c) Skin 1
   d) Taste and Smell 1

15. Skeletal muscles
   a) Histology 1
   b) Physiology of muscle contraction
   c) Physiological properties of skeletal muscle performance
      (Definition of the disorders) 1

16. Sports physiology
   a) Muscles in Exercise
   b) Effect of athletic training on muscles and muscle performance
   c) Respiration in exercise
   d) CVS in exercise
   e) Body heat in exercise
   f) Body fluids and salt in exercise
   g) Drugs and athletics 2

HUMAN ANATOMY AND PHYSIOLOGY (Practicals)
75 hours
1. Determination of hemoglobin content of blood
2. Determination of R.B.C. content of blood
3. Determination of W.B.C. content of blood
4. Determination of differential count of blood
5. Determination of blood groups
6. Determination of blood pressure
7. Determination of Bleeding time & clotting time
8. Determination of vital capacity
9. Study of appliances used in experimental physiology
10. Muscle physiology
    a) To study simple muscle curve
    b) To study the effect of temperature on muscle contraction
    c) To study the effect of load and after load on muscle contraction
    d) To study the fatigue curve
    e) To study the summation muscle curve
11. Study of various models, specimens and bones
12. Study of histology slides of different tissues/organs
13. Study of different family planning appliances
14. To perform pregnancy diagnosis tests

SCHEME OF EXAMINATION

1. Identification - 10 Marks
2. Synopsis - 10 Marks
3. Hematology (2 Expt.) - 20 + 10 Marks
4. Muscle Physiology/theoretical explanation - 10 Marks
5. Viva - 10 Marks

Total - 70 Marks

HUMAN ANATOMY AND PHYSIOLOGY REFERENCE BOOKS


15) Anatomy and Physiology by Kimber - Grey - Stacktote’s

16) Practical Physiology and Biochemistry by Goel, Shah and Patel

**LIST OF MINIMUM EQUIPMENT REQUIRED**

(For a batch of 20 students)

1. Microscopes 20
2. Glass Slides 80
3. Haemocytometer with Micropipettes 20
4. Sahl’s haemocytometer 20
5. Hutchinson’s spirometer 01
6. Sphygmonanometer 20
7. Stethoscope 20
8. Permanent Slides for various tissues, One pair of each tissue
   Organs and endocrine glands
9. Models for various organs One model for each organ System
10. Specimen for various organs and systems One model for each organ System
11. Skeleton and Bones One set of skeleton and one spare bones
12. Different contraceptive devices and models. One set of each device
13. Sherrington’s drum
14. Student Kymigraph
15. Muscle electrodes
16. LucasMoist chamber
17. Myographic lever
18. Stimulator

Items 13-18 are not required as the frog experiments are obsolete as per CPCSEA regulations.
I B.Pharm

1.2: PHARMACEUTICS (Theory)  

50 hours

1. Historical background and development of profession of pharmacy and Pharmaceutical Industry in brief.  

2. Development of Indian pharmacopoeia and introduction to other Pharmacopoeias such as B.P, U.S.P, European pharmacopoeia, Extra Pharmacopoeia and Indian National Formulary.  

2 a) Introduction to dosage forms: Classification and definitions.  
   a) Prescriprion: Definition, parts of prescription and handling  
   b) Posology: Definition, factors affecting dose selection, calculation of children and Infant doses.  

1. Different types of weights and measures, calculations involving percentage of solutions, alligation, proof spirit, isotonic solutions.  

2. Introduction to different types of processes: Fusion, desiccation, sublimation, exsiccatian and ignition. Definition of evaporation, distillation and drying. Various types of Baths; Water bath, Steam bath, Oil bath and Solvent bath  

3. Galenicals: Definition, equipment for different extraction processes: Expression infusion, decoction, maceration and percolation, method of preparation of spirits, tinctures, extracts, soxhlet extraction.  


5. Powders and granules: Classification, advantages and disadvantages, preparation of simple, compound powders, insufflations, dusting powders, Eutectic and explosive powders, tooth powders and effervescent granules.  

9 Monophasic dosage forms: Theoretical aspects including commonly used vehicles, essential adjuvants like stabilizers, colorants, and flavors with examples. Study of following monophasic liquids like gargles, mouthwashes, throat paints, eardrops, nasal drops, liniments and lotions, enemas, colloidsions, syrups, elixirs and solutions.  

10. Biphasic dosage forms: Suspensions: Definition and classification, diffusible and indiffusible suspensions, advantages and disadvantages.  

   Emulsions: Definition, types of emulsions, identification tests emulsifying agents, creaming and cracking of emulsions
11. Suppositories and pessaries: Definition, advantages and disadvantages, types of bases, method of preparation, displacement value.

12. Incompatibilities: Introduction, Physical and Therapeutic incompatibility and methods of overcome to same.

PHARMACEUTICS (Practicals)

1. Syrups
   a) Simple syrup IP*
   b) Syrup of ephedrine hydrochloride NF*
   c) Orange syrup.

2. Elixir
   a) Piperazine citrate elixir BP*
   b) Paracetamol paediatric elixir BPC*

3. Linctuses:
   a) Simple linctus BPC*
   b) Pediatric simple linctus BPC*

4. Solutions:
   a) Solution of cresol with soap IP*
   b) Aqueous iodine solution IP*
   c) Strong solution of iodine IP*
   e) Weak iodine solution IP*
   f) Strong solution of ammonium acetate IP*

5. Liniments
   a) Liniment of turpentinelP**
   b) Liniment of Camphor BPC**
   c) Soap liniment*

6. Suspensions
   a) Calamine lotion IP**
   b) Magnesium hydroxide mixture BP**

7. Emulsions
   a) Liquid paraffin emulsion,**
   b) Castor oil emulsion,**
   c) Cod liver oil emulsion**

8. Powders
   a) Eutectic powder*
   b) Effervescent powder*
   c) Dusting powder*
   d) Effervescent granules**

9. Suppositories
   a) Boric acid suppository**
   b) Zinc oxide suppository**

10. Colloidion
    a) Salicylic acid colloidion

11. Gargle
    a) Potassium chlorate gargle*

12. Mouthwash
    a) Antiseptic mouthwash.*

13. Enema
    a) Anyone*.
SCHEME OF EXAMINATION

1. Synopsis - 15 Marks
2. Major Experiment (Experiments indicated by **) - 30 Marks
3. Minor experiment (Experiments indicated by *) - 15 Marks
4. Viva voce - 10 Marks

Total - 70 Marks

PHARMACEUTICS REFERENCE BOOKS

8. Indian Pharmacopoeia-1966,1985, Published by The Controller of Publications, Delhi.

LIST OF MINIMUM EQUIPMENTS REQUIRED

1. Mechanical stirrers 10
2. Homogeniser 02
3. pH meter 01
4. Suppository moulds 20
5. Electronic balance 02
I B. Pharm
1.3: PHARMACOGNOSY (Theory)  

<table>
<thead>
<tr>
<th>Topic</th>
<th>Hours</th>
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<tbody>
<tr>
<td>1. Definition, history and scope of Pharmacognosy.</td>
<td>2</td>
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<tr>
<td>2. Classification of drugs viz. alphabetical, morphological, chemical, pharmacological, taxonomical and chemotaxonomical methods. General aspects of chemotaxonomy.</td>
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<tr>
<td>3. Cultivation, collection, processing and storage of crude drugs. Conservation of medicinal plants.</td>
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<td>4. Detailed methods of cultivation of the following drugs:</td>
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<td>a) Senna</td>
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<td>b) Cinchona</td>
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<td>c) Isapgol</td>
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<td>d) Cardamom</td>
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<td>e) Opium</td>
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<td>f) Ergot</td>
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<td>5. Study of morphological, microscopical and cell wall constituents of crude drugs:</td>
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<tr>
<td>a) Study of cell wall constituents and cell inclusions.</td>
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<td>b) Study of morphology and microscopy of different plant parts.</td>
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<tr>
<td>i. Leaf: Datura, Senna</td>
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<td>ii. Bark: Cinnamon (Cassia), Cinchona</td>
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<td>iii. Wood: Quassia</td>
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<td>iv. Stem: Ephedra</td>
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<td>v. Root: Rauwolfia, Liquorice</td>
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<td>vi. Rhizome: Ginger, Podophyllum</td>
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<td>vii. Flower: Clove</td>
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<td>viii. Fruits: Coriander, Fennel</td>
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<td>ix. Seeds: Isapgol, Nux Vomica</td>
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<td>6. Study of Natural Pesticides: Pyrethrum, Neem, Tobacco</td>
<td>2</td>
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<td>7. Study of plant constituents:</td>
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<tr>
<td>a) Brief study of various plant constituents.</td>
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<td>b) Detailed study of primary cell constituents: Carbohydrates and related products.</td>
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<td>c) Biological source, method of production, chemical constituents, tests, uses &amp; adulterants of:</td>
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<tr>
<td>i) Isapgol</td>
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<td>ii) Linseed</td>
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<td>iii) Honey</td>
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<td>iv) Acacia</td>
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<td>v) Agar</td>
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<td>vi) Sterculia</td>
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<td>vii) Tragacanth</td>
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<td>viii) Cellulose and its products</td>
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<td>ix) Pectin</td>
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<td>x) Guar gum</td>
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<td>xi) Sodium alginate</td>
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8. Lipids:
   a) Definition, method of extraction, chemistry and method of analysis
   b) Study of method of production, chemical constituents, tests, uses and adulterants of the following oils:
      i) Castoroil  ii) Shark liver oil  iii) Chaulmoogra oil  iv) Woolfat
      v) Beeswax  vi) Spermaceti  vii) Cocabutter  viii) Olive oil

9. Proteins:
   a) Definition, Classification, Chemistry, method of analysis
   b) Study of collagen, gelatin and its products.

10. Study of plant fibers used in surgical dressing and related products.

11. Different methods of adulteration of crude drugs and general methods for detection of adulterants.

PHARMACOGNOSY (Practicals)

   75 hours

1. Study of cell wall constituents and cell inclusions*.

2. General morphological study of different parts of the plants including surgical fibers*.
   a) Leaf  Datura, Senna
   b) Bark  Cinnamon (Cassia), Cinchona
   c) Stem  Ephedra
   d) Wood  Quassia
   e) Flower  Clove
   f) Fruits  Fennel, Coriander
   g) Seeds  Isapgol, NuxVomica
   h) Root  Rauwolfia, Liquorice
   i) Rhizome  Ginger, Podophyllum

3. Transverse sections of drugs mentioned in 2* *

4. Test for identification of adulterants in*:
   a) Castoroil b) Shark Liver oil c) Woolfat d) Beeswax. e) Sesame oil

5. Chemical tests for identification of the following drugs and adulterants in them*.
   a) Acacia b) Agar c) Tragacanth d) Starch e) Honey f) Gelatin.

6. Analysis of fats and oils - Iodine values, Saponification values, Acid values and Ester values* *
SCHEME OF EXAMINATION: Practical and Viva Voce

1. Synopsis - 10 Marks
2. Major Experiment** - 20 Marks
3. Minor Experiment* - 15 Marks
4. Minor Experiment* - 15 Marks
5. Viva-Voce - 10 Marks

Total - 70 Marks

PHARMACOGNOSY REFERENCE BOOKS

6. Medicinal plants of India, Indian Council of Medical Research, and New Delhi.

LIST OF MINIMUM EQUIPMENTS REQUIRED

1. Microscope with Stage 20
2. Balance 20
3. Reflux flask with condenser 20
4. Heating mantle 20
1. Structure and physical properties:
   a) Polarity and dipole moment: Hydrogen bonding and its applications and Protic and aprotic solvents.
   b) Tautomerism, Kets enol tautomerism.
   c) Reaction intermediates - carbocations, carbanions and free radicals
   d) Attacking reagents-electrophiles, nucleophiles.
   e) Acids and bases: Lowry Bronsted and Lewis theories.
   f) An introduction to Isomerism.

2. Nomenclature of organic compounds belonging to the following classes: alkanes, alkenes, dienes, alkynes, alcohols, aldehydes, ketones, amides, amines, phenols, alkyl halides, carboxylic acids, esters, acid chlorides and cycloalkanes. Concept of aromaticity, Hückel’s rule nomenclature of aromatic compounds.

3. Free radical chain reactions of alkanes-mechanism, relative reactivity and stability.

4. Alicyclic compounds: Preparation of cycloalkanes, Bayer’s strain theory, theory of stainless ring, molecular orbital concept.

5. Nucleophilic aliphatic substitution mechanism: nucleophiles, and leaving groups, kinetics of second and first order reaction. Mechanism and Stereochemistry of SN₂ reaction, Mechanism and Stereochemistry of SN¹ reaction. Rearrangement of carbocation, SN³ versus SN¹ reactions, Reactivity of alkyl halides in SN¹ and SN². Factors Affecting SN¹ and SN².


8. Theory of resonance: allyl radical as a resonance hybrid, stability, and orbital picture. Resonance stabilization of allyl cations: hyper conjugation, stability of conjugated dienes, mechanisms of 1,2 and 1,4-additions with examples, effect of temperature on 1,2 and 1,4 addition.

9. Electrophilic aromatic substitution; Effect of substituent groups, determination of orientation, determination of relative reactivity, classification of substituent groups, mechanism of nitration, sulphonation, halogenation, Friedel craft alkylation and Friedel craft's acylation, Reactivity and orientation, activating and deactivating (o, m, p, directing) groups, orientation and synthesis, orientation in disubstituted benzenes, theory of reactivity, theory of orientation, effects of halogens.


11. Nucleophilic acyl substitution in carboxylic acid derivatives, comparison with nucleophilic addition reaction, ionization of carboxylic acids, acidity of acids, structure of carboxylate ion, effect of substituents on acidity. Conversion of acids to acid chloride, amide, ester, anhydrides.

1. Introduction to the various laboratory techniques through demonstrations involving synthesis of the following compounds (atleast 8 compounds to be synthesized).

   1. Acetanilide/Aspirin (acetylation)
   2. Benzanilide/Phenyl benzoate (Benzoylation)
   3. p-Bromoacetanilide/2,4,6 Tribromoanilide (Bromination)
   4. Dibenzylidene acetone (condensation)
   5. 1-Phenylazo-2-naphthol (Diazotisation)
   6. Benzoic acid / Salicylic acid (hydrolysis of ester)
   7. m-Dinitro benzene (nitration)
   8. 9,10- Anthraquinone (oxidation of anthracene) / preparation of benzoic acid from tolune or benzaldehyde.
   9. m-Phenylenediamine (reduction of m-dinitrobenzene)/aniline from nitrobenzene
   10. Benzophenone oxime (oxime formation)
   11. Nitration of salicylic acid
   12. Preparation of picric acid
   13. Preparation of o-chloro benzoic acid from o-chloro tolune
   14. Preparation of cyclohexanone from cyclohexanol.

2. Identification of organic compounds belonging to the following classes by systematic qualitative organic analysis including preparation of derivatives.

   1. Phenols
   2. Amides
   3. Carbohydrates
   4. Amines
   5. Carboxylic acids
   6. Aldehydes and ketones
   7. Alcohols
   8. Esters
   9. Hydrocarbons
   10. Anilides
   11. Nitrocompounds

3. Introduction to the use of stereo models

   1. Methane
   2. Ethane
   3. Ethylene
   4. Acetylene
   5. cis-Alkene
   6. trans-Alkene
   7. Inversion of configuration
4. Determination of melting point and boiling point for some important pharmaceutical Organic compounds.

**SCHEME OF EXAMINATION: Practical and Viva Voce**

1. Synopsis - 10 Marks
2. Major Experiment (Experiments indicated by**) - 35 Marks
   (Systematic Qualitative Analysis)
3. Minor Experiment-I (Experiments indicated by)* - 15 Marks
   (Preparation of Simple Organic Compound)
4. Practical viva - 10 Marks

Total - 70 Marks

**PHARMACEUTICAL ORGANIC CHEMISTRY I REFERENCE BOOKS (Theory)**

PHARMACEUTICAL ORGANIC CHEMISTRY I REFERENCE BOOKS (Practical)

2. Mann and Sounders, Practical Organic Chemistry-, ELBS and Longman group Ltd.,

LIST OF MINIMUM EQUIPMENTS REQUIRED

1. Melting Point Apparatus 10
2. Triple beam balances 10
3. Physical balances 05
4. Suction Pumps 01
5. Water Baths 10
6. Hot Plates 01
7. Oven 01
8. Refrigerator 01
9. Distillation Unit 01
I B. Pharm
1.5: PHARMACEUTICAL INORGANIC CHEMISTRY (Theory)

75 hours

1. Sources and effects of impurities in pharmacopoeial substances, importance of limit test, general principles and procedures for limit tests for chloride, sulphate, iron, arsenic, lead and heavy metals. Special procedures for limit tests. 10

2. General methods of preparation, assays', storage condition & medicinal uses of inorganic compounds belonging to the following classes. (Assays')

2.1 Medicinal Gases: Oxygen, Nitrous oxide, Carbon dioxide 2

2.2 Gastrointestinal agents
- Acidifiers: dil HCl
  - Antacids: Aluminium hydroxide gel, Calcium carbonate, Sod. bicarbonate, Magnesium trisilicate, Magnesium carbonate (light and heavy), Magnesium hydroxide mixture and Zinc oxide.
  - Protective and adsorbents: Kaolin and Talc.

2.3 Major intra and extra cellular electrolytes, major physiological ions and electrolytes used for the replacement therapy, physiological acid base balance, electrolyte combination therapy ORS, Sodium chloride injection, Dextrose and Sodium chloride injection, Calcium gluconate injection. 6

2.4 Topical agents and dermatological preparations:
- Protective: Talc, Zinc oxide, Zinc stearate, Titanium dioxide.
- Antimicrobials: Potassium Permanganate, chlorinated lime, Iodine preparations, Boric acid, Borax. 6

2.5 Dental products: Dentifrices, anticaries agents, desensitizing agents, calcium carbonate, sodium fluoride, Stannous fluoride, Zinc chloride, Zinc eugenol cement. 3
2.6 Miscellaneous agents:

Expectorants: Ammonium chloride (Formal method), Potassium iodide.


