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# The Tamil Nadu Dr. M.G.R. Medical University Chennai

## Regulations For The B. Pharmacy Degree Course

# The Tamil Nadu Dr. M.G.R. Medical University

## Chennai

### Regulations of the University

In exercise of the powers conferred by Section 44 of the Tamil Nadu Dr. M.G.R. Medical University, Madras, Act, 1987 (Tamil Nadu Act 37 of 1987), the Standing Academic Board of the Tamil Nadu Dr. M.G.R. Medical University hereby makes the following regulations:

**Short title and commencement:**

These regulations shall be called "THE REGULATIONS FOR THE B. PHARMACY DEGREE COURSE OF THE TAMIL NADU DR. M.G.R. MEDICAL UNIVERSITY, MADRAS"

They shall come into force from the academic year 2001-2002

The regulation framed is subject to modifications from time to time by the Standing Academic Board.

# REGULATIONS

## 1. QUALIFICATION FOR ADMISSION

a) Candidates belonging to all categories except Scheduled Castes/Scheduled Tribes for admission to the B Pharm. Course must have obtained not less than 50% of marks in aggregate in Physics, Chemistry, Biology (Botany and Zoology) or Mathematics taken together at the qualifying examination (Academic stream) after a period of 12 years of study.

b) Candidates belonging to Scheduled Castes/Scheduled Tribes, the minimum marks for admission shall be 40% in lieu of 50% for General Category.

OR

c) Candidates qualified in the Diploma in Pharmacy examination conducted by the Board of Examinations of the Government of Tamil Nadu or any other Board of any other Sate recognised as equivalent thereto by the authority of this University.

**Other Criteria**

Where the course content is not as prescribed for 10 +2 education structure of the National Committee, the candidates will have to undergo a period of one year pre-professional training before admission to the Pharmacy Colleges.

a) The pre-professional examination with Physics, Chemistry and Biology, after passing either the higher secondary school examination, or the pre-university or an equivalent examination, The pre-professional examination shall include a practical test in these subjects.

b) The pre-university Course which was in vogue prior to the advent of the Higher Secondary examination shall not be dated as equivalent to the Higher Secondary Examination (10 +2) for purpose of eligibility and admission to the course.

c) Wherever the State Board/Body or appropriate authority have taken into account only the Plus Two level marks to determine the class of the candidate and issue the statement of marks accordingly, ie. alone would be taken into consideration.

d) Wherever the State Board/Body or appropriate authority have taken into account the marks obtained at the Plus One and Plus two levels to determine the class of the candidate the aggregate of the two examinations shall be taken into consideration.

e) Candidates who have studied abroad and have passed the equivalency of qualification as determined by the Association of Indian Universities will form the guidelines to determine the eligibility and must have passed in the subjects of Physics, Chemistry, Biology (Botany/Zoology) on Mathematics in 12th Standard level with 50% marks aggregate and with pass in English language.

f) Any criteria not covered under the above provisions, the ruling the Eligibility Committee shall be adopted.

**National Open School Qualification.**

Candidates who have passed the Secondary School examination of National Open School with minimum 5 Subjects with any of the following group of subjects.

a) English, Physics, Chemistry, Botany, Zoology.

b) English, Physics, Chemistry, Biology and any other language.

(To be read along with 'Qualification for Admission' 'a' and 'b')

**Qualification for admission into Direct II Year B. Pharmacy Course through total entry**

a) Should have aggregate of 50% of marks in the first and second year D. Pharmacy Examination with a pass in HSC Physics, Chemistry and Biology

(or)

b) Minimum qualifying marks in 10 +2 examination as per B. Pharmacy statutes with a pass in two year D. Pharmacy course.

## 2. AGE LIMIT FOR ADMISSION

Should have completed the age of 17 years at the time of admission or would complete the said age on or before 31st December of the year of admission to the first year B. Pharm course.

## 3. DURATION OF THE COURSE

4 Academic years (Non-Semester)

## 4. COMMENCEMENT OF THE COURSE

July 1st of an Academic Year

## 5. ACADEMIC TERMS

| | | |
|---|---|---|
| First B. Pharm | ... | July 1st to March 31st |
| Second B. Pharm | ... | June 1st to March 31st |
| Third B. Pharm | ... | June 1st to March 31st |
| Fourth B. Pharm | ... | June 1st to March 31st |

## 6. CUT-OFF DATES

The candidates admitted from 1st July to 30th September, will be registered to take up their 1 year examination in April of the next year.

The Candidates admitted from 1st October to 31st December will be registered to take up their I year examination during the October of the next year.

There will not be any admission after 31st December for that academic year.

## 7. COMMENCEMENT OF EXAMINATION

April 1st / September 1st

If the date of commencement of the examination falls on Saturdays, Sundays or declared Public Holidays, the examination shall begin on the next working day.

## 8. CURRICULUM

The curriculum and syllabi for the course shall be as prescribed by the University from time to time.

## 9. WORKING DAYS IN AN ACADEMIC YEAR

Each academic year shall consist of not less than 200 working days.

## 10. IMPROVEMENT OF MARKS IN THE HIGHER SECONDARY EXAMINATIONS

Candidates who have secured the stipulated minimum academic requirements in two opportunities for improvement within one year from the date of first appearance in the qualifying examination are eligible for I B. Pharm. Degree course.