Emetics: Copper sulphate.

Poisons and antidotes: Sodium thiosulphate, Charcoal (activated)

Pharmaceutical Aids: Bentonite, Sodium metabisulphite, Barium sulphate.

3. Sources of errors, types of errors, methods of minimizing errors, accuracy, precision.


4.1 Principles of redox titrations: Concepts of oxidation and reduction. Redox reactions, strength and equivalent weights of oxidizing and reducing agents, theory of redox titrations, iodometry, bromometry, titrations with potassium iodate, potassium bromate, tiritrations with 2,6-dichlorophenol indophenol.

4.2 Theory of nonaqueous titrations, classification of solvents used in nonaqueous titrations, estimation of Sodium Benzoate by nonaqueous titrations.

4.3 Principles of precipitation titrations, different methods-Mohr's, Modified Mohr's, Volhard's, Modified Volhard's, Fajans with example. Estimation of sodium chloride.

4.4 Principles of complexometric titrations, different types of complexometric titrations, methods of detecting the endpoints in complexometric titrations with example and estimation of calcium Gluconate.
PHARMACEUTICAL INORGANIC CHEMISTRY (Practicals)

75 Hours

(Following experiments to be covered in 25 different practical classes)

1. Limit tests (7 exercises)
   1. Limit test for chlorides*
   2. Limit test for sulphate*
   3. Limit test for iron*
   4. Limit test for heavy metals*
   5. Limit test for Arsenic
   6. Modifications in limit tests* for chloride and sulphates in potassium permanganate, sodium bicarbonate, sodium benzoate and sodium Salicylate.

2. Preparation and standardization of the following (4 exercises).
   1. 0.1 N Sodium hydroxide
   2. 0.1N KMnO₄
   3. 0.1 NCeric ammonium sulphate
   4. 0.1NClO₄
   5. 0.05M Di sodium EDTA

3. Assay of the following compounds (8 exercises)**
   1. Ammonium chloride-acid base titration (Formal titration)
   2. Ferrous sulphate- (redox) Ceric ammonium sulphate titration
   3. Copper sulphate- (redox) Iodometry
   4. Calcium gluconate-complexometry
   5. Hydrogen peroxide- (redox -Permanganometry)
   6. Sodium benzoate-nonaqueous titration
   7. Sodium chloride-Modified Volhard’s method
   8. Assay of KI-KIO₃ titration
   9. Assay of Zinc oxide (acid base back titration)

4. Test for identify for the following (3 exercises)
   1. Sodium bicarbonate
   2. Ferrous sulphate
   3. Potassium chloride
   4. Calcium chloride

5. Test for purity for the following (2 exercises) *
   1. Swelling power in Bentonite
   2. Ammonium salts in Potash alum.
   3. Presence of lodates in KI

6. Preparation of inorganic pharmaceuticals (2 exercises)*
   1. Boric acid
   2. Potash alum
   3. Magnesium hydroxide.
   4. Magnesium sulphate
SCHEME OF EXAMINATION: Practical and Viva Voce

1. Synopsis - 10 Marks
2. Major Experiment (Experiments indicated by**) - 25 Marks
3. Minor Experiment-1
   Limit Test - 13 Marks
4. Minor Experiment-2
   Test for Purity or Preparation - 12 Marks
5. Practical viva - 10 Marks

Total - 70 Marks

Note: * * Denotes major experiments * Denotes minor experiments

PHARMACEUTICAL INORGANIC CHEMISTRY REFERENCE BOOKS

2. Bentely and Driver's Textbook of pharmaceutical chemistry by L.M.Atherden
3. J.D.Lee, Concise Inorganic chemistry. 4th edition.
4. C.A.Discher, Modern inorganic pharmaceutical chemistry.
8. Ayers, Quantitative chemical analysis.
10. Analytical chemistry-principles and techniques by Hargis. G.Larry

LIST OF MINIMUM EQUIPMENTS REQUIRED

1. Analytical Balances 10
2. Physical Balances 05
3. Suction Pumps
4. Muffle Furnace 01
5. Oven 01
6. Hot Plates
7. Water Baths 10
8. Distillation Unit 01
IB. Pharm 1.6: MATHEMATICS

1. Matrices: Definition of matrices, Addition, Subtraction, multiplication of matrices, inverse of a square matrix, solution of linear simultaneous equations by matrix method, the characteristic equation of a matrix statement of Cayley-Hamilton Theorem (without proof) - examples pharmaceutical applications of determinations and matrices, Determinants of order two & order three, adjoint Kramer's rule

2. Trigonometry:
   Relations between the sides and angles of a triangle, Solution of triangle.

3. Analytical Geometry:
   Point: Distance formula-Examples.
   Straight line: General form of the equation to a straight line, slope of the line, slope point form.
   Condition for two lines to be parallel and perpendicular, angle between two lines, Perpendicular distance form the point to the line, Distance between parallel lines
   Circle: General equation of a circle, finding center and radius of the circle.
   Parabola: Derivation of standard equation in the form: \( Y^2 = 4ax \).

4. Differential Calculus:
   Limit of a function, derivative of a function, Differentiation of a sum, Product and quotient, Differentiation of composite functions, Implicit functions, parametric functions, Logarithmic differentiation, differentiation of exponentials, logarithmic, trigonometric, universe trigonometric functions, successive differentiation, Leibnitz Theorem for nth order derivative of a product, partial differentiation, Euler's theorem on homogenous functions of two variables.

5. Integral Calculus:
   Indefinite integrals, integration by substitution and integration by parts important properties of definite integrals.

6. Differential Equations:
   Definition formation of differential equations, differential equations of the first order and first degree, Methods of solving ordinary differential equations: variables separable, homogenous, linear, exact.
   Differential equations and equations reducible to these forms, exact differential equations, linear differential equations with constant coefficients (higher order), homogeneous linear differential equations, simultaneous linear differential equations of the first order, pharmaceutical applications.
7. Laplace Transforms:
Definition, Laplace transforms of elementary functions, properties of linearity and shifting, applications of differential equations using laplace transforms.

MATHEMATICS REFERENCE BOOKS

1. Differential calculus
   Shantinarayan
2. Integral calculus
   Shantinarayan
3. Engineering mathematics
   Grewaf
4. Trigonometry Part-I
   S.L.Loncy
5. A Textbook of Mathematics
   for second year Pre-university
   Prof.B.M.Sreenivasa Rao and S.Nagaraj
# I B.Pharm 1.6:
# BIOLOGY (Theory)

**Part A. BOTANY**

1. General organization of the plant and plant cell and its inclusions.  
   - 2 hours
2. The plant tissues (Meristematic and permanent).  
   - 2 hours
3. The broad classification of the plant kingdom.  
   - 2 hours
4. Morphology of the plant parts like root, stem and leaf and their modifications.  
   - 2 hours
5. Inflorescence, flower and its pollination.  
   - 2 hours
6. Morphology of fruits and seeds.  
   - 2 hours
   - 6 hours
   - 4 hours
   - 3 hours

**Part B. ZOOLOGY**

1. The study of Animal Cell, Animal tissues, Differences between plant and animal cell.  
   - 4 hours
2. The detailed study of frog.  
   - 6 hours
3. The study of representatives of Pices, Reptiles and Aves with special reference to the medicinal values.  
   - 5 hours
   - 5 hours
5. The study of poisonous animals.  
   - 5 hours
BIOLOGY (Practicals)

Part A. Botany

1. The general organization of typical plant and morphological study of plant parts studies in theory (Roots, Stem, Leaves and their modifications).*
2. Inflorescence and flower.*
3. Fruits and seeds (Identifications).*
4. Plant tissues through permanent slides* and Histological preparations of roots, stems, and Leaves by Eosin or Saphranin stain.**
5. Simple experiments on plant physiology.*
6. Identification of cell inclusion.*

Part-B: Zoology

1. The study of Animal tissues through permanent slides.*
2. The study of various systems of Frog using charts & models. * *
3. Identification of poisonous Animals.*
4. Demonstration of the dissections in Rats.*
5. Identification of representatives of Animals Phyla like fish, frog, reptile and Mammal.*

SCHEME OF EXAMINATION

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<tbody>
<tr>
<td>1.</td>
<td>Synopsis -10 Marks</td>
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<tr>
<td>2.</td>
<td>Study of any one system of frog -15 Marks</td>
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<td>3.</td>
<td>Transverse Section -15 Marks</td>
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<td>4.</td>
<td>Minor Experiment 1 -10 Marks</td>
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<td>5.</td>
<td>Minor Experiment 2 -10 Marks</td>
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<td>6.</td>
<td>Viva-Voce -10 Marks</td>
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<td><strong>Total</strong></td>
<td>- 70 Marks</td>
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BIOLOGY REFERENCE BOOKS

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<tbody>
<tr>
<td>2.</td>
<td>Outlines of Zoology - Ekkambarnath Iyer</td>
</tr>
<tr>
<td>3.</td>
<td>Functional Anatomy of a mammal - Tayler and Weber</td>
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<tr>
<td>4.</td>
<td>Comparative anatomy - Atwood</td>
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<tr>
<td>5.</td>
<td>Baleys Histology</td>
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<tr>
<td>6.</td>
<td>A Test Book of Vertebrate zoology - S.N.Prasad</td>
</tr>
<tr>
<td>7.</td>
<td>Vertebrate Zoology Vol.11 - Ekkambarnath Iyer</td>
</tr>
</tbody>
</table>
PART A: STATISTICS

1. Definition, data frequency, distribution, Classification of data. General graphical representation of the data: histogram, Frequency curve and frequency polygon and Ogive. Semilog line graph. Use of semilog scale-examples.  


4. Correlation, Regression: Linear correlation, coefficient of correlation: karlpearsons formula, spearman's rank method, curve fitting by the method of least squares: Fitting a straight line y = a + bx, Fitting a power curve y = ax^b, Fitting an exponential curve y = ab^x, ae^bx. Regression analysis for lines.  

5. Definition of probability: Random experiment, sample space, Addition and multiplication laws of probability (without proof), probability distribution: binomial, poisson's, normal and chi-square, Student test and Pharmaceutical examples.  

PART B: COMPUTER SCIENCE

1. Introduction to computers:
   
2. Introduction to Programming:
   a. Definition of a programme, types of programming language: machine language, decimal number system, binary number or base 2 system, conversion of a binary number to decimal number, conversion of a decimal number to a binary number. Binary addition and subtraction, high level language, types of high level language.

3. Language: Basics of programming: Algorithm, flow chart:
   a. Introduction to C language: Development of C, Features, constants and variables, data types, operators and expressions, library functions. I/O statements: Formatted and unformatted I/O, scan(), print f(), getchar() and putchar() function
   b. Control structures: conditional and unconditional, if, for, while, switch, break and continue, goto statement. Arrays: one and multidimensional arrays, strings and string functions, bubble sort, linear and binary search. Functions: definition, different types, calling a function, passing parameters, call by reference, and call by value, local and global variables, recursive function

4. Computer graphics, computei application and clinical studies 2

COMPUTER SCIENCE (Practicals) 50 hours

1. Ms.Dos commands, Unix, MS-office
2. Study of software package: MS-OFFICE
3. Study of simple C programmes as follows:
   • Get a character and display the same using getchar() and putchar()
   • Printing the reverse of an integer
   • Printing the odd and even series of N numbers
   • Get a string and convert the lowercase to uppercase and vice-versa using getchar() and putchar()
   • Finding the occurrence of a particular character in a string
   • Accept N words and make it as a sentence by inserting blank spaces and a full stop at the end
   • Finding the first N terms of Fibonacci sequence
   • Printing and Multiplication tables of 2 matrices
   • Printing and subtraction of two matrices
   • Converting a hexadecimal number into its binary equivalent
COMPUTER SCIENCE REFERENCE BOOKS

2. SC Gupta, Fundamental of statistics.
4. V.Rajaraman and H.V.Sahasraboudhe, Computer programming in Cobol.
5. Thomas Worth, Cobols for beginners.

STATISTICS REFERENCE BOOKS

I B.PHARM 2.1: PHYSICAL
PHARMACEUTICS (Theory)

75 hours

1. Physical properties of drug molecules: Refractive index, optical rotation, dipole moment, dissociation constant, determination and applications. 5

2. pH, buffers and isotonic solutions: Sorensen’s pH determinations (electrometric and calorimetric), applications, buffer equation, buffer capacity, buffers in pharmaceutical and biological systems, applications, buffered isotonic solutions. 7

3. Solubility phenomena: Solvent-solute interactions, solubility of gases in liquids, solubility of liquids in liquids (binary solutions, ideal solutions, Raoult’s law, real solutions, distillation of binary mixtures, azeotropic mixtures and fractional distillation. Partially miscible liquids (conjugate mixtures), critical solution temperatures, applications, phenol-water system, triethylamine-water system, nicotine-water system. Solubility of solids in liquids: Definitions, determinations, factors influencing the solubility. 8

4. Distribution law: explanation, limitations and applications, effect of molecular association, dissociation and complexation. 5

5. Kinetics: Rates and molecularity of a reaction, determination of order, factors influencing rate of reactions, stabilization of drugs, applications of chemical kinetics to the stability testing of pharmaceuticals. Simple numerical problems. 8

6. Interfacial phenomenon: Liquid interfaces, adsorption at liquid/solid interfaces, adsorption isotherms, concept of contact angle, hydrophile lipophile balance, spreading coefficient, Gibb’s adsorption equation, electrical properties of interfaces. 7

7. Diffusion and dissolution: Steady state diffusion, types of diffusion, diffusion equation, diffusion cells, Dissolution of tablets and capsules, Hixon-crowell cube root law. Dissolution apparatus; factors affecting dissolution. 6

8. Rheology: Newtonian and Non-newtonian systems, thixotropy, determinations of rheological properties (Single and multipoint instruments). Applications to pharmacy. 6


Emulsions: Definition, mechanism of action of emulsifying agents, theories of emulsification. Formulation of emulsions-instability of emulsions, evaluation of emulsion stability. Rheology of emulsions, microemulsions, multiple emulsions

11. Colloids: Definition types, preparation, purification, stabilization of colloids, properties, optical properties, kinetic properties, electrical properties. Donnan membrane phenomenon.


**PHYSICAL PHARMACEUTICS (Practicals)**

75 hours

1. Determination of viscosity of liquids using Ostwald’s viscometer.*
2. Determination of surface tension of liquid by drop weight method.*
3. Preparation of buffers and measurement of pH using pH meter. *
4. Determination of dissociation constant and pKa values.*
5. Determination of solubility of solids in liquid.*
7. Preparation of deflocculated and flocculated suspension and their evaluation. *
8. Preparation, stabilization and evaluation of hydrophobic colloids.*
9. Determination of partition coefficient of Iodine between water and carbon tetrachloride. **
10. Determination of partition coefficient of Benzoic acid between Benzene and water.**
11. Determination of % composition of sodium chloride and water using CST method.*
12. Determination of HLB number of surfactants by Griffins method. **
13. Determination of rate constant for first order and second order reactions. **
14. Study of particle size distribution by optical microscopy.*
15. Determination of required HLB number for the oil phase to be presented as an emulsion. Formulation and evaluation of emulsion.*
16. Determination of constants of Freundlich and Langmuir adsorption for adsorption of acetic acid on activated charcoal.**
17. Determination of stability constant of Glycine-Copper complex by pH titration method.**
18. Determination of CMC of a surfactant by surface tension measurements by stalagmometer method.**
19. Construction of rheograms and study of rheological behaviour of biphasic systems employing multipoint viscometers. (For demonstration)

SCHEME OF EXAMINATION: Practical and Viva Voce

1. Synopsis - 10 Marks
2. Major experiment (Experiments indicated by**) - 30 Marks
3. Minor experiment (Experiments indicated by*) - 20 Marks
4. Viva voce - 10 Marks

Total - 70 Marks

PHYSICAL PHARMACEUTICS REFERENCE BOOKS


LIST OF MINIMUM EQUIPMENTS REQUIRED

1. Ostwald's viscometer 15
2. Stalagmometer 15
3. Digital pH meter 01
4. Microscopes 05
5. Stage and eye piece micrometers 05
6. Brookfield's viscometer 01
7. Digital Electronic Balance 03
1. Introduction to the science of microbiology. Major divisions of microbial world, and relationship among them. 

2. Classification of microbes and study of bacteria, fungi, yeasts, actinomycetes, virus, rickettsia and spirochaetes. Study of mode of transmission and treatment of microbial diseases like, Cholera, Typhoid, Tuberculosis, Diphtheria, Tetanus, Syphilis and AIDS. 

3. Nutritional requirements, growth and cultivation of bacteria and virus. Study of different important media required for the growth of aerobic and anaerobic bacteria and fungi. Differential media, enriched media and selective media, maintenance of laboratory cultures. 


5. Detailed study of different methods of sterilization including their merits and demerits. Sterilization of equipments, validation of sterilization. Sterilization methods for all pharmaceutical products. Detailed study of sterility testing of different pharmaceutical preparations. 


7. Introduction to genetics, Phenotypic and genotypic changes in bacteria, Mutations, genetic exchange in bacteria-transformation, transduction and conjugation. 

9. **Immunology**: Antigens, structure and formation of antibodies, antigen-antibody reactions.
   Diagnostic tests such as Shick's test, Elisa test (HIV), Widal, Mantoux and VDRL. Methods involved in production of Vaccines - Polio myelitis, BCG, Typhoid, Diphtheria and Tetanus toxoid and production of Sera - Diphtheria antitoxin.

10. **Fermentation**: Introduction to fermentation technology. Methods of production of Penicillin, Streptomycin, Riboflavin and Cyanocobalamine.

11. **Principles and methods of different microbiological assays including sensitivity testing**, microbiological assay of Cephelexin, Streptomycin and Vitamin B₂. Standardisation of vaccines and sera.

12. **Animal tissue culture**: techniques, nutritional requirements and characters of animal cell cultures. Hybridoma technology. Production and application of monoclonal antibodies.

**PHARMACEUTICAL MICROBIOLOGY AND BIOTECHNOLOGY (Practicals)**

75 hours

1. Study of apparatus used in experimental microbiology.
2. Sterilisation of glasswares, Preparation and Sterilisation of media.
3. Staining techniques - Simple staining*, Gram's staining. **
4. Motilitytesting*
5. Total and viable count*.
6. Isolation and maintenance of pure culture*.
7. Biochemical tests. (IMViC reactions, Carbohydrate fermentation)*.
8. Sensitivity testing.*
9. Determination of MIC*
10. Microbiological assay of antibiotics by cup plate method*.
11. Sterility testing by direct transfer and membrane filtration technique*.
12. Bacteriological analysis of water by MPN technique*.
13. Estimation of DNA by spectroscopic method. * *
14. Estimation of RNA on spectroscopic method. **
### Scheme of Examination

1. Synopsis - 10 Marks
2. Major Experiment** - 20 Marks
3. Major Experiment** - 20 Marks
4. Minor Experiment* - 10 Marks
5. Viva-Voce - 10 Marks

**Total - 70 Marks**

### Pharmaceutical Microbiology and Biotechnology Reference Books

7. Pharmacopoeia of India Govt, of India 1966 & 1996 editions
15. Ananth Narayan and Pannicker, Text Book of Microbiology, 5th Ed, Orient-longman, Chennai, 1995-

### List of Minimum Equipments Required

1. Autoclave - 02
2. Hotair oven - 01
3. B.O.D. Incubator - 01
4. Refrigerator - 01
5. Laminar air flow - 01
6. Colony counter - 02
7. Zone reader - 01
8. Spectrophotometer - 01
9. Microscope with stage and oil immersion objective - 20
10. Balances - 20
11. Sterility testing unit - 01
1. Basic principles of cell injury and adaptation:
   i) Causes, pathogenesis and morphology of cell injury 3
   ii) Abnormalities in lipoproteinaemia, glycogen infiltration and glycogen storage disease 3

2. Inflammation:
   A) i) Pathogenesis of acute inflammation
      ii) Chemical mediators in inflammation.
      iii) Pathogenesis of chronic inflammation 5
   B) Repairs of wounds in the skin, Factors influencing healing of wounds. 2

3. Diseases of Immunity:
   i) Introduction to T and B cells
   ii) MHC proteins or transplantation antigens.
   iii) Immune Tolerance 3

   A) Hypersensitivity:
      i) Hypersensitivity type I, II, III, IV
      ii) Biological significance of hypersensitivity.
      iii) Allergy due to food, chemicals and drugs. 4

   B) Auto-immunity:
      i) Mechanism of Autoimmunity.
      ii) Classification of autoimmune diseases in man.
      iii) Transplantation and allograft reactions, mechanism of rejection of allograft. 5

   C) Acquired Immune Deficiency Syndrome (AIDS) 2

   D) Amyloidosis 1
4. Cancer:
   Disturbances of growth of cells,
   General biology of tumors,
   Differences between benign and malignant tumors
   Classification of tumors Histological diagnosis of
   malignancy Etiology and pathogenesis of cancer
   Invasions, metastasis, patterns of spread of cancer.

5. Shock: Types, mechanism, stages and Management

6. Biological effects of radiation:

7. Environment and Nutritional diseases:
   i) Air pollution and smoking - S02, NO, NO2, CO
   ii) Protein calorie malnutrition, vitamins, obesity, starvation.

8. Pathophysiology of common diseases:
   i) Parkinsonism
   ii) Schizophrenia
   iii) Depression and Mania
   iv) Stoke (Ischemic and Hemorrhage)
   v) Hypertension
   vi) Angina
   vii) Myocardial Infarction
   viii) CC
   F
   ix) Atherosclerosis
   x) Diabetes Mellitus
   xi) Peptic ulcer and inflammatory bowel disease
   xii) Cirrhosis and Alcoholic liver diseases
   xiii) Acute and chronic renal failure
   xiv) Asthma and chronic obstructive airway diseases

9. Infectious diseases Hepatitis -
   Infective hepatitis,
   Sexually transmitted diseases (Syphilis, Gonorrhea, HIV)
   Pneumonia, Typhoid, Urinary tract infections, Tuberculosis, Leprosy, Malaria, Dysentery (Bacterial and amoebic)
PATHOPHYSIOLOGY REFERENCE BOOKS


1. Bio chemical organization of the cell and transport processes across cell membranes. 3

2. Bio energetics 3
   a) Concept of free energy and its determination; redox potential; 1
   b) Energy rich compounds; ATP; Cyclic AMP; their biological significance 2

3. Biological Oxidation 5
   a) Electron transport chain (its mechanism and role) 2
   b) Inhibitors and Uncouplers of ETC 1
   c) Oxidative phosphorylation 1
   d) Substrate level phosphorylation and oxidative phosphorylation 1

4. Enzymes and Coenzymes 14
   a) Definition; Nomenclature; IUB Classification 1
   b) Properties of enzymes; 1
   c) Factors effecting enzyme activity; 2
   d) Enzyme kinetics (Michaelis plot; Line Weaver Burke plot) 2
   e) Enzyme Inhibition (with examples) 1
   f) Iso-enzymes 1
   g) Enzyme Induction; repression 1
   h) Applications of enzymes 1
   i) Coenzymes, categories of reactions requiring coenzymes; 4
      a. Structure of, its coenzyme, and biochemical role of 1
      b. Vitamins- water soluble, fat soluble 1

5. Carbohydrate metabolism 12
   a) Introduction 1
   b) Glycolysis, 2
   c) Glycogenesis glycogenolysis, 1
   d) TCA cycle; (Amphibolic nature of TCA cycle) 2
   e) Gluconeogenesis 1
   f) Various shuttle systems (glycerol phosphate; Malate aspartate) 1
   g) HMP Shunt Pathway; 2
   h) Uronic acid pathway and galactose metabolism 1
   i) Glucose tolerance test and blood glucose regulation. 1

6. Lipid metabolism * 10
   a) Introduction 1
   b) Oxidation of saturated (palmitic acid) fatty acids 2
   c) Oxidation of unsaturated fatty acids (-linolenic acid) 1
<table>
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<tr>
<th>Chapter</th>
<th>Subject</th>
<th>Pages</th>
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<tbody>
<tr>
<td>7.</td>
<td><strong>Amino acid metabolism</strong></td>
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<tr>
<td>a)</td>
<td>Amino acids definition, classification and significance</td>
<td>1</td>
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<tr>
<td>b)</td>
<td>General reactions of amino acids: Transamination, Deamination and decarboxylations of amino acids</td>
<td>2</td>
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<td>c)</td>
<td>Urea cycle</td>
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<td>d)</td>
<td>Metabolism of sulphur containing amino acids</td>
<td>1</td>
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<tr>
<td>e)</td>
<td>Catabolism of tyrosine, tryptophan, phenylalanine</td>
<td>2</td>
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<td>f)</td>
<td>Synthesis &amp; significance of biologically important substances: creatine, histamine, 5-HT, dopamine, noradrenaline, adrenaline.</td>
<td>2</td>
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<td>g)</td>
<td>Porphyrins, Bile Pigments: Hyperbilirubinemia</td>
<td>2</td>
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<td>8.</td>
<td><strong>Nucleotides and Nucleic acids</strong></td>
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<tr>
<td>a)</td>
<td>Introduction</td>
<td>1</td>
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<td>b)</td>
<td>Purine nucleotides biosynthesis</td>
<td>1</td>
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<tr>
<td>c)</td>
<td>Pyrimidine nucleotides biosynthesis</td>
<td>1</td>
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<td>d)</td>
<td>Catabolism of purines and pyrimidines</td>
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<tr>
<td>e)</td>
<td>DNA structure, significance as genetic material</td>
<td>1</td>
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<td>f)</td>
<td>RNA types, structure and significance</td>
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<td>g)</td>
<td>DNA replication</td>
<td>1</td>
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<td>h)</td>
<td>Mutation and repair of DNA</td>
<td>1</td>
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<tr>
<td>i)</td>
<td>Transcription or RNA synthesis</td>
<td>1</td>
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<td>j)</td>
<td>Genetic code</td>
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<tr>
<td>k)</td>
<td>Translation or protein synthesis and its Inhibition</td>
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<td>9.</td>
<td><strong>Principles and significance for following Biochemical tests</strong></td>
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<td>a)</td>
<td>Kidney function tests</td>
<td>2</td>
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<tr>
<td>b)</td>
<td>Liver function tests</td>
<td>2</td>
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<tr>
<td>c)</td>
<td>Lipid profile</td>
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APPLIED BIOCHEMISTRY (Practical)  
75 hours

1. Identification of carbohydrates (Scheme and identification)  
   (glucose, fructose, lactose, maltose, sucrose)
2. Identification of proteins (Scheme and identification)  
   (casein, albumin, gelatin, peptone)
3. Quantitative estimation of carbohydrates (any one method)  
   DNS reagent, Anthrone Reagent
5. Qualitative analysis of Urine  
   a) For Normal constituents
   b) Abnormal constituents
6. Quantitative Urine analysis  
   a. Titrable acidity and ammonia
   b. Estimation of reducing sugars in Urine (benedicts method)
   c. Estimation of chlorides in Urine
   d. Estimation of Creatinine in Urine
   e. Estimation of calcium in Urine
7. Quantitative analysis of blood  
   a. Estimation of glucose in blood (Folin-Wu method)
   b. Estimation of creatinine in blood
   c. Estimation of cholesterol in blood
   d. Estimation of urea in serum
   e. Estimation of SGOT in serum
   f. Estimation of SGPT in serum
8. Enzyme  
   a. Salivary amylase activity
   b. Effect of temperature on enzyme (amylase) activity
   c. Effect of pH on enzyme (amylase) activity
9. Preparation of Std. Buffer solutions (Acetate; Borate; Carbonate; Citrate and Phosphate) and measurement of pH (any two)

SCHEME OF EXAMINATION : Practical and Viva Voce  
1. Synopsis -10 Marks
2. Urine Analysis -15 Marks
3. Titrmetric Experiment -20 Marks
4. Colorimetric Experiment -15 Marks
5. Viva -10 Marks
Total -70 Marks
APPLIED BIOCHEMISTRY REFERENCE BOOKS

1) Harpers Review of Biochemistry - Martin
2) Text book of Biochemistry - Lehninger
3) Outlines of Biochemistry - Conn and Stump
4) Text Book of Biochemistry - Harron and Mazur
5) Hawk's Physiological Chemistry - Oser
6) Text Book of Biochemistry-Varun Kumar Malhotra
7) Hand Book of Basic Pharmacokinetics - Pitachel

LIST OF MINIMUM EQUIPMENTS REQUIRED

1) Colorimeter 01
2) Centrifuge 01
3) Electronic Balance 01
4) Physical/Chemical Balance 01
5) pH meter 01
6) Water bath
   a) Temperature controlled 01
   b) Ordinary 01
7) Volumetric flasks 60
8) Pipettes
   a) Graduated
   b) Bulb
9) Burettes 20
10) Conical flasks 20
11) China dish 20
12) Burners 20
13) Glass wares such as measuring cylinders, reagent bottles, glass rods, tubes etc.
14) Folin-Wu tubes 120
The subject is to be treated in the light of modern perspective giving stress wherever possible on the following aspects-structure, nomenclature, preparation, properties, energy of activation, transition state, resonance, stereochemistry, optical isomerism, Geometric isomerism and mechanism of reaction.

I. Stereochemistry:


2. Stereo selective and steriospecific reactions. Stereochemical mechanisms for the following reaction such as addition of halogen to alkenes, E\textsuperscript{1} and E\textsuperscript{2} reactions, syn and anti reactions, and nucleophilic substitution reactions.

3. Geometrical isomerism, its nature of formation, rotation about bonds: nomenclature of isomers, determination of configuration.

4. Stereochemistry of alicyclic compounds and biphenyls, stereochemistry of oximes.

II. Heterocyclic Chemistry:

1. General classification of heterocyclic compounds, nature and nomenclature, reactions, synthesis and properties of the following heterocyclic systems and their derivatives.

   a) Pyrrole, Furan and Thiophene
   b) Fused ring systems involving Pyrrole, Furan, Thiophene, Indole and Benzofuran
   c) Pyridine
   d) Quinoline, Isoquinoline, acridine
   e) Pyrazole, Imidazole, Oxazole, Isoxazole
   f) Pyrimidine, Pyrazine, Pyridazine, Purine, benzodiazepines
1. Study of basic structures, compounds having pharmacological activity/medicinal compounds of tricyclic hetero ring systems-phenothiazines, and benzodiazepines. 3

2. Structure and medicinal uses of the following official compounds

II Poly Nuclear Hydrocarbons; Synthesis (Haworth's and Diel's Alder)
   properties and reactions of Naphthalene, Phenanthrene and Anthracene. Structure and medicinal uses of Propranolol, Tolnaftate, Menadione, Naphzoline, Phenindione, Morphine and Codeine. 4

III Chemistry of bio molecules of pharmaceutical importance:

1. Carbohydrates:
   Introduction, Definition, Classification, Nomenclature, Structural determination of Glucose and Fructose. Stereoisomers of monosaccharides, reactions, conversions, configuration, cyclic structures of glucose, determination of ring size in Glucose. Fischer projection formulae, and conformations. Disaccharides and polysaccharides. Chemical nature of maltose, lactose, sucrose, starch and cellulose, derivatives used in pharmacy. 9

2. Fats and Oils:

3. Proteins and Amino acids:
   Introduction, definition, classification of proteins and amino acids and their properties, reactions, synthesis of amino acids (Gabriel's Pthalimide, synthesis, Strecker's synthesis, Koop's and Erlenmeyer's azalactone synthesis). Peptide linkages, structures of proteins, C-terminal and N-terminal analysis. Isoelectric points and its significance. 6
PHARMACEUTICAL ORGANIC CHEMISTRY-II (Practicals)

75 hours

(Following experiments to be in 25 different classes)

I. Quantitative determination of organic compounds via functional groups
   1. Phenolic group by bromination method.
   2. Alcoholic group by acetylation method.
   3. Carbonyl group by hydroxylamine hydrochloride-pyridine method.
   4. Aldehyde group by sodium sulphite-sulphuric acid procedure.
   5. Carboxyl group by acid-base method.
   6. Determination of acetone by sodium hypoiodide method
   7. Amino group by bromination method.

II. Analysis of oils and fats: (I.P.Method).
   1. Acid value.
   2. Saponification value.
   3. Iodine value.

III. Synthesis/preparation involving more than one step*
   1. p-bromocanaline from acetanilide.
   2. p-Nitroaniline from acetanilide.
   3. p-Nitrophenyldrazine from p-nitroaniline.
   4. 3-methyl-1-phenyl-5-pyrazole from ethyl acetoacetate.
   5. Benzilic acid from benzene.
   6. Phthalimide from benzophenone.
   7. Phthalimide from phthalic acid.
   8. Benzyl benzoate from benzaldehyde. (Cannizzaro's reaction)
   9. Synthesis of 2,3-Diphenyl quinoxaline.
   10. Preparation of 2,5,-Dimethyl thiophen.
   11. Preparation of 2,5,-Dimethyl pyrole.
   12. Preparation of 2,5,-Dimethyl furan.
PHARMACEUTICAL ORGANIC CHEMISTRY-II REFERENCE BOOKS (Theory)

75 hours


PHARMACEUTICAL ORGANIC CHEMISTRY-II REFERENCE BOOKS (Practical)

2. Mann and Sounders, Practical Organic Chemistry-ELBS and Longman group Ltd.,
LIST OF MINIMUM EQUIPMENTS REQUIRED

1. Suction Pumps 01
2. Analytical Balances 01
3. Physical Balances 05
4. Triple Beam Balances
5. Water Baths, Reflux flask and condenser 10
6. Hot Plates
7. Mechanical Stirrers
8. Magnetic Stirrers with Thermostat
9. Distillation Unit 01
10. Refrigerator 01
11. Oven 01

SCHEME OF EXAMINATION

1. Synopsis -10 Marks
2. Major Experiment (**) -30 Marks
3. Minor Experiment (*or oil analysis) -20 Marks
4. Viva -10 Marks

Total -70 Marks
I. Basic Principles of Medicinal Chemistry

A. A brief introduction to the subject, history and development of medicinal Chemistry, definition and fundamental principles of drug therapy.  

B. Effects of the following physicochemical properties of drug molecules on biological activity: Solubility, partition coefficient, hydrogen bonding, protein binding, chelation, Geometrical and optical isomers, redox potential, ionization and surface activity.  

C. Principles of drug design (theoretical aspects): General principles of drug action and drug receptor interactions.  


A study of the development of the following classes of drugs including structure activity relationships (SAR), mechanisms of action, synthesis of compounds underlined and superscribed by ‘s’, chemical nomenclature, generic names, brand names (a few important marketed products and side effects).

II. Central nervous system depressants

A. General anaesthetics:
   1. Inhalation anaesthetics: Halothanes, Methoxy flurane, Nitrous oxide.  
   2. Ultra short acting barbiturates: Methohexital sodiums, Thiopental sodium,  
   3. Dissociative anaesthetics: Ketamine hydrochloride.  