## 11. RE-APPEARANCE OF FAILED CANDIDATES

Candidates who have passed the failed subjects in the qualifying examination in two opportunities within a period of one year or the first appearance are eligible for admission to the First B. Pharm Course.

## 12. ELIGIBILITY CERTIFICATE

Candidates who have passed any qualifying examination other than the Higher Secondary Course examination conducted by the Government of Tamil Nadu shall obtain an eligibility certificate from the University by remitting the prescribed fees along with the application form before seeking admission to any one of the affiliated institutions.

## 13. REGISTRATION

A candidate admitted to the course in any of the affiliated colleges shall register with this University by remitting the prescribed fees along with the application form for registration duly filled in and forwarded to this University Through the Head of the Institution within the stipulated date.

## 14. ATTENDANCE REQUIRED FOR ADMISSION TO EXAMINATION

a) No candidate shall be permitted to appear for any one of the parts of B. Pharm. examinations unless he has attended the course in the subject for the prescribed period in an affiliated institution recognised by this University and produces the necessary certificate of study, attendance, satisfactory conduct and progress from the Head of the Institution.

b) A candidate is required to put in minimum 80 % of attendance in both theory and practical separately in each subject before admission to the examination.

c) A candidate lacking in the prescribed attendance and progress in any one subject in theory and practical shall not be permitted for admission to the entire examination in the first appearance.

## 15. REGULATIONS FOR CONDONATION OF LACK OF ATTENDANCE

Condonation of shortage of attendance upto a maximum of 10% in the prescribed eligible attendance for admission to an examination rests with the discretionary powers of the Vice-Chancellor. A candidate lacking in attendance should submit an application in the prescribed form and remit the stipulated Fee, 15 days prior to the commencement of the theory examination. The Head of the Department and Head of the Institution should satisfy themselves on the reasonableness of the candidate's request while forwarding the application with their endorsements to the Controller of Examinations, who would obtain the approval of the Vice-Chancellor for admission of the said candidate to the examination. No application would be considered if it is not forwarded through proper channel.

Application for condonation of lack of attendance shall be taken up for consideration on the following grounds:

a) Any illness afflicting the candidate. (The candidate should submit to the Head of the Institution a Medical Certificate from a registered Medical practitioner soon after he/she returns to the Institution after treatment.)

b) Any unforeseen tragedy in the family. (The parent/guardian should give in writing the reason for the ward's absence to the Head of the Institution.)

c) Participation in NCC/NSS and other co-curricular activities representing the Institution or University. (The Head of the Institution

should instruct the concerned officers in-charge of the student activities in their institution to endorse the leave.)

d) Any other leave the Head of the Institution deems reasonable for condonation.

## 16. RE-ADMISSION AFTER BREAK OF STUDY

a) Candidates having a break of study of 5 years and above from the date of admission and more than two spells of break will not be considered for re-admission.

b) The five years period of break of study shall be calculated from the date of first admission of the candidate to the course for the subsequent spells of break of studies.

c) Candidates having break of study shall be considered for readmission provided that they are not subjected to any disciplinary action and no charges are pending or contemplated against them.

d) All re-admission of candidates are subject to the approval of the Vice-Chancellor.

e) The candidates having a break of study below 6 months shall apply for re-admission to the Academic Officer of this University. The candidates may be re-admitted in the corresponding course of study at the commencement of the session and shall undergo a minimum period of study of 3 months and after fulfillment of the regulations of this University be admitted for the examination. The candidates shall be granted exemption in the subjects they have already passed.

f) The candidates having a break of study of 6 months and above but less than one year shall apply for re-admission to the Academic Officer of this University. The candidates may be re-admitted in corresponding course of study at the commencement

of the session and shall undergo a minimum period of study of 3 months and after fulfillments of the regulations of this University be admitted for the examination. The candidates shall be granted exemption in the subjects they have already passed.

g) The candidates having a break of study of one year and above but less than three years shall apply for condonation to the Academic Officer of this University.

The candidate may be re-admitted in the corresponding course of study at the commencement of the session and shall undergo a minimum period of study of 6 months and after fulfillment of the regulations of this University be admitted for the examination. The candidates shall be granted exemption only in the subjects they have already passed.

h) The candidates having a break of study of 3 years but less than 5 years shall apply for re-admission to the Academic Officer of this University.

The candidates may be permitted to re-join the course at the beginning of the course with the condition that these candidates will have to undergo the prescribed period of study permitted by the University on re-admission and will not be granted any exemption in any subject they have already passed. They shall subscribe to the regulations of this University.

## 17. MIGRATION / TRANSFER OF CANDIDATES

Migration / Transfer of candidates from one recognised institution to another recognised institution of this University shall be granted on the following conditions:

a) All migrations / transfers are subject to the approval of the Vice-Chancellor.

b) Transfer shall be effected only at the beginning of the academic year.

c) The transfer application should be sent through proper channel to the Academic Officer within three months of publications of the results or admission to the course.

d) Transfers shall be effected during any year of study after fulfillment of the regulations of this University.

e) Transfers will be effected subject to the condition that the sanctioned strength of that institution in that particular year is not exceeded.

f) The provision of combination of attendance shall be granted to the transferee for admission to the examination of this University of satisfactory fulfillment of the regulations of this University.

## 18. SUBMISSION OF LABORATORY RECORD NOTE BOOKS

At the time of practical examination, each candidate shall submit to the Examiners his / her laboratory note books duly certified by the Head of the Department as a bonafide record of the work done by the candidate.