B. Anxiolytic, sedative and hypnotic agents:
   1. SAR of Benzodiazepine Chlor Diazepoxides, Diazepams, Oxazepam, Chlorazepam, Lorazepam, Flurazepam, Alprazolam.  
   2. SAR of Barbiturates:  
      a) Barbitals, methabarbital, Phenobarbitals,  
      b) Amobarbitals, Butabarbital,  
      c) Pentobarbitals, Secobarbital  


3. Miscellaneous sedative hypnotics:
   a) Amides and Imides: Glutethmide, Methyprylon, Methaqualone.
   b) Alcohols and their carbamate derivatives: Ethchlorvynol, Ethinamate, Meprobamate.
   c) Aldehydes and their derivatives: Chloral hydrate, Paraldehyde.

C. Skeletal muscle relaxants: Chlorphensin, Methocarbamol.

D. Drugs used in spasticity: Baclofen, Buspirone.

E. Anticonvulsants:
   1. Mechanism of anticonvulsant action.
   5. Succinimides: Phensuximides, Methsuximide, Ethosuximide.
   6. Urea and monoacylureas: Phenacetamide, Carbamazepine.

III. Adrenergic agents:
A. Adrenergic neuro transmitters: function, structure, and physicochemical properties, biosynthesis and metabolism of noradrenaline.
B. Adrenergic receptors: alpha and beta-adrenergic receptors, their distribution in the human body.
C. Sympathomimetic agents:
   1. Direct acting agents: Definition and examples: Phenylethylamine, Noradrenaline.
   2. Indirect acting agents: Definition and examples: Isoprotene, Terbutalin.
   3. Agents with mixed mechanism: Examples: Clonidine.
   6. Aliphatic amines: Triaminoheptane, Cyclopentamine.

j. Adrenergic blocking agents:
   2. Beta halo alkyl amines: Dibenamine, Phenoxybenzamine.
   3. Imidazolines: Tolazoline, Phentolamine, Prazocin.
IV. Cholinergic drugs and related agents.

A. Cholinergic agents;

1. Cholinergic neurotransmitter: function, structure, physiochemical properties, biosynthesis and metabolism of Acetylcholine. Cholinergic receptors: muscarinic and nicotinic receptor, their distribution in the human body.

2. Indirectly acting cholinergic agonists:
   a) Cholinesterase inhibitors: Physostigmine, Neostigmine, Pyridostigmine.
   b) Irreversible inhibitors: Malathion, Parathion.

B. Cholinergic blocking agents: Parasympathetic postganglionic blocking Agents:
   Atropine, Hyoscyamine, Scopolamine, Homatropine, Methscopolamine.
C. Synthetic Cholinergic blocking agents: Cilnidium bromide, Dicyclomine, Propantheline, Benzotropine Chlorphenoxamine.
D. Ganglionic blocking agents: Trimethaphan camsylate, Mecamylamine.
E. Neuromuscular blocking agents: d-Tubocurarine chloride, Metocurine iodide. Synthetic compounds with curare form activity—Decamethonium bromide.

V. Local anaesthetics

A. Historical development, mechanism of action of local anaesthetics.
B. SAR of - Benzoic acid derivatives, Lidocaine derivatives.

VI. Histamines and anti histaminic agents

A. Histamine, receptors and their distribution in the human body
B. Antihistaminic agents: H, antagonists.
   1. Amino alkyl ethers: Diphenhydramine hydrochloride, Bromodiphenhydramine, Doxylamine.
   2. Ethyleneamines: Tripelemamine, Pyrilamine.
   5. Piperazine derivatives: Cyclizine, Medclizine.
   6. Miscellaneous compounds: Phenindamine, Cyproheptidine.
A. \( \text{H}_2 \) - Antagonists: Mechanism of \( \text{H}_2 \)-Antagonists

Cimetidine\(^5\), Ranitidine.

Gastric proton pump inhibitor– an introduction

Omeprazole. 6

I. Analgesic Agents

A) Structure and uses of morphine, codeine and diacetyl morphine.

B) Narcotic Antagonists: Structure and uses of Nalorphine, Levalorphan.

C) Antitussive agents: Structure and uses of Noscapine, Dextromethorphan 2

D) Peripheral and Nuclear modification of Morphine. 2

E) Anti-Inflammatory agents

1. Salicylic derivatives: Sodium Salicylate

2. \( \text{N} \)-aryl anthranilic acid derivatives: Mefenamic acid, Diclofenac sodium.

3. Aryl Acetic acid derivatives: Indomethacin, Ibuprofen\(^3\), Piroxicam\(^5\).

4. Aniline and \( \text{P} \)-aminophenol derivatives: Phenacetin\(^5\), Acetaminophen\(^5\).


II. Prostaglandins and other Eicosanoids

A. History and discovery

B. Eicosanoid biosynthesis

C. Drug action mediated by Eicosanoids.

D. Design of Eicosanoid drugs.

E. Eicosanoid approved for human clinical use.

F. Prostaglandins F\(_2\), Prostaglandin E\(_2\), 15-(s)-methyl-PG

F\(_2\) Prostaglandin E\(_1\), 16-(S, R) methyl—16—hydroxy—methyl ester. 5

MEDICINAL CHEMISTRY I REFERENCE BOOKS (Theory)

1. Burger’s medicinal chemistry M.E. Welly Medicinal Chemistry M.E. Walffed Johnwilley and sons, Vo 1,2 and 3.


6. I.P85 and 96, Govt, of India, Ministry of Health.

MEDICINAL CHEMISTRY I (Practicals)
75 hours

I. Monograph analysis of the following compounds *
1. Acetazolamide
2. Aminophylline
3. Ascorbic acid
4. Aspirin
5. Atropine sulphate
6. Caffeine
7. INH
8. Paracetamol

11. Assay of medicinally useful compounds (in solid dosage forms)**
1. Ibuprofen by alkalimetry
2. Diclofenac by alkalimetry
3. Analgin by iodimetry
4. Ephedrine hydrochloride by non-aqueous titration.
5. Phenobarbitone sodium by non-aqueous titration.
6. Procaine/Benzocaine by diazotisation.
7. Chlorpromazine by cerimetry.

I. Preparation of medicinally useful compounds* 
1. Phenytoin from Benzoin.
2. Paracetamol from p-nitro phenol.
3. Benzocaine from p-amino benzoic acid.
4. 4-hydroxy coumarin from resorcinol.
5. Mefenamic acid from anthranilic acid.

IV 1. Degradation of Ephedrine to Benzoic acid.
1. Degradation of Caffeine to Demethyl alloxan and methyl urea.

SCHEME OF EXAMINATION

1. Synopsis -10 Marks
2. Assay or Estimation (Major Experiment) (Major experiments indicated by **) -25 Marks
3. Preparation (Minor experiments indicated by *) -15 Marks
4. Test for Identity/purity - 10 Marks
5. Practical viva-voce - 10 Marks

Total - 70 Marks

MEDICINAL CHEMISTRY I REFERENCE BOOKS (Practicals)

6. T.Robinson, Organic constituents of higher medicinal plants.
7. CIMS.

LIST OF MINIMUM EQUIPMENTS REQUIRED

1. Suction Pumps 01
2. Analytical Balances 10
3. Physical Balances
4. Triple beam balances
5. Water Baths, Reflux flask and condenser 10
6. Hot Plates 01
7. Mechanical Stirrers 02
8. Magnetic Stirrers with Thermostat 02
9. Distillation Unit 01
10. Refrigerator 01
11. Fuming Hood 01
12. Oven 01
III B. Pharm

3.2: PHARMACEUTICAL JURISPRUDENCE AND ETHICS (Theory)  

50 hours

1. Introduction
   a. Pharmaceutical legislations—brief review. 1
   b. Drugs and pharmaceutical industry—a brief review. 2

2. An elaborate (practical oriented) study of the following
   a. Pharmaceutical ethics 2
   b. Pharmacy Act 1948 3
   c. Drugs and Cosmetics Act 1940 and rules 1945 (with special reference to schedule M, P, U, V and Y) 23
   4. Medicinal and Toilet Preparations (Excise Duties) Act 1955 3
   e. Narcotic Drugs and Psychotropic Substances Act 1985 and rules 3
   f. Drugs Price Control Order, Pharmaceutical Policy 2002 3

3. A brief study of the following with special reference to the main provisions
   a. Drugs and Magic Remedies (Objectionable Advertisements) Act 1954 2
   b. Prevention of Cruelty to Animals Act 1960 including study of CPSCEA guidelines, INSA & ICMR guidelines 4
   c. Indian Patents Act with special reference to pharmaceuticals along with amendment bills, process patent and product patent 2

4. k brief study of the various prescription/non-prescription products, Medical/surgical accessories, diagnostic aids, appliances available in the market. 2

Note: The teaching of all the above acts should cover the latest amendments

PHARMACEUTICAL JURISPRUDENCE REFERENCE BOOKS

1. N.K. Jain, A text book of Forensic Pharmacy, Vallabh Prakashan New Delhi, 2002
2. Latest issues of CIMS, MIMS, PDR, DDR.
3. Remington's Practice of Pharmacy.
4. Latest issues of IDMA Bulletin
5. ICMR Guidelines
6. CPSCEA Guidelines
7. Helsinki Guidelines
1. Isolation, purification and estimation of phytoconstituents:
   a) General methods used for the isolation and purification of natural products including superfluid critical extraction.
   c) Detailed study of chromatographic techniques for separation, isolation & identification of phytoconstituents.
   d) Evaluation of natural products - Morphological, Physical, Microscopical, Chemical, Spectroscopical and Biological methods.

2. Biogenesis of phytopharmaceuticals:
   a) Techniques employed in the elucidation of biosynthetic pathways.
   b) Brief study of basic metabolic pathways
   c) Biosynthesis of - Tropane, Quinoline, Opium and Indole alkaloids, Steroids and Anthraquinone glycosides.

3. Glycosides:
   a) Definition, general characters and classification.
   b) Definition, general properties, chemical nature, general methods of isolation, estimation and uses of the followings:

4. Alkaloids:
   a) Definition, general properties, chemical tests, general methods of isolation and estimation of alkaloids.
   b) Sources, diagnostic characters, constituents, uses and adulterants of:

5. Essential Oils:
   a) Introduction, definition, general properties, chemical nature, and classification.
   b) Source, diagnostic characters, chemical constituents and uses of:
      (i) Clove (ii) Cinnamon (iii) Coriander (iv) Fennel (v) Eucalyptus (vi) Mentha piperita (vii) Sandal wood.
c) Methods of production and analysis of -Clove, Cinnamon, Eucalyptus, Mentha and Sandal wood oils. 10

6. Resins:
   a) Study of properties, classification and method of production
   b) Sources, diagnostic characters, active constituents, uses and adulterants of:
      (ii) Cannabis (ii) Podophyllum (iii) Ginger (iv) Capsicum (v) Benzoin (vi) Asafoetida (vii) Colophony. 6

7. Tannins:
   a) Definition, properties, classification, general method of isolation, estimation and uses of tannins.
   b) Source, chemical constituents, tests and adulterants of
      (i) Catechu (ii) Tannic Acid (iii) Nutgall 4

PHARMACOGNOSY AND PHYTOCHEMISTRY (Practicals)
75 hours

1. Quantitative Microscopy**.
   i. Ratio Values: Stomatal number and Stomatal Index.
   ii. Determination of dimension of starch grains and lengths of fibre using eye piece micrometer and camera lucida methods.
   iii. Determination of starch grains using lycopodium spore method.

2. Chemical tests for Asafoetida, Benzoin, Tannic acid, Pale catechu, Black catechu, Aloes *

3. Determination of Proximate Values.*
   (i) Moisture Content (ii) Ash Value (iii) Extractive Values

4. Study of Morphology of drugs:*

5. Study of Powder Microscopy (including analysis of mixture) * *
   Digitalis, Squill, Senna, Rhubarb, Cascara, Liquorice, Wild Cherry Bark, Lobelia, Cinchona, Ipecac, Rauwolfia, Kurchi, Ephedra, Clove, Cinnamon, Coriander, Fennel, Ginger.

5. Production of volatile oils, resins, tannins.*
SCHEME OF EXAMINATION

1. Synopsis                  10 Marks
2. Quantitative Microscopy** 20 Marks
3. Powder Microscopy**        20 Marks
4. Minor Experiment*          10 Marks
5. Viva-Voce                  10 Marks

Total - 70 Marks

PHARMACOGNOSY AND PHYTOCHEMISTRY REFERENCE BOOKS

11. Manitto P, the Biosynthesis of Natural Products, Ellis Horwood, Chichester.


LIST OF MINIMUM EQUIPMENTS REQUIRED

1. Camera lucida 20
2. Eye piece micrometer 20
3. Stage micrometer 20
4. Microscope with stage 20
5. Clavengersapparatus 20
6. Heating mantle 01
7. Incinerator 01
8. Moisture balance. 01
9. Vaccumpump 02
10. Balances 20
III B.Pharm

3.4: PHARMACEUTICAL ENGINEERING (Theory)

75 Hours

1. Stoichiometry: Unit Processes, material and energy balances, units and their conversions
   Dimensional formulae, dimensionless numbers.
   2

2. Fluid flow:
   a) Fluid statics: hydrostatic pressure, definition of heads, manometers,
   b) Fluid dynamics: mechanism of fluid flow, Reynolds's experiment, Bernoulli's theorem and its
      applications, Flow meters-, orifice meter, venturimeter, pitot tube and rotameter
      6

3. Heat transfer: Concept of heat flow by conduction through single wall, applications of Fourier's
   law, Forced and natural convection, surface coefficients, Boiling liquids, Condensing vapors,
   Temperature gradients in parallel and counter current heat exchangers. Heat interchangers,
   Radiation, black body, Stefan-Boltzmann equation, Kirchoff's law.
   6

4. Evaporation: Basic concept of phase equilibria, factors affecting evaporation. Evaporators, - film
   evaporators, single effect and multiple effect evaporators, theory and economy.
   5

5. Distillation: Raoult's law, Volatility, simple, steam and flash distillations. Principles of
   rectification, azeotropic, molecular and extractive distillation.
   6

6. Drying: Moisture content and mechanism of drying, factors affecting drying. Classification and
   types of dryers, dryers used in pharmaceutical industries. Construction and working of tray dryer,
   fluidized bed dryer, drum dryer, vacuum Dryer, Freeze dryer and Spray dryer.
   5

7. Size reduction: Definition, objectives of size reduction, factors affecting size reduction, laws
   governing energy and power requirements of a mill, types of mills, construction and working of ball
   mill, hammer mill, fluid energy mill, Edge runner and end runner mill.
   3

8. Size separation: Different techniques of size separation- sieves, sieve shakers, sedimentation
   tanks, Mechanical classifiers, Cyclone separators, Air separators, Bag Filter.
   3

2. Material handling system: Construction and working of a belt conveyor screw conveyor, pneumatic conveyor, cycloidal blowers and chain conveyers.


7. Corrosion: Classification and mechanism of corrosion, Factors, Prevention and control.

8. Plant location: Layout, utilities and services. Industrial hazards and safety measures.
PHARMACEUTICAL ENGINEERING (Practicals)
100 hours

1. Drying of wet granules and to plot the rate of drying curves. **
2. Operation of Ball mill and to calculate Rittinger's and Kick's coefficient**.
3. Operation of sieve shaker and sieve analysis and deriving various statistical parameters. **
4. Particle size measurement by Stoke's law. **
5. Determination of mixing index of blenders for a solid mixture using salicylic acid.
6. Rate of filtration studies, Calculation of specific cake and filter medium resistance. **
7. Determination of water vapor permeability across the packaging material.
8. Experiment to determine the leaching of contents from packaging material: Ampoules and Vials.
10. Mixing: Determination of mixing efficiency when propeller blade is introduced in different positions. **
11. Homogenizing: measurement of efficiency of Homogenization. **
12. Methods of crystallization, study of crystal habit.
13. Steam distillation: collection of volatile oil (Demonstration)
14. Evaporation: factors affecting the rate of evaporation. **

SCHEME OF EXAMINATION

1. Synopsis  - 15 Marks
2. Experiment (One only) Two
   i) Major**- 25M
   ii) Minor* : 20M  - 45 Marks
3. Viva voce  - 10 Marks

Total  - 70 Marks

PHARMACEUTICAL ENGINEERING REFERENCE BOOKS


LIST OF MINIMUM EQUIPMENTS REQUIRED

1. Tray dryer 01
2. Ball mill 01
3. Sieve shaker with set of sieves 01
4. Double cone blender 01
5. Propeller type mechanical agitator 05
6. Homogeniser 03
7. Buchner filtration apparatus 01
8. Vaccumpump 01
9. Desiccators 05
10. Energy meter 01
11. Permeability cups 05
12. Andreasen's Pipette 03
13. Autoclave 01
14. Steam distillation still 01
1. General Pharmacology
   a) Introduction and definitions - Sources and active ingredients of drugs. 1
   b) Routes of administration of drugs. 1
   c) Absorption of drug and the factors affecting them. 2
   d) Drug Distribution, Bio-transformation and Excretion 4
   e) Mechanism of drug action - Drug-Receptor interactions and molecular & biochemical basis of drug action. Additive effect, synergism, potentilation. 4
   f) Factors modifying drug effects. 1
   g) Drug toxicity 2
   h) Dose response relationship, structure activity relationship 2
   i) Drug interactions: Basic concepts of Drug interactions (Both in vitro & in vivo) 1
   j) Pre-clinical & clinical evaluations. 3

Note: The term Pharmacology used here refers to the classification, mechanism of action, Pharmacokinetics, pharmacodynamics, adverse effects, contraindications, therapeutic uses and dosage.

2. Pharmacology of drugs acting on Autonomic Nervous System
   a) Introduction-Neurohumoral Transmission 2
   b) Adrenergic and Cholinergic receptors 1
   c) Adrenergic drugs. 2
   d) Adrenergic receptor blockers, adrenergic neuron blockers. 2
   e) Cholinomimetics, Anticholinesterases. 3
   f) Antimuscarinic agents 1
   g) Ganglionic blockers and stimulants 1
   h) Neuromuscular blocking agents 1
   i) Drugs used in parkinsonism and myasthenia gravis. 2

Definition: Health, Drug, Pharmacology, Pharmacokinetics and Pharmacodynamics.