The practical record shall be evaluated by the concerned Head of the Department (Internal Evaluation ) and the practical record marks shall be submitted to the University 15 days prior to the commencement of the theory examinations.

The candidate may be permitted at the discretion of examiners to refer to the practical record book during the practical examination. No other materials, handwritten, cyclostyled or printed guides is allowed for reference during the practical examinations.

In respect of failed candidates the marks awarded for records at previous examinations will be carried over for the subsequent examination or the candidates shall have the option to improve his performance by submission of fresh records.

## 19. INTERNAL ASSESSMENT

A minimum of four written examinations shall be conducted in each subject during an academic year and the average marks of three best performances shall be taken into consideration for the award of sessional marks.

A minimum of three practical examinations shall be conducted in each subject during an academic year and an average of two best performances shall be taken into consideration for award of sessional marks.

A failed candidate in any subject should be provided an opportunity to improve his sessional marks by conducting a minimum of two examinations in theory and practical separately and the average may be considered for improvement.

The internal assessment marks (both in written and practicals taken together) should be submitted to the University endorsed by the Head of the Institutions 15 days prior to the commencement of the theory examinations.

A candidate to be eligible for appearing for the university examination should have appeared for the internal assessment examination conducted by the institution. This shall come into effect from November 94 examination.

The candidate should have appeared for theory, practical and oral examinations for securing a pass in a subject.

## 20. CLASSIFICATION OF SUCCESSFUL CANDIDATES

a) A successful candidate who secures 60% or above of the marks in the aggregate in his / her first appearance will be declared to have passed in the first class in that particular subject and a successful candidate securing 75% or above of the marks in the aggregate in any subject in the first appearance will be declared to have passed the examination in the subjects with distinction.

b) First class may be awarded to such candidates who have passed all the subjects at the first appearance and obtained 60% of marks and above in aggregate in all the subjects he / she had appeared.

c) Candidates who have passed all the subjects at the first appearance and obtained 75% of marks and above (in aggregate) in all the subjects he / she had appeared shall be awarded first class with distinction.

d) All other successful candidates shall be declared to have passed in second class.

## 21. EXEMPTION FROM RE-EXAMINATION IN A SUBJECT

Candidates who failed in the examination but obtained pass marks in any subject shall be exempted from re-examination in that subject.

## 22. CARRY-OVER OF FAILED SUBJECTS

a) A candidate is permitted to carry over 2 first year subjects to the second year, but shall pass the first year failed subjects before admission to the third year.

b) The candidate is permitted to carry over 2 second year

subjects to third year, but shall pass the second year subjects before admission to the fourth year.

c) The candidate is permitted to carry over 2 failed subjects in third year and appear along with the final year examination. A subject means theory, practical, oral taken together)

## 23. PRACTICAL TRAINING

A practical training of 3 months at the end of third academic year in Dispensing Hospital Pharmacy or a Pharmaceutical industry should be encouraged, which is optional.

## 24. PROJECT WORK

All the students shall submit a short report on a project study undertaken in any of the following subjects:

a) Pharmaceutics

b) Pharmaceutical Chemistry

c) Pharmacognosy

d) Pharmacology

The project shall be carried out under the guidance of a teacher in the College.

The project may be carried out either individually or in groups not exceeding 5 in number.

The project report shall be submitted in triplicate (typed copy not exceeding 25 pages)

The project will be evaluated by the examiner at the time of the practical examination (Final year) appointed by the University.

The projects shall be evaluated by qualitative grading as Excellent / Good / Average.

The evaluation of the project report shall not be considered for the purpose of pass / class / rank, but the grading shall be included in the Mark Sheet of the Final B. Pharm. Course.

## 25. SUBJECTS OF STUDY

**First B. Pharm**

i) Pharmaceutical Inorganic Chemistry

ii) Pharmaceutical Organic Chemistry

iii) Pharmaceutical Physical Chemistry

iv) Anatomy, physiology & Health Education

v) Mathematics including Bio-Statistics

**Second B. Pharm**

i) Bio-Chemistry

ii) Advanced Pharmaceutical Organic Chemistry

iii) Pharmacy Administration & Industrial Business Management.

iv) Physical Pharmaceutics

v) Preparative Pharmacy including History of Pharmacy

vi) Pharmacy Practice.

**Third B. Pharm**

i) Pharmacognosy and phyto Chemistry

ii) Chemistry of Synthetic Drugs

iii) Pharmacology & Toxicology

iv) Hospital & Clinical Pharmacy

v) Forensic Pharmacy

vi) Pharmaceutical Technology

**Fourth B. Pharm**

i) Chemistry of Natural Products

ii) Pharmaceutical Biotechnology

iii) Formulative & Industrial Pharmacy

iv) Advanced Pharmacognosy

v) Modern Methods of Pharmaceutical Analysis

vi) Project work

## 26. MARKS QUALIFYING FOR A PASS

50% of marks in the University theory examinations

50% of marks in the University Practical examinations

50% of marks in aggregate in theory, practical and oral

## 27. REGULATIONS FOR REVALUATION OF ANSWER PAPERS

As prescribed for other Under-graduate courses.