3. Pharmacology of Drug acting on Cardiovascular System
   a) Anti-hypertensives. 2
   b) Anti-anginal drugs 2
   c) Anti-arrhythmic drugs. 2
   d) Drugs used for therapy of congestive cardiac failure 2
   e) Drugs used in hyperlipidaemias 1
4. Pharmacology of Drugs Acting on Central Nervous System
   a) General consideration (Introduction) 1
   b) Alcohol 1
   c) General anaesthetics 2
   d) Sedatives and hypnotics 3
   e) Anti-convulsants 2
   f) Narcotic analgesics 2
   g) Non-steroidal anti-inflammatory agents and Analgesics 4
   h) Psychopharmacological agents: Antipsychotics, Antidepressants, Anxiolytics 5
   i) Drug dependence and drug abuse 1

2. Pharmacology of Local anaesthetics 2

3. Pharmacology of Drugs Acting on Blood and Blood forming Agents
   a) Coagulants and anti-coagulants. 2
   b) Haemopoietics. 2
   c) Thrombolytics and antiplatelet agents. 2

4. Pharmacology of Drugs Acting on Renal System (Diuretics) and antidiuretics. 3

PHARMACOLOGY I REFERENCE BOOKS

11. Applied therapeutics: The clinical use of drugs, applied therapeutics, Inc.
IV B.Pharm

4.1: PHARMACEUTICAL TECHNOLOGY AND BIOPHARMACEUTICS (Theory) 75 hours

1. Tablets:
   a. Formulation of different types of tablets, granulation technique, equipment employed. In process, evaluation of tablets and packaging. 5
   b. Tablet coating: Types of coating, coating materials, formulation of coating solution, methods of coating and equipment employed, quality control tests of coated tablets. 5

2. Capsules:
   b. Soft gelatin capsules: Nature of shell and capsule content, importance of base adsorption and minim/gram factors, production, in process and final product quality control tests. 8

3. Parenteral Preparation: Definition, types, advantages and limitation, general formulation, vehicles, production procedure, production facilities and controls. Formulation of injections, sterile powders, implants and long acting parenterals, emulsions and suspensions. Containers and closures pertinent to sterile preparations and Pharmacopoeial quality control tests. 14

4. Ophthalmic formulations: Requirements, formulation of eye drops, eye lotions and eye ointments, containers and evaluation. 4

5. Liquid orals: Formulation of solutions, manufacturing, filling and packaging. 5

6. Semisolid dosage forms: Definition, types, semisolid bases, their selection. Formulation of semisolidssuch as ointments, gels, jellies, suppositories, packaging, and their evaluation. 4
7. Pharmaceutical aerosols: Definition, propellants, containers, valves, types of aerosol systems, manufacture of aerosols, quality control and stability studies.


9. Cosmetics: Formulation and preparation of the following cosmetic preparations. Lipsticks, Shampoos, Face and talcum powders, Nail lacquers, cold cream and vanishing cream and toothpastes, hair dyes.

10. Biopharmaceutics: Definition and applications, passage of drugs across the biological barriers (passive diffusion, active transport, facilitated, pinocytosis) factors influencing absorption - Physiological, physicochemical, and pharmaceutical, blood level curves for I.V, constant rate infusion, oral, I.M., and sustained release dosage forms. Bioavailability, measurement of Bioavailability ($c_{max}$, $T_{max}$, AUC). Definition of Bio equivalence

PHARMACEUTICAL TECHNOLOGY AND BIOPHARMACEUTICS (Practicals)

75 hours

1. Manufacture of tablets**
   a. Ordinary compressed tablet-wet granulation
   b. Tablets prepared by direct compression
   c. Soluble tablet
   d. Chewable tablet

2. Formulation and filling of hard gelatin capsules*

3. Manufacture of parenterals. **
   a. Ascorbic acid injection
   b. Calcium gluconate injection
   c. Sodium chloride infusion
   d. Dextrose and Sodium chloride injection/Infusion

4. Evaluation of pharmaceutical formulations (Q.C. tests)*
   a. Tablets
   b. Capsules
   c. Injections
1. Formulation of two liquid oral preparations* and evaluation by assay* *
   a. Solution: Paracetamol syrup
   b. Antacid suspensions - aluminum hydroxide gel

2. Formulation of semisolids* and evaluation by assay* *
   a. Salicylicacid and benzoic acid ointment
   b. Gel formulation Diclofenac gel

3. Cosmetic preparations*
   a. Lipsticks.
   b. Cold cream and vanishing cream
   c. Clear liquid shampoo
   d. Tooth paste and tooth powders.

4. Tablet coating (demonstration)

SCHEME OF EXAMINATION

1. Synopsis - 10 Marks
2. Major experiment (Experiments indicated by**) - 30 Marks
3. Minor experiment (Experiments indicated by *) - 20 Marks
4. Viva voce - 10 Marks

Total - 70 Marks

PHARMACEUTICAL TECHNOLOGY AND BIOPHARMACEUTICS

REFERENCE BOOKS

<table>
<thead>
<tr>
<th>No.</th>
<th>Equipment</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Standard Granulating sieves, 2 sets, Sieve No, 10,12,22,24</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>Tray dryer</td>
<td>01</td>
</tr>
<tr>
<td>3</td>
<td>Tablet punching machine</td>
<td>01</td>
</tr>
<tr>
<td>4</td>
<td>Capsule filling machine</td>
<td>01</td>
</tr>
<tr>
<td>5</td>
<td>Ampoule washing machine</td>
<td>01</td>
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<tr>
<td>6</td>
<td>Ampoule filling and sealing machine</td>
<td>01</td>
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<tr>
<td>7</td>
<td>Tablet Disintegration test apparatus IP</td>
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<td>8</td>
<td>Tablet dissolution test apparatus IP</td>
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<td>9</td>
<td>Monsanto's hardness tester</td>
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<td>10</td>
<td>Pfizer type hardness tester</td>
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<td>11</td>
<td>Friability test apparatus</td>
<td>02</td>
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<tr>
<td>12</td>
<td>Clarity test apparatus</td>
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<tr>
<td>13</td>
<td>Digital thermometer</td>
<td>02</td>
</tr>
<tr>
<td>14</td>
<td>Mechanical stirrer</td>
<td>03</td>
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<tr>
<td>15</td>
<td>Ointment filling machine</td>
<td>01</td>
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<td>16</td>
<td>Ointment crimping machine</td>
<td>01</td>
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<tr>
<td>17</td>
<td>Lipstick moulds</td>
<td>10</td>
</tr>
<tr>
<td>18</td>
<td>Tablet coating pan</td>
<td>01</td>
</tr>
<tr>
<td>19</td>
<td>Magnetic Stirrer, 500ml and 1 litre capacity</td>
<td>05</td>
</tr>
</tbody>
</table>
4.2: INSTRUMENTAL AND BIOMEDICAL ANALYSIS (Theory)

The subject to be discussed with special reference to quality control and assurance of pharmaceuticals, its scope and its importance in the pharmaceutical industry. The following analytical techniques should be discussed with suitable examples.

1. Absorption spectroscopy: Theory of electronic, atomic and molecular spectra, Beer and Lambert's law, Derivation and Deviations, Application of Beer's law to single component analysis and multicomponent systems, Chromophores, Auxochromes, Bathochromic shift, hypsochromic shift, Hyperchromic and hypochromic effects, Effect of solvent on absorption spectra. 5

2. UV/Visible spectroscopy: Instrumentation and working; Sources of radiation, Wavelength selectors; Filters-Prisms and Gratings, Sample cells, Detectors- Phototube, Photomultiplier tube, Barrier layer cell and Silicon photo diode. 4

3. IR Spectroscopy: Instrumentation, Working and Sample handling methods, Sources of radiation, Monochromators, Sample cells and detectors- Bolometers, Thermocouples, Golay cells. 3

Applications: Measurement of equilibrium constant and rate constant by spectroscopy, spectrophotometric titrations, IR Frequency - structure correlation, study of characteristic fundamental stretching vibrations of functional groups like Alcohol, Carboxyl, Amide esters, Amine, Aldehyde, Ketone and Phenol. 5

2. Fluorimetric analysis: Theory, concept of singlet and triplet electronic states, Internal and external conversions, Intersystem crossing, factors affecting fluorescence, Quenching. Instrumentation- Study of Fluorimeter, Spectrofluorimeter and Applications 3

3. Flame emission and atomic absorption spectrometry: Theory, Nebulization, flames and flame temperatures, interferences, flame spectrometric techniques. 3
4. Nephelometry and Turbidimetric Analysis: Theory, General principles, Instrumentation and applications. 1

5. Chromatography: Introduction and classification, 1
   A) Column chromatography: Adsorption column chromatography, development Techniques - Frontalanalysis, Displacement analysis and elution analysis. Factors affecting column efficiency. Applications, Partition Chromatography. 2
   B) Thin layer chromatography: Introduction, principle, technique, Rf values and applications. 1
   C) Paper Chromatography: Introduction, Principle, Technique, Development, methods and applications. 1
   D) Ion exchange chromatography: Ion exchange materials, synthetic ion exchange resins, Properties of ion exchangers, mechanism of ion exchange process, factors affecting ion exchange, applications. 3
   F) HPLC: Introduction, theory, instrumentation - Solvent treatment systems, Pumps - Reciprocating and displacement pumps, Columns, Detectors - UV detectors, Flourimetric detectors, Refractive index detectors and applications. 2
   G) Electrophoresis: Principles of separation, equipment for paper and gel electrophoresis, Moving boundary electrophoresis, Applications. 2

6. Electrometric methods:
   A) Potentiometry: Electrochemical cell, construction and working of reference electrode, Normal hydrogen electrode, calomel electrode, silver-silver chloride electrode, Indicator electrodes - Glass electrode, Antimony electrode, Quinhydrone electrode, Potentiometric titrations, methods of detecting end point. 5
B) Conductometry: Introduction, conductivity cell, conductometric titrations, Applications. 2

4. Quality assurance: Introduction, Sources of quality variation, control of quality variation, Validation methods. 3

INSTRUMENTAL AND BIOMEDICAL ANALYSIS (Practicals)
75 hours
At least 15 experiments to be covered from the following list:

1. Separation and identification of amino acids by paper chromatography*
2. Separation and identification of alkaloids by thin layer chromatography. *
3. Separation and Identification of Dyes by radial paper chromatography*
4. Conductometric titration of Benzoic acid with NaOH* *
5. Potentiometric titration of HCl with NaOH.**
6. Estimation of quinine sulphate by fluorimetry. **
7. Estimation of Riboflavine by fluorimetry. * *
8. Study of quenching effect in fluorimetry: ex Quenching of Quinine fluorescence by iodide ions*.
10. Colorimetric estimation of Ferrous ions using 1,10 Phenanthroline.**
11. Colorimetric estimation of Sulphanilamide using N-1 -Napthyl Etherylene Diamine dihydorchloride.**
12. Assay of Dextrose injection by colorimetry. * *
13. U.V.spectrometric determination of Ibuoprofen tablets.*
14. Determination of chlorideand sulphate in calcium gluconate by Nepheloturbidimetricanalysis. **
15. Infrared spectral graphs/ peaks identification of samples with different functional groups (-COOH, -COOR, CONHR, -NH2, -NHR, -OH,-CHO,-C=O)...
16. Determination of Sodium/ Potassium by flame photometry.
18. Determination of water content by Karl Fischer electrometric titration method. * *

SCHEME OF EXAMINATION

1. Synopsis -10 Marks
2. Major experiment (Experiment indicated by**) -30 Marks
3. Minor experiment (Experiment indicated by*) -20 Marks
4. Viva voce -10 Marks

Total -70 Marks
INSTRUMENTAL AND BIOMEDICAL ANALYSIS REFERENCE BOOKS
(Theory)


2. Skoog and West, Pharmaceutical Analysis,


6. Leon Lachman, Lieberman, and J.L. Kanig, Theory and practice of industrial pharmacy

(Practicals)


6. Indian Pharmacopoeia, Vol I & II, Ministry of Health & Family welfare, Govt, of India, Published by Controller of the Publications, New Delhi, 1996.


11. William Kemp, Spectroscopy methods, ELBS.


LIST OF MINIMUM EQUIPMENTS REQUIRED

Equipments
1. Colorimeter 01
2. UV Spectrophotometer 01
3. Fourier Transform Infra Red spectrometer 01
4. Fluorimeter 01
5. Nephelo turbidity meter 01
6. Flame photometer 01
7. Potentiometer 02
8. Conductivity meter 02
9. Analytical weighing Balance (1 mg sensitivity) 01
10. Oven 01

Apparatus
1. Volumetric flasks 10 ml, 25 ml, 50 ml and 100ml.
2. Weighing bottles
3. Pipettes-Graduated 10 ml
4. Pipettes-Bulb 1 ml, 2ml,5ml and 10ml
5. Beakers-100 ml, 250 ml and 500 ml
6. Separating funnels
7. TLC plates
8. Chromatographic papers
9. TLC and Paper chromatography- Developmant chambers.
10. Water bath
1. Pharmacology of Autacoids and their Antagonists
   Histamine and antihistaminics 1
   5-Hydroxytryptamine and its antagonists 1
   Lipid derived autacoids and platelet activating factor 1

2. Pharmacology of Drugs Acting on Respiratory Tract
   Bronchodilators, Mucolytics, Expectorants, Antitussives, Nasal decongestants.

3. Pharmacology of Drugs Acting on Gastro Intestinal Tract
   Antiulcer drugs, Antacids 1
   Laxatives and Purgatives 1
   Emetics and Antiemetics 1
   Appetizers, Digestants, Carminatives 1

4. Pharmacology of Hormones and Hormone Antagonists
   Thyroid and antithyroid drugs. 2
   Insulin, Insulin analogues and oral hypoglycemic agents 2
   Sex hormones and oral contraceptives 2
   Oxytocin and other uterine stimulants and relaxants 1

5. Chemotherapy
   a) Introduction 1
   b) Sulfonamides and Co-trimoxazole 1
   c) Penicillins and Cephalosporins 2
   d) Tetracyclins and Chloramphenicol 1
   e) Macrolides Aminoglycosides, Polypeptide antibiotics. 2
   f) Quinolones and Fluoroquinolones 1
   g) Antifungal antibiotics 1
   h) Antiviral agents 2
   i) Chemotherapy of Tuberculosis and Leprosy 3
   j) Chemotherapy of Malaria 3
   k) Chemotherapy of Protozoal infections (amoebiasis, Giardiasis) 2
   l) Pharmacology of Anthelmintic drugs 1
   m) Chemotherapy of Cancer (Neoplasms) 2

6. Bio Assays
   Scope, Principles involved and General methods. 2

7. Immunopharmacology
   Pharmacology of immunosuppressants and stimulants 2
1. Principles of Toxicology
   a) Acute, Subacute & Chronic toxicity
   b) General principles of treatment of acute toxicity and acute poisoning.
   c) Signs, Symptoms and treatment of acute and chronic poisoning due to.
      i) Barbiturates ii) Alcohols iii) Benzodiazepines iv) Antidepressants
      v) Neuroleptics vi) Insecticides vii) Snake bite viii) Heavy metals (iron, lead, mercury, arsenic).


PHARMACOLOGY & TOXICOLOGY II (Practicals)
100 hours

1. Study of laboratory animals and their handling (a. Frogs, b. Mice, c. Rats, d. Guinea pigs and e. Rabbits)

2. Study of physiological salt solutions used in experimental pharmacology

3. Study of laboratory appliances used in experimental pharmacology

4. Study of use of anesthetics in lab animals.

5. To record the dose response curve of histamine using isolated guinea pig ileum preparation.


7. To carry out bioassay of Histamine using isolated guinea pig ileum preparation by interpolation method.

8. To carry out bioassay of Histamine using isolated guinea pig ileum preparation by three point method.


10. To carry out bioassay of Acetylcholine using isolated ileum/rectus abdominis muscle preparation by interpolation method.

11. To carry out bioassay of Acetylcholine using isolated ileum/rectus abdominis muscle preparation by three-point method.

12. To study the routes of administration of drugs in animals (Rats, Mice, Rabbits)

13. Study of theory, principle, procedure involved and interpretation of given results for the following experiments:
   a) Analgesic property of drug using analgesiometer
   b) Anti inflammatory effect of drugs using rat-paw edema method
c) Anti convulsant activity of drugs using MES and pentylene tetrazole methods.

d) Antidepressant activity of drugs using pole climbing apparatus and Pentobarbitone induced sleeping time methods.

e) Locomotor activity evaluation of drugs using Actophotometer and rotorod.

f) Cardiotonic activity of drugs using isolated frog heart and mammalian heart preparations.

1. Simulated Experiments:
   a) Effects of drugs on isolated heart of frog.
   b) Effects on B.P, HR and RR of dog.
   c) Effects of drugs on locomotor activity of rat
   d) Effects of drugs on rabbit's eye
   e) Effects of drugs on ciliary motility of frog's esophagus
   f) Ileum - Dose response curve and matching assay
   g) Mouse-Evaluation of analgesic activity by hot plate method.