## 28. VACATION

6 weeks in an Academic year

| Sl. No. | Subject Code | Subject | THEORY | | | | | | | PRACTICAL | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Year of Study | Course of Study/ Week | Scheme of Examination | | | | Course of | Scheme of Examination | | | | | |
| | | | | | Duration | Univ. Marks | I.A. | Oral | Total | Study/ Week | Duration | Univ. Marks | I.A. | Record | Total |
| 1. | PCI | Pharmaceutical Inorganic Chemistry | I B. Pharm | 2Hrs | 3Hrs | 90 | 30 | 30 | 150 | 3Hrs | 3Hrs | 70 | 20 | 10 | 100 |
| 2. | PCII | Pharmaceutical Organic Chemistry | I B.Pharm | 3Hrs | 3Hrs | 90 | 30 | 30 | 150 | 3Hrs | 3Hrs | 70 | 20 | 10 | 100 |
| 3. | PCIII | Pharmaceutical Physical Chemistry | I B. Pharm | 2Hrs | 3Hrs | 90 | 30 | 30 | 150 | 3Hrs | 3Hrs | 70 | 20 | 10 | 100 |
| 4. | PGL-I | Anatomy, Physiology & Health Education | I B. Pharm | 3Hrs | 3Hrs | 90 | 30 | 30 | 150 | 3Hrs | 3Hrs | 70 | 20 | 10 | 100 |
| 5. | BMB | Mathematics including Biostatistics | I B. Pharm | 4Hrs | 3Hrs | 75 | 25 | - | 100 | - | - | - | - | - | - |
| 6. | PGL-II | Biochemistry | II B. Pharm | 3Hrs | 3Hrs | 90 | 30 | 30 | 150 | 3Hrs | 3Hrs | 70 | 20 | 10 | 100 |
| 7. | P-I | Physical Pharmaceutics | II B. Pharm | 3Hrs | 3Hrs | 90 | 30 | 30 | 150 | 3Hrs | 3Hrs | 70 | 20 | 10 | 100 |
| 8. | P-II | Preparative Pharmacy including History of Pharmacy | II B. Pharm | 3Hrs | 3Hrs | 90 | 30 | 30 | 150 | 3Hrs | 3Hrs | 70 | 20 | 10 | 100 |
| 9. | PC-IV | Advanced Pharmaceutical Organic Chemistry | II B. Pharm | 3Hrs | 3Hrs | 90 | 30 | 30 | 150 | 3Hrs | 3Hrs | 70 | 20 | 10 | 100 |
| 10. | PAIBM | Pharmacy Administration & Industrial Business Management | II B. Pharm | 3Hrs | 3Hrs | 75 | 25 | - | 100 | - | - | - | - | - | - |
| 11. | P-IV | Pharmacy Practice | II B. Pharm | 3Hrs | 3Hrs | 90 | 30 | 30 | 150 | 3Hrs | 4Hrs | 70 | 20 | 10 | 100 |
| 12. | | Hospital and Clinical Pharmacy | III B. Pharm | 3Hrs | 3Hrs | 75 | 25 | - | 100 | - | - | - | - | - | - |
| 13. | PC-V | Chemistry of Synthetic Drugs | III B. Pharm | 3Hrs | 3Hrs | 90 | 30 | 30 | 150 | 4Hrs | 4Hrs | 70 | 20 | 10 | 100 |
| 14. | PCOG-I | Pharmacognosy and Phyto Chemistry | III B. Pharm | 3Hrs | 3Hrs | 90 | 30 | 30 | 150 | 6Hrs | 3Hrs | 70 | 20 | 10 | 100 |
| 15. | PGL-III | Pharmacology & Toxicology | III B. Pharm | 3Hrs | 3Hrs | 90 | 30 | 30 | 150 | 4Hrs | 4Hrs | 70 | 20 | 10 | 100 |
| 16. | FP | Forensic Pharmacy | III B. Pharm | 3Hrs | 3Hrs | 75 | 25 | - | 100 | - | - | - | - | - | - |
| 17. | P-IV-A | Pharmaceutical Technology | III B. Pharm | 3Hrs | 3Hrs | 75 | 25 | - | 100 | - | - | - | - | - | - |
| 18. | PC-VI | Chemistry of Natural Products | IV B. Pharm | 3Hrs | 3Hrs | 90 | 30 | 30 | 150 | 4Hrs | 4Hrs | 70 | 20 | 10 | 100 |
| 19. | PC-VII | Modren Methods of Pharmaceutical Analysis. | IV B. Pharm | 3Hrs | 3Hrs | 90 | 30 | 30 | 150 | 4Hrs | 4Hrs | 70 | 20 | 10 | 100 |
| 20. | P-V | Formulative & Industrial Pharmacy | IV B. Pharm | 3Hrs | 3Hrs | 90 | 30 | 30 | 150 | 3Hrs | 4Hrs | 70 | 20 | 10 | 100 |
| 21. | P-VI | Pharmaceutical Biotechnology | IV B. Pharm | 3Hrs | 3Hrs | 90 | 30 | 30 | 150 | 3Hrs | 4Hrs | 70 | 20 | 10 | 100 |
| 22. | PCOG-II | Advanced Pharmacognosy | IV B. Pharm | 3Hrs | 3Hrs | 90 | 30 | 30 | 150 | 6Hrs | 4Hrs | 70 | 20 | 10 | 100 |
| 23. | PW | Project Work | IV B. Pharm | - | - | Grading | | Grading | - | - | - | - | - | - | - |

For the Candidates admitted from 1996-97

## PROFORMA

**Format for furnishing details of candidates in whose cases Condonation of shortage of attendance has been granted for appearing for THEORY EXAMINATIONS**

Name of the College :

Academic year for which condonation has been granted for:

| Sl. No. | Name of the Candidate (s) | Name of the Course and Branch | Total No of working days/ hours for the year/ Semester | Minimum No. of days required for attendance certificate (80%) | No. of days attended by the candidate | Actual Shortage of attendance |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 1. | | | | | | |
| 2. | | | | | | |
| 3. | | | | | | |
| 4. | | | | | | |
| 5. | | | | | | |

1. Requested Condonation of attendance in respect of the above candidate/s as the shortage of attendance is within the condonation limit.
2. The Demand Draft for Rs..... being the Condonation fee shortage of attendance, drawn in favour of the Registrar, the Tamil nadu Dr. M.G.R. Medical University, Chennai is / are enclosed.

Date:

Place:

Signature of the Principal with College Seal

Signature of the Head of the University Departments with seal

Note:

1. The fee prescribed for condonation of shortage of attendance is Rs. 1000/- per student.
2. The forms should reach the University at least 15 days before the commencement of respective University Examinations.
3. A separate list (Three copies Degreewise) showing candidates who have not earned the required attendance and are not eligible for condonation should also be sent at least 15 days before the commencement of Examinations.

## *SYLLABUS*

## 1-B. PHARMACY

## PHARMACEUTICAL INORGANIC CHEMISTRY

THEORY

1. Atomic structure and valency. Development of periodic classification of elements and discussion of the periodic table on the modern conception of atomic structure and its importance. Radioactivity, Radio isotopes and Pharmaceutical applications of Radiopharmaceuticals viz. Ferric Citrate ($^{59}Fe$) Sodium iodide ($^{181}I$) Sodium phosphate ($^{32}P$) and cyanocobalamin ($^{58}Co$):

2. Sources of impurities in Pharmaceutical substance: Official limit tests : Limit test for chloride, sulphate, iron, heavy metals, arsenic and lead.

3. A study of theory of assays involving neutralisation, oxidation, precipitation and gravimetric methods. Study of theory and choice of indicator in assays.

4. a) A systematic study of the following Inorganic Compounds for their preparation, properties, assay and uses. Official compounds of Oxygen, Sulphur, Selenium, Halogens, Nitrogen, Phosphorous, Boron, Silicon, Titanium, Calcium, Barium and lead. (Mention about Pharmacopoeias and details about typical monograph of drugs.)

b) Selected test for purity as given below:

i) Setting property of plaster of Paris.

ii) Oxidising substance in Oxygen.

iii) $CO_2$ and CO in Oxygen.

iv) Magnesium and alkali metals in Calcium Chloride.

v) Acidity and Stability in Hydrogen Peroxide.

vi) Sucroe and reducing sugars in calcium gluconate etc.

5. Official compounds of Sodium Potassium, Copper, Silver, Gold, Magnesium, Zinc, Mercury, Arsenic, Antimony, Bismuth, Iron and Aluminium.

Selected test for purity viz.

a) Iodides and Bromides in Sodium Chloride

b) Sulphate and sulphite in sodium thiosulfate

c) Iron in Sodium metabisulphite.

d) Iodides and chlorides in Potassium bromide.

e) Cyanides in potassium permanganate.

g) Lead in Zinc Chloride.

h) Coarse particles in Light Kaolin

i) Water and alcohol soluble dyes in calamine.

j) Ferric ion and reducing sugars in ferrous gluconate.

k) Microbial limit in milk of Magnesia

l) Acid absorption by Magnesium trisilicate.

m) Neutralising capacity of Aluminium hydroxide.

6. Methods of preparation and uses of the following Chemicals / reagents used in Pharmaceutical analysis.

| | |
|---|---|
| 1. Sodium edetate | 2. Sodium Thiosulfates |
| 3. Titanous chloride | 4. Ferric sulphate |
| 5. Hydrogen Peroxide | 6. Nessler's reagent |
| 7. Karl Fischer's reagent | 8. Benedict's reagent |
| 9. Mayer's reagent | 10. Lithium Aluminimum hydride |
| 11. Boron triflouride | 12. Thionyl chloride |
| 13. Periodic acid | 14. Perchloric acid |
| 15. Alumina | 16. Silicagel |

7. Theory of Co-ordination compounds with special reference to applications in Pharmacy and Pharmaceutical analysis viz. E D T A, Dimercaprol, Penicillamine.

**PRACTICALS**

1. Limits test - Chlorides, Sulphates, Arsenic, Iron and Heavy metals in various drugs and chemicals.

2. Assy of Pharmaceutical inoranic compounds involving acid - base, Argentimetry, Iodimetry, Redox titration, Complexometry and Gravimetry.

3. Qualitative analysis of mixture of inorganic salts containing Two acid and Two basic radicals.

## REFERENCES


1. Pharmaceutical Inorganic Chemistry by Discher.
2. Pharmaceutical Chemistry by M.L. Schroff.
3. Bentley and Drivers Pharmaceutical Chemistry.
4. Inorganic Medicinal and Pharmaceutical Chemistry by Block Roches, Soine and Wilson.
5. Advanced Inorganic Chemistry by G.R, Chatwal.
6. Indian Pharmacopoeia

# PHARMACEUTICAL ORGANIC CHEMISTRY

## THEORY

### Atomic and Molecular Structure :

Molecular orbitals, ionic bond, covalent bond, multiple bond, polarity of bond.