Note: CPCSEA approval to be obtained for experiments on animals

SCHEME OF EXAMINATION

1. Synopsis - 10 marks
2. Identifications - 10 marks
3. Experiments
   a) Interpretation of given graph/simulated experiment -10 marks
   b) Bioassay - 30 marks
4. Viva voce - 10 marks

Total - 70 Marks

PHARMACOLOGY & TOXICOLOGY II REFERENCE BOOKS


11. Applied therapeutics: The clinical use of drugs, applied therapeutics, Inc.


**LIST OF MINIMUM EQUIPMENTS REQUIRED**

<table>
<thead>
<tr>
<th>No.</th>
<th>Equipment</th>
<th>Quantity</th>
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<tbody>
<tr>
<td>1.</td>
<td>Sherrington's Kymograph Machine</td>
<td>20</td>
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<tr>
<td>2.</td>
<td>Sherrington Drum</td>
<td>20</td>
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<tr>
<td>3.</td>
<td>Perspex bath assembly (single unit)</td>
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<tr>
<td>4.</td>
<td>Aerators</td>
<td>20</td>
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<td>5.</td>
<td>Dissection Tray and Boards</td>
<td>20</td>
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<td>6.</td>
<td>Haemostatic artery forceps</td>
<td>20</td>
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<tr>
<td>7.</td>
<td>Hypodermic syringes and needles of size 18,24,26G</td>
<td>20</td>
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<tr>
<td>8.</td>
<td>Computer with LCD</td>
<td>20</td>
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<tr>
<td>9.</td>
<td>Software packages for experiment.</td>
<td>01</td>
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<tr>
<td>10.</td>
<td>Standard graphs of various drugs.</td>
<td>Sufficient</td>
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<tr>
<td>11.</td>
<td>Actophotometer</td>
<td>01</td>
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<tr>
<td>12.</td>
<td>Rotarod</td>
<td>01</td>
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<tr>
<td>13.</td>
<td>Pole climbing apparatus</td>
<td>01</td>
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<td>14.</td>
<td>Analgesiometer(Eddy's hot plate and radiant heat methods)</td>
<td>01</td>
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<td>15.</td>
<td>Convulsimeter</td>
<td>01</td>
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<td>16.</td>
<td>Plethysmograph</td>
<td>01</td>
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<tr>
<td>17.</td>
<td>Levers, Cannulae</td>
<td>40</td>
</tr>
<tr>
<td>18.</td>
<td>Website: expharm.virtulave.net</td>
<td></td>
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</tbody>
</table>
IV B.Pharm 4.4: MEDICINAL CHEMISTRY II (Theory)  
75 hours

A. Modern concepts of rational drug design: A brief introduction to quantitativ structure activity relationship (QSAR), Prodrug, combinatorial chemistry and computer aided drug design. (CADD)

B. History and development of chemotherapeutic agents: Structure, uses and synthesis of only those compounds that are underlined and superscribed by 's'.

C. Anti-infective agents:
   1. Local anti-infective agents:
      a) Alcohols and related compounds: Alcohol, isopropyl alcohol, formaldehyde solution.
      b) Phenols and their derivatives: p-Chloro phenol, hexachlorophene, Resorcinol, hexyl resorcinol.
      c) Oxidizing agents: Hydrogen peroxide solution, hydrous benzoyl peroxide.
      d) Halogen containing compounds: Iodine Tincture, Chlorine containing compounds halozone.
      e) Cationic surfactants: Benzalkonium chloride, cetylpyridinium chloride.
      f) Dyes: Gentian Violet, Methylene blue.
      g) Nitrogen compounds: Nitrofurazone, Furazolidone.

   2. Preservatives:
      a) Para hydroxy benzoic acid derivatives: Methylparaben, Propyl paraben, Ethyl paraben.
      b) Miscellaneous: Chlorobutanol, Benzyl alcohol, Phenylethyl alcohol, Sodium benzoate, Phenyl mercuric nitrate, Phenyl mercuric acetate.

   3. Antifungal agents:
      a) Antifungal antibiotics- Nystatin, Candididin, Hamycin, Griseofulvin Ampoterecin-B
      b) Synthetic anti fungal agents:
         3
      c) Substituted imidazoles: Clotrimazole, Miconozole, Ketoconazole.
      c) Miscellaneous-Zinc propionate, Sodium caprylate, Tolnaftate.

4. Urinary tract anti-infectives:
   a) Quinalones: Nalidixic acid, Cinoxacin, Norfloxacin, Ciprofloxacin, Pefloxacin Ofloxacin, Sparfloxacin
   b) Miscellaneous: Nitrofurantoin.
1. Antitubercular drugs: SAR of antitubercular drugs,
   a) Synthetic antitubercular agents: p-Aminosalysilic acid\(^1\), Isoniazid\(^2\), EthambutoP, Pyrazinamide, Ethionamide, Clofazamine.
   b) Antitubercular Antibiotics: Cycloserine, Viomycin sulfate, Capreomycin sulfate, Rifampicin.

2. Anti Viral Agents.
   a) Amantidine hydrochloride, Idoxuridine, Acyclovir, Zidovidine.
   b) Anti-AIDS: Azathymidine, Suramin

3. Antipprotozoal agents: Emetine hydrochloride, Metronidazole\(^3\), Diloxanide furoate\(^5\), 8-hydroxy quinoline derivatives(cloquinal\(^5\), iodoquinal). Carbarsone.

4. Anthelmintics: Piperazine, Diethyl carbamazine\(^1\), Pyrantel pamoate, Thiabendazole\(^6\), Mebendazole,

A. Sulfonamides, Sulfones as antibacterial agents:
   1. SAR of Sulfonamides.
   2. Classification of sulfonamides based on duration of action and site of action with examples.
      Sulfamethiazole, Sulfisoxazole\(^5\), Sulfapyridine, Sulfamethoxazole\(^2\), Sulfadiazine, Sulfacetamide, sulfasalazine, Phthalyi sulfathiazole.
   3. Folate reductase inhibitors: Trimethoprim\(^4\), Synergistic action of the combination of sulfamethoxazole and trimethoprim.

4. Sulfone: Dapsone\(^4\).

B. Antimalarials: Etiology of malaria, History, Mechanism and SAR
   1. Quinolines and analogues
      7-chloro-4-amino quinolines : Chloroquine phosphate\(^5\), Hydroxy Chloroquine sulphate, Amodiaquine. 8-amino quinolines: Pamaquine Primaquine\(^5\),9-amino acridines: Quinacrine\(^5\)
   2. Miscellaneous: Mefloquine, Pyrimethamine\(^5\), Trimethoprim.

C. Antibiotics: Historical background, Mechanism of action, classification-
   2. Beta lactamase inhibitors: Clavulanic acid and its salts, Thienamycin.
   3. Cephalosporins: Structure and uses of Cephalexin, Cephradine, Cefadroxil, Cefixime, Cefapyridine, Cefuroxime

5. Aminoglycosides: Structural features and Mechanism of action, Streptomycin, Amikacin Neomycin. Kanamycin, Gentamycin, Netilmicin

6. Teracyclines: Chemistry and SAR, tetracycline, Chlortetracycline, Methacycline, Demeclocycline, Oxytetracycline, Meclocycline, Doxycycline, Minocycline.


8. Lincomycins: Lincomycin, Clindamycin.


G. Antineoplastic agents: Introduction, mechanism of action and classification with examples. 5
2. Antimetabolites: Mercaptopurine, Thioguanine, 5-Flourouracil, Methotrexate,
3. Antibiotics: Dactinomycin, Bleomycin, Mitomycin, Streptozocin.
5. Hormones: Dromostanalone, Megestrol,

H. Cardiovascular agents:
I. Antianginal agents and vasodilators: Chemical structure and specific uses of Amyl nitrite, Nitroglycerine, Isosorbide dinitrate.

2. Calcium antagonists: Brief introduction of calcium channels and their blockers. Chemical structures and uses of Verapamil, Diltiazem, Nifedepine, Nimodepine, Felodipine Dipyridamole, Cyclandelate.

3. Antiarhythmic drugs: Structure, chemical name, and classification of antiarrythmics with examples

   Class I- Membrane depressant drugs: Quinidine Procaainamide, Phenytoin.
   Class II-Beta adrenergic blocking agents: Tocainide, Propranolol
   Class III-Repolarization prolongators: Bretylium, Amiodarone
   Class IV-Calium channel blocker: Diltiazem, Verapamil
1. Antihypertensive agents:
   - Beta-blockers: Propranolol, Timolol
   - ACE Inhibitors: Captopril, Enalapril
   - Diuretics: Hydrochlorothiazide, Spironolactone
   - Calcium channel blockers: Nifedipine, Felodipine, Amlodipine
   - O2-agonist: Prazocin
   - O2-agonist: Clonidine, Guanethidine
   - Miscellaneous: Resperpine, Hydralazine, Minoxidil

   - Clofibrate, Lovastatin, Cholesterolamine, Colestipol.


4. Hypoglycemic agents: Sulfonyl ureas—Chlorpropamide,
   - Acetohexamide, Glipizide.

5. Thyroid hormones: L-thyroxine, L-thyronine,


I. Diuretics: Introduction
   1. Carbonic anhydrase inhibitors: Acetazolamide, Methazolamide.
   2. Thiazide and Thiazide like diuretics: Chlorthiazides, Benzthiazide,
   - Xipamide, Chlorthalidone.
   3. High-ceiling or loop diuretics: Furosemide, Ethacrynic acid.
   5. Miscellaneous: Mannitol.
MEDICINAL CHEMISTRY II REFERENCE BOOKS (Theory)

1. Foye's principles of Medicinal chemistry.
3. Burger’s medicinal chemistry.
5. A.I.Vogel, Text Book of practical organic chemistry including the qualitative analysis.
6. A.H.Becket and J.B.Stanlake, Practical Pharmaceutical chemistry.
8. I.P1985, Ministry of Health, Govt.of. India.
11. T.Robbinson, Organic constituents of higher plants
12. Feiserand Feiser Steroids.
13. Drug design by Ariens.
14. Smith and Williams, Introduction to principles of drug design.
15. Purcell, Strategy of drug design
16. CIMS.

MEDICINAL CHEMISTRY II (Practicals)

75 hours

Assay of
1. Sulphadiazine by diazotization.
2. Chloroquine by nonaqueous titration
3. Ascorbic acid by iodimetry.
4. Isonicotinic acid by $\text{KBrO}_3$ (bromimetry)
5. Benzyl penicillin by iodometry.
6. Metronidazole/Mepacrine by nonaqueous titration.
7. Dapsorie by diazotization.

Preparation of medicinally important compounds or intermediates required for synthesis of drugs.

1. Benzimidazole from o-phenylene diamine.
2. PAS from p-nitro salicylic acid.
3. DichloramineT from toluene p-sulphonamide.
4. ChloramineT from DichloramineT.
5. Fluorescein from pthalic anhydride.
6. Eosin from Fluorescin.
7. Sulphacetamide from sulphanilamide.
8. Phenothiazine from Diphenylamine.
10. Cinnamic acid from Perkin's reaction.
11. Benzyl alcohol by Cannizoro's reaction.
12. INH from Isonicotinic acid.
13. Chlorobutanol.
15. Quinoxaline.
16. Benzotriazole.
17. 3-Diphenyl quinoline.
18. 2,4,5 Triphenyl imidazole from Benzoin

Estimation of the functional groups in medicinally important compound.
1. Hydroxyl group in cholesterol.
2. Ketone in camphor.
3. Hydroxyl group in menthol.
4. Amide in nicotinamide.

SCHEME OF EXAMINATION

1. Synopsis - 10 Marks
2. Assay/Estimation (including standardization) - 30 Marks
3. Preparation including re-crystallisation and Melting Point determination - 20 Marks
4. Practical viva - 10 Marks

Total - 70 Marks

MEDICINAL CHEMISTRY II REFERENCE BOOKS (Practicals)
1. A.I.Vogel, Text Book of practical organic chemistry.
2. A.H.Beckettand Stanlake, Practical pharmaceutical chemistry.
3. J.G.Mann and Saunders, Practical organic chemistry.
4. Feiserand Feiser, Steroids.
7. CIMS.

LIST OF MINIMUM EQUIPMENTS REQUIRED

1. Suction Pumps 01
2. Analytical Balances 10
3. Physical Balances
4. Triple beam balances 10
5. Water Baths Reflux Flask and condensers 10
6. Hot Plates 01
7. Mechanical Stirrers 01
8. Magnetic Stirrers with Thermostat 01
9. Distillation Unit 01
10. Refrigerator 01
11. Fuming Hood 01
IV B.Pharm
4.5: INDUSTRIAL PHARMACOGNOSY (Theory)  

50 hours

1. Introduction:
   a) Importance and status of herbal medicines and cosmetics.
   b) Brief account of herbal drug Industry.

2. Phytopharmaceuticals:
   Detailed methods of isolation, identification and estimation of the following: Quinine, Ephedrine,
   Digitoxin, Ca-sennosides, Diosgenin, Glycyrrhizin, Rutin, Andrographolides,
   Phyllanthin,
   Guggulsterone, Gymnemic acid, Asiaticoside,

3. Herbal Formulations:
   a) General introduction to alternative systems of medicine like Ayurveda, Siddha, Unani and
      Homeopathy.
   b) Methods of preparation of formulations in Ayurveda like Aristas, Asava, Ghutika, Taila,
      Churna, Leha, and Bhasma.
   c) Role of herbs in cosmetics. Study of the following herbs.
      Shampoos: Soapnut
      Conditioners: Amla, Henna,
      Hair colorants: Amla, Henna
      Skin Care: Aloe vera, Turmeric, Sandalwood
   d) Nutraceuticals: Spirulina, Garlic
   e) Different methods of processing extract

4. Standardization:
   a) Importance of standardization of raw materials, extracts and formulations with suitable
      examples.
   b) WHO guidelines for the assessment of crude drugs and extracts.
   c) Role of markers in the evaluation of Herbal drugs. Applications of HPLC and HPTLC for the
      evaluation of drugs and extracts.
   d) Standardization of the following drugs:
      i) Gokhru
      ii) Aswagandha
      iii) Kalmegh
      iv) Brahmi
      v) Phyllanthus
      vi) Tinosporavii
      vii) Vasakaviii
      viii) Gymnema
      ix) Curcuma
      x) Glycyrrhiza
   e) Determination of alcohol content in Aristas and Asavas.

5. Patenting of Natural Products
6. Plant Biotechnology and applications:
   a) Polyplody, Mutation and Chemodemes and their applications in improving the quality of medicinal plants.
   b) Tissue Culture:
      i) Types, techniques and applications
      ii) Callus and Suspension cultures.
      iii) Production of secondary metabolites.
      iv) Protoplast isolation and fusion
      v) Bio transformation, immobilisation of cells and enzymes.
   c) Transgenic plants and their applications: Gene transfer in plants using vectors and physical delivery methods

7. Enzyme Biotechnology:
   a) Introduction, general methods of isolation and purification of enzymes, enzyme reactors, applications of immobilized enzymes in drug manufacture and drug analysis.
   b) Sources, method of preparations, chemical natures and uses of Papain and Bromelain.
   c) Study of Streptokinase and Urokinase.

8. Study of Traditional Drugs:
   Common and vernacular names, source, active constituents and uses of
   i) Kantakari ii) Malkangani iii) Shatavari iv) Tylophora v) Bilva vi) Kalijeera
   vii) Karvera viii) Rasna ix) Apamarg x) Gokhru xi) Shankapushpi xii) Gaduchi
   xiii) Arjunaxiv) Shelajit xv) Chirata

INDUSTRIAL PHARMACOGNOSY (Practicals)

75 hours

1. Isolation of Phytopharmaceuticals**
   i) Aloin ii) Andrographolide
   iii) Quinine iv) Ammonium glycyrrhizinate
   v) Ca sennosides vi) Caffeine

2. Estimation of Curcumin, Aloin, Quinine, Caffeine **

3. General and specific chemical tests for
   a) Alkaloids-Atropine, quinine
   b) Caffeine
   c) Cardiac glycosides- Digitoxin, Digoxin
   d) Saponins-Glycerrhizin
   e) Anthraquinone glycosides - Sennosides, Aloin
   f) Flavone glycosides
   g) Cyanogenetic glycosides
4. Chromatographic techniques*
   a) Paper chromatography of sugars
   b) Thin layer chromatography of alkaloids
   c) Identification of markers in glycerrhiza, Aloe, Berberis, Cinchona.
5. Evaluation of crude drugs by powder microscopy*
   i) Punarnava ii) Ashwagandha iii) Kalmegh iv) Vasaka v)Ashoka vi) Tinospora
6. Estimation of alcohol content in various preparation*
7. Estimation of bitters in Kalmegh
8. Initiation of callus culture*
10. Study of morphology of traditional drugs. *
11. HPTLC and HPLC profiles of few drugs.

SCHEME OF EXAMINATION

1. Synopsis -10 Marks
2. Isolation and identification/estimation of Phytopharmaceuticals* -20 Marks
3. Chromatography of Phytopharmaceuticals** -20 Marks
4. Minor experiment* -10 Marks
5. Viva-Voce -10 Marks

Total -70 Marks

INDUSTRIAL PHARMACOGNOSY REFERENCE BOOKS
7. Satyavati, Medicinal Plants of India, 1. Indian Council of Medical Research, New Delhi.
10. www.botanical.com

LIST OF MINIMUM EQUIPMENTS REQUIRED

1. Heating mantle 20
2. Soxhlet apparatus 10
3. TLC chamber and sprayer 10
4. Hot air oven 01
5. Water bath 20
6. Autoclave 01
7. Laminar airflow 01
8. B.O.D. Incubator 01
9. Microscope 20
10. Balance (Digital) 02
11. Spectrophotometer 01
12. Flourimeter 01
13. Reflux flasks and condensers 20
14. Distillation units 05
15. Vacuum pump 02
16. HPTLC 01
17. HPLC 01
IV B.Pharm. 4.6.1: INDUSTRIAL PHARMACY 4.6.1 (a): ADVANCED INDUSTRIAL PHARMACY
50 hours

1. Controlled delivery systems: Principle, advantages, disadvantages, selection of drug candidates, approaches to design of controlled release formulations - methods such as ion exchange resins, microencapsulation (definition, applications, air suspension, coacervation and phase separation), matrix tablets, invitro evaluation.

2. Novel drug delivery systems: Concepts, advantages and disadvantages, types of drug delivery systems such as transdermal, nasal ocular, buccal with suitable examples. Drug carriers and drug targeting-Explanation and applications of liposomes, niosomes, microspheres, nanoparticles, advantages and disadvantages.