Hydrogen bond. Organic compound and their purification. organic formulae and nomen clature.

Nomenclature of organic compounds including polynuclear aromatic compounds.

### Alkanes :

General methods of preparation. Reaction of alkanes with special reference to substitution reaction, free radical chain reaction and bond dissociation energy.

### Petroleum :

Official Pharmacopoeial compounds, their test for purity and assay. Light liquid paraffin, liquid paraffin, soft paraffin, white soft paraffin, hard paraffin, and ichthamnol.

### Alkenes :

General methods of preparation of alkenes, structure of ethylene, carbonium ion theory, reactions of carbon - carbon double bond. Addition reaction, Markownikoff's rule peroxide effect, electrophilic addition, free radical addition and ozonolysis.

### Alkynes and Dienes :

General methods of preparation and reactions of alkynes, carbon - carbon triple bond, dienes and conjugated dienes.

**Alicyclic Compounds :**

Ring formation, Ring size and stability, Bayers strain theory and Diels alder reaction.

**Benzene :**

Aromatic character, concept of resonance, its applications and structure of Benzene.

**Substitution in Aromatic Ring :**

Nucleophilic, Electrophilic Substitution, Mechanism of Nitration, Halogenation, sulphonation, alkylation and acylation and orientation.

Preparation, test for purity, assay and medicinal uses of prepared coal, dicophane, gamaxene, saccharin, chloramine and dichloramine T.

**Alkyl Halides and Aryl Halides :**

General method of preparation of alkyl and aryl halides, Nucleophilic substitution (SN 1, SN 2) reaction, Elimination reaction, (El & E2), Elimination Vs substitution. Preparation, test for purity, assay and Medicinal uses of Ethyl chloride, chloroform, Trichloroethylene, Tetrachloroethylene Iodoform.

**Alcohols :**

General methods of preparation and reaction of alcohols, Hydrogen bonding, structure of methyl alcohol, Di and Tri hydricalcohols, Glycol and glycerol, their synthesis and uses. Thio-alcohols, preparation and test for purity, assay and medicinal uses of the following Pharmacopoeial compounds : Tar, Ethyl alcohol-rectified spirit, Industrial methylated spirit, Chlorbutol, Cetostearyl

alcohol, Benzyl alcohol, mephenesin, Glycerol, Dimercaprol, Propylene Glycol, Glyceryl trinitrate and Wood Alcohols.

**Caboxylic Acids and Esters :**

General methods of preparation and reaction: Acid chlorides Amides, Snhydrides, Esters, their preparations from carboxylic acid. Synthetic uses, saponification, Di and tricarbozylic acid. Preparation, tests for purity, assay and medicinal uses of the following Pharmacopoeial compounds :-

Acetic acid, Trichloroacetic acid, Lactic acid, oleic acid, undecenoic acid. Ethyl oleate, sodium lauryl sulphate, tartaric acid, citric acid, succinic acid, oxalic acid, benzoic acid, benzyl benzoate, Dimethyl phthalate, salicyclic acid, Mathy salicylate, Aspirin, Sodium amino Salicylate, Phenoiodol, Lopanoic acid, Ethyl biscoumacetate and Balsams.

**Aldehydes and Ketones (Aliphatic and Aromatic) :**

General methods of preparations and reactions, preparations, tests for purity, assay and medicinal uses of the following Pharmacopoeial compounds. Formaldehyde solution, paraldehyde, Acetone, Chloral hydrate, Hexamine, Benzaldehyde and Vanillin.

**Aliphatic and Automatic Amines:**

General methods of preparations of amines, quaternary ammonium salts, Ring substitution in aromatic amines, Urea and ureides.

Preparation, test for purity, assay and medicinal uses of ethanolamine, Mustine hydrochloride, ethylenediamine hydrate, urethane, urea, carbromal, aniline, Amphetamine, Sulphanilamide and Acetanilide.

**Diazonium Compounds :**

Preparation, reaction and synthesis involving diazonium salts.

**Phenols :**

Preparation, test for purity, assay and medicinal uses of important phenols.

**Acetoacetic ester & Malonic ester :**

Preparation and synthetic uses (excluding sulfonamides). Ethers : General method of preparation and properties. Compound anaesthetic ethers.

**PRACTICALS**

1. Syn thesis of some organic compounds involving single step reactions like nitration, halogenation, acetylation and hydrolysis.

2. Assay of organic compounds involving acidimetry, alkalimetry, iodimetry etc.

3. Qualitative analysis of simple organic compounds for elements present, determination of saturation or unsaturation, aliphatic or aromatic and functional groups.

**REFERENCES**


1. Organic Chemistry by I.L. Finar.
2. Organic Chemistry by Morrison and Boyd.
3. Organic Chemistry by pine, Hendrickson, Cram and Hammond.
4. Bentley and Drivers Textbook of Pharmaceutical Chemistry.
5. Organic Chemistry by P.L. Soni.

## PHARMACEUTICAL PHYSICAL CHEMISTRY

### THEORY

1. Physicochemical properties of gases, liquids and solids, Density, Surface tension, molecular volume, parachor, viscosity refractivity, polarisation of light, optical activity, dipole moment, absorption and emission spectra. X-ray analysis, physical properties, Molecular structure and chemical bonding, Crystal form, crystal lattices, Binding forces and properties of crystals.