3. Methods to improve bioavailability of drugs: Solid dispersion and complexation


5. Herbal Formulations Antibacterial preparations, toothpaste, antitussive preparations - Definitions, formula and preparation.


7. Formulation of Veterinary products: Antibacterials, Anthelmintics, Antiamoebic in the form of bolus, powder and liquid.

ADVANCED INDUSTRIAL PHARMACY REFERENCE BOOKS


11. Dr.N.Udupa, Drug Delivery Systems-Manipal experience.


1. **Marketing:**
   a. The meaning and scope of marketing.
   b. The Pharmaceutical market: Quantitative and qualitative aspects, size and composition of the market, demographic descriptions and socio psychological characteristics of the consumer, market segmentation.
   c. Analysing the market-Role of market research
   d. Consumer profile-Motivation and prescribing habits of the physician, patients' choice of physician and retail pharmacist.

2. **The Pharmaceutical product:**
   a. Market consideration in product development, marketing mix, product life cycle (PLC), effects of different elements of marketing mix at different stages of PLC, product classification, product planning, product differentiation, me-too products, modification of existing product.
   b. New product development-All stages from the new product idea to the stage of marketing the developed product (bulk drugs and formulations)
   c. Branding- Concept of brand, Different types of brand, importance and reasons for branding, packaging.

3. **The organization:**
   Manufacturer-Company objectives, influence of internal controls such as company policy on the company's operation, effects of Government regulations and controls on marketing practices.

4. **Distribution:**
   a. The wholesaler-His role in distribution of Pharmaceutical services offered to the manufacturer and the retailer, advantages and disadvantages of distribution through wholesaler.
   b. The retailer-Classification of retail institutions, advantages and disadvantages of retail institutions, the hospital as retail outlet.

5. **Competitive practices in the Pharmaceutical Industry:**
   b. Price competition-Pricing, rate contracts.
6. Promotions:
   a. Communication and its importance
   b. Different ways of promotion - Advertising, direct mail, professionals, journals, sampling, retailing, medical exhibition, public relations.
   c. Professional sales representative duties of PSR, purpose of detailing, selection and training, compensation and future prospects of the PSR.

7. Management:
   a. Concepts of management, Principles of management
   b. Primary functions of management - planning, organizing, staffing, directing controlling, motivation, entrepreneurship development.
   c. Secondary functions of management: decision-making, leadership, innovation, delegation of authority/responsibility.

8. Good manufacturing practices (GMP):
   GMP as per schedule M, WHO guidelines, USFDA guidelines, MCA guidelines and TGA guidelines.

9. ICH guidelines:
   Quality, efficacy and safety of drugs, impurity profiles.

PHARMACEUTICAL MARKETING AND MANAGEMENT REFERENCE BOOKS
1. Harold T Amrine, John A Ritchey, Oliver S. Hulley, Manufacturing organization and management, Prentice Hall of India Pvt Ltd, New Delhi, Fourth Edition
3. Dr Varma, R.K. Agarwal, Production management, King Books, Educational publishers, Delhi
4. K. Aswathappa, Production management: Himalaya publishing House
5. PC Tripathi, PN Reddy, Principles of management, Tata McGraw Hill publishing Co. Ltd.

8. Mickey C Smith, Principles of Pharmaceutical marketing CRS Publishers and Distributors, New Delhi, 3rd Edition


5. Dr. A. Patani, Drug & Cosmetics Act 1940, Eastern Book Co., Lucknow


7. WHO Expert Committee on “Specifications for Pharmaceutical preparations” 13th, 22nd, 23rd, 24th, 34th Reports.

8. www.ich.org


10. www.fda.gov


12. www.mca.gov.uk
### IV B.Pharm 4.6.11: PHARMACY PRACTICE

4.6.11 (a): PHARMACOKINETICS AND THERAPEUTIC DRUG MONITORING

50 hours

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>a) Introduction to Pharmacokinetics, Types of pharmacokinetic models, Their advantages and limitations.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>b) Model-Independent calculations (from equations as well as graphs) for pharmacokinetic parameters - Area under the curve, $k_a$, $k_e$, Biological half-life, Apparent volume of distribution and Clearance.</td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Compartment models:</td>
</tr>
<tr>
<td></td>
<td>a) One compartment open model - monoexponential decline - IV bolus (blood &amp; urine analysis), IV infusion and oral (Blood analysis).</td>
</tr>
<tr>
<td></td>
<td>b) Two compartment model-biexponential disposition-IVbolus.</td>
</tr>
<tr>
<td></td>
<td>c) Three compartment model - triexponential disposition -The concept.</td>
</tr>
<tr>
<td></td>
<td>d) Multiple dosing - consequences, equations to calculate $C_{min}$, and $C_{ss}$, accumulation index, concept of loading dose and maintenance dose.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Drug distribution:</td>
</tr>
<tr>
<td></td>
<td>a) Factors affecting (perfusion &amp; permeability)</td>
</tr>
<tr>
<td></td>
<td>b) Protein binding - Kinetics of protein binding &amp; Clinical significance.</td>
</tr>
<tr>
<td></td>
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</tr>
<tr>
<td>4</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Therapeutic Drug Monitoring:</td>
</tr>
<tr>
<td></td>
<td>Introduction, Necessity of TDM, Criteria for valid TDM, Essentials for effective TDM, Organization of a TDM service, Effectiveness of TDM.</td>
</tr>
<tr>
<td></td>
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</tr>
<tr>
<td>5</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Analytical aspects of TDM, Uses of HPLC and Immunoassays in TDM for measurement of serum drug concentrations.</td>
</tr>
<tr>
<td></td>
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</tr>
<tr>
<td>6</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Dosage regimen design, Dosing of drug in special population - Pregnancy &amp; lactation, Paediatrics &amp; Geriatrics, Dosage adjustment in renal and hepatic impairment, Patient compliance.</td>
</tr>
</tbody>
</table>
7. TDM. of selected individual drugs-Aminoglycosides, Carbamazepine, Cyclosporine, Digoxin and Methotrexate.

PHARMACOKINETICS AND THERAPEUTIC DRUG MONITORING REFERENCE BOOKS

5. Mike Hallworth and Nigel Caps, Therapeutic Drug Monitoring and Clinical Biochemistry.
7. Leon Shargel, Pharmacy Review.
I. Clinical Pharmacy and Therapeutics

1. Introduction to Clinical Pharmacy:

   Definition, History and Development of Clinical Pharmacy, Study of daily activities of a clinical pharmacist like Drug therapy monitoring (Medication chart review, Clinical review, TDM, Pharmacist interventions), Ward round participation, Adverse drug reaction management, Medication history interview and patient counseling.

2. Drug and Poison Information:

   Requirements for setting up a Drug Information Center, Types of resources and Answering a Drug Information query.

3. Patient data analysis:

   Clinical laboratory tests used in the evaluation of common disease states, and interpretation of test results of Liver function tests, Pulmonary function tests, Haemogram and Renal function tests.

4. Adverse drug reactions:

   Epidemiology, Classification, Risk factors, Monitoring and detecting adverse drug Reaction Assessing Casuality using WHO scale and Reporting adverse drug reactions.

5. Definition, Symptoms, Classification of the diseases, treatment and parameters to monitor the therapy of following systems/diseases:

   5.1 Cardiovascular system
       Hypertension, Congestive cardiac failure and Ischaemic heart disease,

   5.2 Respiratory system
       Asthma.

   5.3 Renal system
       Acute and chronic renal failure.
5.4 Hematological disease
Iron, B12 and Folic acid deficiency anemias. 2

5.5 Endocrine System
Diabetes Mellitus. 1

5.6 Nervous System
Epilepsy. 1

5.7 Gastrointestinal System
Ulcer disease and Hepatitis. 2

5.8 Infectious disease
Gastro-enteritis, Pneumonia, Typhoid, Tuberculosis, Malaria and Amebiasis. 6

6. Concept of Essential Drugs and Rational Drug use. 3

II. Hospital and Community Pharmacy

1. The role of the hospital pharmacy, department and its relationship to other hospital departments and staff. 1

2. Hospital Drug Policy:
   1. Pharmacy and Therapeutics committee.
   2. Formulary and guidelines. 3

3. Organisation of Hospital Pharmacy Services:
   1. Purchasing and Inventory control, Storage and drug recall procedure.
   2. Drug distribution methods
   3. Central sterile supply division 4

4. Research:
   1. Practice-based research
   2. Clinical trials. 3
1. The role of the community pharmacy and its relationship to other local health care providers.

2. Prescribed medication order and interpretation.

3. Patient counseling in community pharmacy including OTC products.

4. Social Pharmacy:
   1. General concepts of health and disease, disease causing agents and prevention of disease.
   2. Classification of food requirements, balanced diet, nutritional deficiency disorders, their treatment and prevention.
   3. Demography and family planning.

5. Code of Ethics for community pharmacists.

CLINICAL AND HOSPITAL PHARMACY REFERENCE BOOKS

10. Relevant review articles from recent medical and pharmaceutical literature.
ETHICS IN PHARMACY

Introduction

With the advances in science and technology and the increasing needs of the patient, their families and community, there is a concern for the health of the community as a whole. There is a shift to greater accountability to the society. It is therefore absolutely necessary for each and every one involved in the health care delivery to prepare themselves to deal with these problems. Pharmacists like the other professionals are confronted with many ethical problems.

Standards of professional conduct for pharmacist are necessary in the public interest to ensure an efficient pharmaceutical service. Every pharmacist should not only be willing to play his part in giving such a service, but should also avoid any act or omission which would prejudice the giving of the services or impair confidence, in respect, for pharmacist as a body.

To accomplish this and develop human values, it is desired that all the students undergo ethical sensitization by lectures or discussion on ethical issues.

Introduction to ethics

Ethics may be defined as “the code of moral principles” or as “the science of morals”. The conduct of individuals in any society is governed by the governmental controls on the one hand and the social customs and duties on the other. The former has the sanction of the law and the latter is left to the individual and the society. For this purpose, societies lay down a code of conduct to help the individuals to decide what is right and what is wrong. Such a code, when practiced by any society for a long time, results in the culture of a conscience in the individuals, which gives them a faculty to decipher for themselves, the right way of conducting their daily life, conductive to the well being of the society. This way of conducting life is said to be the ethical way and the culture of such conscience may well be termed as morality.

The candidate after completion of B.Pharm, while practicing shall follow ethics in all spheres asunder

- Pharmacist in relation to his job
- Pharmacist in relation to his trade
- Pharmacist in relation to medical profession
- Pharmacist in relation to his profession
Professional Ethics

The candidate is required to

• Follow Code of conduct
• Maintain confidentiality
• Follow Fairtrade practice
• Follow ethics in handling of prescriptions
• Maintain professional vigilance

Human values, ethical practice and communication abilities

• Adopt ethical principles in all aspects of the professional practice
• Foster professional honesty and integrity
• Discharge the duties irrespective of social status, caste, creed or religion of the customer / client
• Develop oral and written communication skills
• Provide leadership and get the best out of his or her team in a congenial working atmosphere
• Apply high moral and ethical standards while carrying out human or animal research
• Be humble and accept the limitations in his or her knowledge and skill and to ask for help from colleagues when needed.

Pharmacist Oath

I swear by the code of ethics of Pharmacy Council of India in relation to the community and shall act as an integral part of health care team

I shall uphold the laws and standards governing my profession

I shall strive to perfect and enlarge my knowledge to contribute to the advancement of Pharmacy and Public health

I shall follow the system, which I consider best for Pharmaceutical care and counseling of patients

I shall endeavor to discover and manufacture drugs of quality to alleviate sufferings of humanity

I shall hold in confidence the knowledge gained about the patients in connection with my professional practice and never divulge unless compelled to do so by the law

I shall associate with organizations having their objectives for betterment of the profession of Pharmacy and make contribution to carry out the work of those organizations

While I continue to keep this oath unviolated may it be granted to me to enjoy life and the practice of Pharmacy respected by all at all times!

Should I trespass and violate this oath, may the reverse by my lot!
NORMS AND STANDARDS

1.0 STAFF NORMS

The knowledge, skills, attitudes and values of staff are assets which greatly contribute to their own individual effectiveness as well as to institutional performance. In addition, to the pattern and structure of staff, staff norms should therefore, emphasize on processes of recruitment, deployment and development as well as appraisal.

The norms stipulated are primarily for a Pharmacy college with an annual intake of 40 & 60 students.

1.1 Weekly work schedule

<table>
<thead>
<tr>
<th>Activity</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student contact hours per week</td>
<td>40 hrs.</td>
</tr>
<tr>
<td>Student contact hours in formal learning</td>
<td>32 to 35 hrs.</td>
</tr>
<tr>
<td>Student centered activities (Library studies)</td>
<td>5 to 8 hrs.</td>
</tr>
<tr>
<td>guidance &amp; counseling, Seminars, etc.</td>
<td></td>
</tr>
</tbody>
</table>

1.2 Annual Work Schedule

In a semester there should be a minimum of 72 (desirable 90 days) instructional days, excluding examination. Theses norms are deemed to be essential for completion of the semester.

1.3 Student-Teacher Ratio

The student teacher ratio in a class will depend on (i) teacher time required for formal instruction requiring student contact (ii) student time devoted to formal learning requiring teacher contact and (iii) class sizes for different forms of instruction.

The desirable student to teacher ratio for pharmacy degree programme may be 10:1. However, it should not be allowed to rise beyond 15:1.

The teacher will engage in group/class sizes for formal teaching in the ratio as given below:

<table>
<thead>
<tr>
<th>Type</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory lecture class</td>
<td>60:1</td>
</tr>
<tr>
<td>Lab practical</td>
<td>20:1</td>
</tr>
</tbody>
</table>
1.1 Staff Pattern - Categories

i) Principal/HOD/Director and Teaching Staff
ii) Technical supporting staff
iii) Library & computer centre staff
iv) Administrative staff
v) Miscellaneous staff including maintenance staff

1.2 Teaching Staff cadre

The cadre structure should be as follows:

i) Principal/Director/Chairman/HOD
ii) Professor
iii) Reader/Assistant Professor
iv) Lecturer-Selection Grade
v) Lecturer-Senior Scale
vi) Lecturer

1.3 Cadre distribution - flexibility

The distribution of faculty position in the Pharmacy institution, will depend on the work loads of the different departments based on the curriculum structure. Flexibility in the distribution of different faculty cadres is permitted so long as such flexibility is for meeting the specific needs of the institution in terms of job requirements and courses offered.

1.4 Leave training reserves

To enable institutions to sponsor teachers for staff development programmes and to allow teachers to avail leave to which they are entitled it is necessary that adequate reserve capacity of teachers is available. Each institution will have such reserve capacity in accordance with leave training reserves sanctioned by Central/State Governments from time to time.

1.5 Selection and Recruitment of the teaching staff

The positions of Professors, Assistant Professors/Readers and Lecturers should be filled up through an open selection process. The posts of Senior Lecturers and Lecturers (Selection grade) shall be filled by promotion from the cadre of Lecturers. The selection agencies of states and institutions should adopt reliable and valid procedures for selecting candidates on the basis of competence knowledge, skills, attitudes and values required for the profession, adhering to the stipulations regarding qualification and experience.

1.6 Job description and qualifications of staff

As prescribed by AICTE from time to time.
1.10 Performance Appraisal system

A performance appraisal system for teachers should be set up, well integrated with institutional functioning, and this should lead to the identification of individual training and development needs. This should also enable the identification of faculty members whose performance is outstanding. Such performance and excellence should be well recognized and rewarded. All institutions should introduce a system for performance appraisal conforming with the guidelines formulated in this regard.

1.11 Training and Development

Teachers will be provided with opportunity to improve their qualifications through Quality Improvement Programmes (for Ph.D. in Pharmacy based areas). In addition to these, opportunities will be provided for pedagogy and professional industrial training.

Under the Quality Improvement Programme a variety of short term courses to meet training and retraining needs will be provided for all levels of teachers in Pharmacy Colleges. In addition, Managerial skills Development Programmes for Principals and senior teachers would be made available.

Selected institutions would be offering short-term and long-term training programmes. States and institutions would have to plan training requirements and deployments of trained teachers on an annual basis, making use of these programmes for development of their staff.

Training of teachers is expected to contribute both towards their professional development and improvement in career prospects.

Similarly, summer schools and winter schools will be organized by institutions having expertise in selected areas of interest with the help of ISTE, State Govt, or other funding agencies for the benefit of the teachers in Pharmacy institutions.

2.0 NORMS FOR INFRASTRUCTURE

2.1 Norms for Space and Buildings

The norms for space and buildings have been arrived at, based on the functions, a pharmacy institutions offering degree or diploma programmes, has to perform. In all cases, unit norms have been evolved taking the absolute minimum needs which are indicated as norms. As such the institutions, while envisaging their space and building requirements, must keep their perspectives for development in mind and formulate their plans accordingly.
Around the administrative buildings, class rooms and drawing halls, there is considerable movement of students and there must be adequate veranda space in this part of the college building so that the classes do not disturbed. For this reason, the ratio of plinth to carpet area for the normal building may be taken as 1:4.

**Classification of Building Area**

The building area required for the pharmacy institution can be classified as instructional area, administrative area, amenities area and residential area.

Instructional area will include class rooms, tutorial rooms, laboratories, computer centre, library, instructional resource centre, seminar hall etc.

Administrative area comprises Principal’s room, visitors lounge, staff rooms, administrative office, departmental offices, stores, conference room, confidential room etc.

Area for amenities consists of common rooms, recreation centre, hobby centre, offices for Gymkhana, N.S.S. and Alumni Association, Co-operative Stores, Dispensary, etc.

Residential area includes student hostels, staff quarters and guest house.

### 2.2 Building Space for Instructional Area

The course structure of any pharmacy institution offering degree programme will include lecturers, tutorials, laboratory work and seminars/colloquium. The institute must have adequate building area for all these instructional activities.