2. Equilibrium : Law of Mass action, effect of temperature and pressure on chemical equilibrium. Energy of activation, Heterogeneous equilibrium.

3. Dilute Solutions : Osmosis and Osmotic pressure, Vapour Pressure, Raoults law. Molecular weight determination using measurement of Osmotic Pressure, vapour pressure, elevation of boiling point and depression of freezing point, Abnormal molecular weights.

4. Solutions : Gases in liquids, henry's law. Liquids in liquids, mutual solubility of liquids and critical solution temperature, partially miscible, completely miscible and completely immisicible liquids, constant boiling mixtures. Theory of steam distillation, solubility curve and supersaturation. Distribution law, partition coefficient, and process of extraction.

5. Electrochemistry : Electrolytic conductance Faraday's laws of electrolysis, conductivity of electrolyte and its determination. Ionic mobility, Kohlraush law and transport number. Voltaic cells, reversibility, polarisation of electrodes. Single electrode potential, Standard oxidation - reduction potential. Reference electrode and indicator electrodes.

6. Ionic Eqilibria : Ostwalds dilution law, Degree of ionisation, Hydrogen ion concentration and its determination, Hydrolysis of

salfs, Degree of hydrolysis. Ionic product of water, Buffer solution, indicator, Solubility product, Common ion effect.

7. Thermo Chemistry : Heat of reaction, heat of solution, heat of formation and heat of neutralisation and Hess law.

8. Phase rule and its application to system of one component, triple point and sublimation, hydration and dehydration, efflorescence exsiccation, deliquescence and hygroscopicity, eutectic mixture.

Catalysts : Theory of catalysts and its application in Pharmacy.

9. Adsorption : Theory of adsorption and its application.

10. Principle's of gas Analysis.

**PRACTICALS**

1. Determination of Physicochemical contents like Refractive index, surface tension, viscosity, optical rotation etc.

2. Determination of rate of reaction in zero, first order reactions.

3. Experiments based on Raoult's law like depression of freezing point, elevation of boiling point etc., molecular weight determination.

4. Determination of partition coefficient of Organic substances.

5. Buffer solution, determination of pH.

6. Experiments based on adsorption principles.

**REFERENCES**

1. Textbook of Physical Chemistry by Glasstone & Lewis.

2. Jenkin's quantitative Pharmaceutical Chemistry by kneven.

3. Principles of Physical Chemistry by S.H.Maron.

4. Physical Chemistry by Gerasimov.

5. Physical Pharmacy by Martin.

## ANATOMY, PHYSIOLOGY & HEALTH EDUCATION

### THEORY

**Anatomy and Physiology:**

1. General: The general build of the human body. Classification into various systems, Bones of the trunk, limbs and the skull, joints of body.

2. Blood: Its composition plasma and serum, corpuscles, platelets, normal quantity of blood in the body. Clotting of blood and its value in daily life.

3. Circulation: The heart, its anatomical structure, different types of Blood circulation chamber and valves, cardiac cycle, heart sounds. Blood pressure-pulse, blood vessels, artery, wein and capillary (circulation of blood) purpose of circulation.

4. Respiration: Respiratory apparatus, Respiratory movements, external respiration, internal or tissue respiration, composition of inspired and expired air. regulation of respiration, artificial respiration.

5. Digestion and Nutrition: Organs - Functions of different organs and accessory glands, salivary, gastric and intestinal, digestive enzymes, bile, absorption, metabolism, defalcation.

6. Food: Proximate Principles: Physiological values of carbohydrates, fats, proteins, vitamins, minerals, roughage and water, balanced diet.

7. Urinary System: Structure of kidney. Mechanisms of urine formation, composition of urine. Function of ureter and bladder. Mechanism of micturtition. Daily out-put of urine. Factors controlling daily out-put.

8. The Skin: Epidermis, dermis epidermal structure, nails, haris and glands. Perspiration, Function of the Skin.

9. Nervous System: The meninges, cerebrum, seat of intelligence, will-power memory, inhibition and sensation, cerebellum. Regulation centre of posture and equilibrium, midbrain, pons and medulla, spinal cord, nerve fibres, reflex action. Autonomic nervous system.

10. Sense Organs: Structure and function: Eye, ear, nose, tongue and skin.

11. Endocrine: Thyroid, pancreas, pituitary, suprarenal and gonads.

12. Reproductive System.

13. Concept of health and disease, basic principles of rural health and sanitation, population problem, family planning programme principles underlying family planning methods, types of contraceptives, brief outline of bacterial, rickettsial, viral, fungal, protozoal infections, worm infestations prevention of contagious diseases.

## PRACTICALS

### Laboratory Experiments:

1. To study stimulus response phenomenon as exemplified by the response of the frog gastrocnemius muscle carrying intensities of faradic stimulation.

2. To study factor determining the extent of muscular contraction summation of inadequate and adequate stimuli.

3. To study additional factors which may influence muscular response. The effect of previous stimuli is observed-treppe and fatigue. Influence of load and muscle length on work.

4. The study of the functions, composition and properties of blood, counts, differentials, haemoglobin determination, sedimentation rate, coaulation time, grouping, blood pressure measurement.

5. A study of cardiac activity, normal cardiac action of frog observed. Gradient of automaticity, effect of nervous factors, cardiac activity.

6. Histology:

a) Histology - General - Epithelium - Connective tissues - muscle and nervous tissues.

b) Reproductive organs, alimentary system, endocrines, lymphoid -tissue.