According to the model curriculum, during annual session, the total number of hours per week for which the student is to have contact with the teacher will vary between 27 to 34. In view of this, the instructional schedule is spread over a period of 34 hours a week.

The student strength in a theory class should not exceed 60. The class should be divided into smaller groups of 20 in case of junior (I & II year) classes and 15 students for the senior (III & IV year) and a teacher is assigned to each group. In case of tutorial work, these smaller groups must be accommodated in separate rooms.

The seminars/colloquium of the senior students must be conducted with the entire class of particular discipline.

### 2.3 Number of Rooms for Theory Classes

The number of rooms required for the theory class can be determined by applying the following relationship.
1.1 **Number of Rooms for Tutorial Work**

The number of rooms required for the Tutorial work can be determined by applying the following relationship.

1.2 **Rooms size for Theory Classes and Tutorial Work**

The carpet area requirement of the class rooms and tutorial rooms depends upon the number and type of seating arrangement for the students and provisions for a platform, a table and a chair for the teacher. In pharmaceutical science classes, very frequently students make use of a data book, a calculator and note book. As such he will require slightly more spacious desk as compared to the requirements of classes for students of general education. Further, as the space required for teacher will remain the same irrespective of the class strength, the per student requirement of carpet area will increase with the decrease in class strength.

Considering the above requirements and size of class room furniture and drawing tables normally used in the institution, the following carpet area norms per student are prescribed for class rooms of different size and drawing halls.

<table>
<thead>
<tr>
<th>Type of Rooms</th>
<th>Carpet Area Requirements in Sqm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Classification of Size Minimum</td>
</tr>
<tr>
<td>Class rooms for 40 students</td>
<td>48</td>
</tr>
<tr>
<td>Class rooms for 60 students</td>
<td>66</td>
</tr>
</tbody>
</table>

1.1 **Laboratories**

The requirements of the laboratories depend upon the programmes that are being offered by the institution and the curricula adopted for theses programmes irrespective of the students population. The norms for the carpet area of the different laboratories are given in the Table below. Care should be taken to provide laboratories in all allied subjects to be taught in a programme.

The size of the laboratories should be suitable for a minimum batch of 20 students. The floor area of each laboratory may be calculated at the rate of 3.0 sq.mtr. per student with the minimum of space as given:

<table>
<thead>
<tr>
<th>Department</th>
<th>Laboratory (Lab.code)</th>
<th>Minimum</th>
<th>Desirable</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Pharm. Chemistry</td>
<td>Pharmaceutical Chemistry</td>
<td>80</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Laboratory-(PCI) Medicinal Chemistry &amp; Natural Products Pharmaceutical Chemistry Laboratory-II (PC2) Organic and Inorganic Chemistry Balance Rooms (2) 2*20 sq.m.</td>
<td>80</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>40</td>
<td>50</td>
</tr>
<tr>
<td>2. Pharmaceutics</td>
<td>Pharmaceuticals Laboratory-I (PH1)</td>
<td>80</td>
<td>100</td>
</tr>
<tr>
<td>Area</td>
<td>Minimum</td>
<td>Desirable</td>
<td></td>
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<tr>
<td>----------------------------------------------------------------------</td>
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<td></td>
</tr>
<tr>
<td>Dispensing Pharmacy and Cosmetology</td>
<td></td>
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<tr>
<td>Pharmaceutics Laboratory-II (PH2) including Microbiology and Bio-pharmaceutics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Microbiology Laboratory (PH3) (Desirable)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aseptic room</td>
<td>25</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>Physical Pharmacy (Phy. Pharm.)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Industrial Pharmacy (Ind. Pharm.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Machine Room</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aseptic room</td>
<td>25</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>Physical Pharmacy (Phy. Pharm.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industrial Pharmacy (Ind. Pharm.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Machine Room</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>3. Pharmaceutical Analysis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pharmaceutical Analysis (PHA) and Biochemistry</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Instrument Room (Inst, room) (partly air conditioned)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Pharmacognosy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1) Pharm. Biology Laboratory</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2) Pharmacognosy Laboratory</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>5. Pharmacology</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1) Human Anatomy &amp; Physiology</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2) Pharmacology Laboratory including Anatomy, Physiology and health education smoke room</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>6. General</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Animal House (including feed store)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Computer room</td>
<td>30</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Water pumps room</td>
<td>10</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Gas Plant (where LPG gas is not available)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stores-I (General)</td>
<td>100</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Stores-II (for inflammable materials)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The above areas do not include the rooms of the teaching staff even though such staff rooms are attached to the laboratories. However, they do include the sitting space for the technical supporting staff and storage of laboratory consumables and instruments.

2.7 Library

Purpose: Acquiring, storing, cataloguing, indexing, issuing and returning of books, periodicals and non-print instructional material and providing reader services. Development and production of print and non-print instructional resources such as class notes, handouts, illustrations, slides, filmstrips, audio-visual materials, models charts etc.

NORMS

<table>
<thead>
<tr>
<th>Minimum</th>
<th>Desirable</th>
</tr>
</thead>
<tbody>
<tr>
<td>150sq.m.</td>
<td>200sq.m.</td>
</tr>
</tbody>
</table>
FACILITIES

Projection Room: One of the class rooms to be equipped with Projection facilities.

2.8 Museum

Every institution shall maintain a museum of crude drugs herbarium sheets/charts of the drugs and plants mentioned in the course in addition, the following is recommended.

1. Colored slides and charts of medicinal plants;
2. Display of popular patent medicines; and
3. Containers of common usage in medicines

The following fittings will be required for the museum:

1. Showcases
2. Cupboards
3. Counters with lighting arrangement
4. Literature counter on specimens.

Minimum area required for museum will be 100 sq.m.

2.9 Other Provisions

(1) Examination Hall cum Auditorium

Purpose: Conducting examinations, conference, extension lectures and functions.

Area requirement: 150 sq.m.

2.10 Building Space for Administrative Offices

The space to be provided for administrative office in technical institution/college will be as per norms given below:

<table>
<thead>
<tr>
<th>Carpet area (Sq.m.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Principal/Office</td>
</tr>
<tr>
<td>Confidential/Strongroom</td>
</tr>
<tr>
<td>Conference room</td>
</tr>
<tr>
<td>Administrative office</td>
</tr>
<tr>
<td>Maintenance office</td>
</tr>
</tbody>
</table>

2.11 Other Space in the Department
In addition to the teaching space the norms for building requirement in a teaching department for other purposes are as below:

### 2.1 Building Space for Amenities

The minimum unavoidable requirements for such amenities for normal functioning of the institute are given below along with the norms for the building space.

#### 2.13 Students Activity Centre

This will consist of provisions for the indoor games, gymnasium, dramatics and alumni centre etc. (60 sq.m.)

#### 2.14 Toilet Blocks

The college building and the hostels will be provided with adequate number of toilet blocks with urinals, lavatories and wash basins. It will also be necessary to provide separately one toilet block for women in the college building.

Toilet area requirement is as below:

- Education Building for 240 students - 24 sq.m.

#### 2.15 Cycle and Scooter Stand

This will be provided as open or covered area as per requirement.

#### 2.16 Other Amenities

The norms of space (Carpet area) or other miscellaneous amenities are as given below:

<table>
<thead>
<tr>
<th></th>
<th>Sq.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canteen</td>
<td>100</td>
</tr>
<tr>
<td>Cooperative Stores</td>
<td>100</td>
</tr>
<tr>
<td>NSS Office cum Stores Girls common</td>
<td>100</td>
</tr>
</tbody>
</table>

Desirable

<table>
<thead>
<tr>
<th></th>
<th>Sq.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stores Girls common</td>
<td>60</td>
</tr>
</tbody>
</table>
2.17 Play Fields

The institution must be provided with play fields so that the students can have adequate participation in games and sports for healthy and constructive activities within the campus.

2.18 Building Space for Residential Area (Desirable)

The hostel requirements depend on a variety of factors like the location of the institution, the region from which students are admitted, local availability of accommodation and that of transport. Though, the requirement of residence for teachers and other employees of the institution also depend upon these factors but at the same time it is necessary to provide an attraction to the new teacher from far off places by providing suitable accommodation at the campus.

2.19 Hostels (Desirable)

The hostel accommodation will be provided with the norms as given below:

<table>
<thead>
<tr>
<th>Location of College</th>
<th>Hostel Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within 20km of large city</td>
<td>25% of boys and 50% of girls enrollment</td>
</tr>
<tr>
<td>Other locations</td>
<td>50% of boys and 100% of girls enrollment</td>
</tr>
</tbody>
</table>

The boys’ hostel will be made as a unit for 120 students while there is no minimum for a girls-hostel unit. The first year students will be accommodated in triple seated rooms while others will be given single seated rooms. The norms for the room areas will be as below:

**Carpet area (Sq.m.)**

- Single room: 9
- Triple seated: 20

The other building space needed in a hostel unit will be as per norm given below:

**Carpet area (Sq.m.)**

- Kitchen and Dining Hall: 20
- Indoor game cum Common Hall: 0
- Medical room: 15
- Canteen: 15
- Warden office: 18
- Guest rooms (2 nos): * (Four additional rooms of 9 sq.m. each within the hostel blocks)
2.20 Staff Residences

The minimum residential accommodation that should exist in the campus should be for the Principal, all Heads of the Departments, all Wardens, and the essential staff including a caretaker, an electrician, a driver, a water supply operator, and chowkidars.

The building space for residence will be as per norms given below:

<table>
<thead>
<tr>
<th>Position</th>
<th>Sqm.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Principal</td>
<td>140</td>
</tr>
<tr>
<td>Professor</td>
<td>100</td>
</tr>
<tr>
<td>Asst.</td>
<td>80</td>
</tr>
<tr>
<td>Professor/Lecturer</td>
<td>80</td>
</tr>
<tr>
<td>Class III Staff</td>
<td>80</td>
</tr>
<tr>
<td>Class IV Staff</td>
<td>80</td>
</tr>
</tbody>
</table>

2.21 Guest House (Desirable)

To meet the needs of the quests visiting the institution for official work and the parents visiting the students, it will be necessary to have a guest house having four suits with attached toilets, a common dining hall, and a kitchen.

2.22 Furniture

All laboratories, library, lecture, and tutorial rooms, offices, hostels, and guest houses, etc., should be adequately furnished. No norms for furniture are being laid; however, it is excepted that the furniture should conform to the requirements of a dignified institution. The institutions may equip the buildings with the furniture as available indigenously.

2.24 Land

It will not be desirable to set the norms of land requirements for the pharmacy college because of existing high pressure on land availability and other similar factors. If enough land is not available near a large town, the double and triple storey construction may have to be resorted to. However, it will be desirable to have the total land area so as all requirements of the building space are fully met as envisaged in these norms.

In addition, it will be necessary to have additional land available within the campus for future expansion.

2.23 Laboratory Equipments

The following factors are to be considered in identifying the equipment for the laboratories and workshops:
i) Development of laboratory skills, i.e., verification calibration, performance testing, investigation and problem solving.

ii) Development of practical skills, i.e., manufacturing dispensing and communication skills etc.

Laboratory models of equipment are necessary for imparting skills in the laboratories. Equipment similar to the ones used in industry are necessary for developing practical skills. Small scale and less expensive models available in the market, if found adequate for training, should be preferred to large-scale and expensive equipment.

Development activities, which the pharmacy institution has to undertake, have a bearing on the equipment list. In such cases, provision may have to be made for drug store management, training in hospital - pharmacy and community services.

The number of tools/equipments/apparatus to be provided depends on the size of students group, utilization factor, capital cost and operating cost. The number of students in laboratories in any batch should not be, more than 20 with one teacher. Typical layout of the labs for pharmacy programme.

a. Purpose: Demonstrating, guiding, evaluating by the teacher and investigation, discussing, measuring and testing by the students.

b. Terminology: The names of the laboratories are in accordance with the terminology used in the model curriculum.

2.25 Norms of construction & fitting

Typical laboratory for a pharmacy institution should follow following norms of construction:

1. All the laboratories should be spacious, well lit and well ventilated.
2. All laboratories should be provided with basic amenities and services like exhaust fans and fume chamber to reduce the pollution wherever necessary.
3. The work benches should be smooth and easily cleanable preferably made of nonabsorbent material.
4. The water taps should be non-leaking and directly installed on sinks. Drainage should be efficient and enclosed.
5. Fire extinguisher and first Aid Kit should be provided in each lab.
6. Preparation room (minimum 10 sq.m.) attached to the laboratories.
7. Balance room attached to concerned laboratories.

Each laboratory should have the following fittings:

1. Gas, Water and electric supply, gas plant or cylinders.
2. Shelves for keeping reagents
3. Working surfaces
4. Sinks
5. Storage cabinets (lockers) for students to keep the apparatus issued to them for a year wherever required.
6. Exhaust fans and ceiling fans
7. Fume chambers whatever necessary
8. Black board with light
9. Furniture (suitable arrangement for sitting of the teachers)
10. Artificial lighting wherever required for microscopic work.

2.26 Library Books and Periodicals

The minimum norms for the initial stock of books, yearly addition of the books and the number of journals to be subscribed are as given below:

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Item</th>
<th>Minimum</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Number of books</td>
<td>1500 adequate coverage of a large number of titles in all disciplines of pharmacy</td>
</tr>
<tr>
<td>2</td>
<td>Annual addition of books</td>
<td>100 to 150 books</td>
</tr>
<tr>
<td>3</td>
<td>Periodicals</td>
<td>15 to 20 national periodicals</td>
</tr>
</tbody>
</table>

2.27 Teaching Aids

The degree in pharmacy being professional courses with sufficient practical application component, will require presentation and discussion in the class room. This can be greatly facilitated by the use of overhead projector, video and computers. Thus an institute shall have the following teaching aids such as overhead projectors for lecture class room, computers, VCR TV and cassettes for the courses.
### Staff Pattern for B.Pharm/D.Pharm/NI.Pharm Courses Branch Wise

#### Department of Pharmaceutics

<table>
<thead>
<tr>
<th>Name of Post</th>
<th>With intake of 40 students</th>
<th>Branch wise intake 60 students</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. College with B.Pharm only</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Professor</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Asst. Professor</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Lecturers</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

| **2. College with B.Pharm and M.Pharm** |                        |                               |
| Professor    | 2                          | 2                             |
| Asst. Professor | 2                       | 2                             |
| Lecturers    | 2                          | 2                             |

| **3. College with B.Pharm, M.Pharm & D.Pharm** |                        |                               |
| Professor    | 2                          | 2                             |
| Asst. Professor | 3                       | 3                             |
| Lecturers    | 3                          | 4                             |

| **4. College with B.Pharm and D.Pharm** |                        |                               |
| Professor    | 1                          | 1                             |
| Asst. Professor | 2                       | 2                             |
| Lecturers    | 3                          | 4                             |

#### Department of Pharmaceutical Chemistry

<table>
<thead>
<tr>
<th>Name of Post</th>
<th>With intake of 40 students</th>
<th>Branch wise intake 60 students</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. College with B.Pharm only</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Professor</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Asst. Professor</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Lecturers</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

| **2. College with B.Pharm and M. Pharm** |                        |                               |
| Professor    | 2                          | 2                             |
| Asst. Professor | 2                       | 2                             |
| Lecturers    | 3                          | 4                             |

| **3. College with B.Pharm, M.Pharm & D.Pharm** |                        |                               |
| Professor    | 2                          | 2                             |
| Asst. Professor | 2                       | 2                             |
| Lecturers    | 4                          | 5                             |

<p>| <strong>4. College with B.Pharm and D.Pharm</strong> |                        |                               |
| Professor    | 1                          | 1                             |
| Asst. Professor | 2                       | 2                             |
| Lecturers    | 3                          | 4                             |</p>
<table>
<thead>
<tr>
<th>Department of Pharmacology</th>
<th>Name of Post</th>
<th>With intake of 40 students</th>
<th>Branch wise intake 60 students</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. College with B.Pharm only</td>
<td>Professor</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Asst. Professor</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Lecturers</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>2. College with B.Pharm and M.Pharm</td>
<td>Professor</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Asst. Professor</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Lecturers</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>3. College with B.Pharm, M.Pharm &amp; D.Pharm</td>
<td>Professor</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Asst. Professor</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Lecturers</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>4. College with B.Pharm and D.Pharm</td>
<td>Professor</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Asst. Professor</td>
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<td>1</td>
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<tr>
<td></td>
<td>Lecturers</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Department of Pharmacognosy</th>
<th>Name of Post</th>
<th>With intake of 40 students</th>
<th>Branch wise intake 60 students</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. College with B.Pharm only</td>
<td>Professor</td>
<td>1</td>
<td>1</td>
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<tr>
<td></td>
<td>Asst. Professor</td>
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<tr>
<td></td>
<td>Lecturers</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2. College with B.Pharm and M.Pharm</td>
<td>Professor</td>
<td>1</td>
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<td>3. College with B.Pharm, M.Pharm &amp; D.Pharm</td>
<td>Professor</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Asst. Professor</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>4. College with B.Pharm and D.Pharm</td>
<td>Professor</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Asst. Professor</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Note: Part time teaching staff for Maths, Biology & Computer Science may be appointed
VISION STATEMENT

The Rajiv Gandhi University of Health Sciences, Karnataka, aims at bringing about a confluence of both Eastern and Western Health Sciences to enable the humankind “Live the full span of our lives allotted by God in Perfect Health”

It would strive for achievement of academic excellence by Educating and Training Health Professionals who

> Shall recognize health needs of community,

> Carry out professional obligations Ethically and Equitably and in keeping with National Health Policy. It would promote development of scientific temper and Health Sciences Research.

It would encourage inculcation of Social Accountability amongst students, teachers and Institutions.

It would Support Quality Assurance for all its educational programmes.

MOTTO

Right for Rightful Health Sciences Education