**REFERENCES**

1. Human Physiology (Vol.I) by Chandi Charan Chatterjee, Medical Allied agency, Calcutta.

2. Human Physiology (Vol.II) by Chandi Charan Chatterjee, Medical Allied Agency, Calcutta.

3. Best & Taylor's Physiological basis of Medical Practice II Edition by John B. West, M.D., Ph.D. (Williams & Wikkins, Baltimore/London).

4. Physiology of the Human Body by C. Guyton, M.D. (Saunders College Publishing Holt-saunders Japan).

5. Human Physiology by Chakrabarti, Ghosh & Sahana, The New Book tall. Calcutta.

6. Atlas of Human Anatomy with integrated text by J.A. Gosling M.D., P.F. Harris, M.D., and J.R. Humpherson, M.B.

(Churchill Livingstone Edinburgh, London, Newyork).

7. Samson Wright's applied Physiology by Cyril A. Keele, Eric Neil and Norman Joels.

8. Anatomy & Physiology in Health and Illness Kathleen. J.W. Wilson, E.L.B.S.

9. A Textbook of practical physiology by V.G. Ranade, Shaline Pradhan and Dr. P.N. Joshi.

10. A Textbook of practical physiology by C.L. Ghai, III Edition (Jaypee Brothers, New Delhi-2.)

11. Textbook of antomy and Physiology by Anthony & Thibodeau (The C.V. Morby Company).

12. Textbook of Preventive and Social Medicine by J.E. Park and K. Park (M/S Banarsidas Bhanot)

13. Social and Preventive Medicine by Yash Pal Bedi (Atma Ram & Sons, Delhi-6)

14. Medical Laboratory Technology by Dr. Ramnik Sood, M.D., (Jaypee Brothers).

# MATHEMATICS INCLUDING BIOSTATISTICS

**Mathematices:**

1. Algebra: Partial fractions, statement of the following theorems (without proof), Binomial, exponential and logarithmic and summation based on these three series.

2. Matrices (up to 4th order) set theory.

3. Trignometry: Complex numbers, Dimoivre's Theorem, expansions, Sin (no), Cos No. Sin No, Cos No Hyperbolic functions, simple problems.

4. Calculus: Limits, differential calculus coefficient of integration, integration of functions, integrations by parts (simple integrals) Laplace transformation.

5. Differential Equations:

a) Variable Separable.

b) Homogeneous equations.

c) Non-Homogeneous but linear coefficients.

d) Linear equation of first order.

c) Equations reducible to linear form.

**STATISTICS:**

1. Scope of statistical methods of Medicine and Pharmacy.

2. Collection of Data.

3. Classification and tabulation of collected data.

4. Visual aids, diagrams, charts and graphs.

5. Measure of central tendency.

6. Dispersion.

7. Theory of sampling.

8. Statistical inference.

9. Regression and correlation

10. Probabilities.

**REFERENCES**

1. Differential calculus by Shanthi Narayan.

2. Integral Calculus by Shanthi Narayan.

3. Differential Equations by Shanthi Narayan.

4. Trigonometry by S. Natarajan.

5. Differential calculus by T.K. Manicavachagam Pillai.

6. Integral Calculus by T.K. Manicavachagam Pillai.

7. Differential Equations by T.K. Manicavachagam Pillai.

# II B. PHARMACY

## BIOCHEMISTRY

THEORY

**Chemical Aspects:**

Chemical nature of carbohydrates, lipids, proteins.

**Carbohydrates:**

Classification, saccharides including polysaccharides starchglycogen-dextrin, inulin, cellulose etc.

**Lipids:**

Definitions, classification, chemical nature and properties of fatty acids, fats, sterols.

**Proteins & Amino Acids:**

Classification, biosynthesis and properties of protein and amino acids, insulin.

**Macromolecules:**

Physical and chemical properties, structures of protein, Haemoglobin, immunoglobulins, nucleoprotein, properties of macro molecules in general.

**Separation & Analysis of carbohydrates, lipids & Proteins:**

**Vitamins:**

Chemistry, source, assay, requirement, functions, deficiency manifestations.

**Hormones:**

Chemical nature, properties and biochemical functions, Biochemical mode of action of hormones.

**Enzymes**

Enzyme kinetics, classification and their properties, mechanism of action, coenzymes, antimetabolites, enzyme induction inhibition.

**Bioenergetics & TCA Cycle:**

Digestion, absorption and metabolism of carbohydrates, lipids proteins and nucleoprotein.

**Transport across biomembranes:**

Nucleic acids, D.N.N.Structure, t-RNA structure:

**Mineral Metabolism:**

Calcium, phosphorous, magnesium, iron, sodium, potassium, other trace elements.

**Nutrition :**

Principles of nutrition and nutritional significance of carbohydrates, lipids and proteins and major food stuffs. Principles of biochemical genetics, Biochemistry of urine, CSF and faeces. Constituents of Blood. Functional tests of liver and kidney. Experiments on metabolism and balance studies. Elementary basis of boichemical mode of action of drugs, liposome benzoxidation.

**PRACTICALS**

1. Identification of carbohydrates, proteins and fats.

2. Identification of normal and abnormal constituents of urine.

3. Estimation of chlorides, glucose, titrable acidity and ammonia and creatinine in urine.

4. Acid hydrolysis and action of salivary amylase on starch.

5. Experiment on food products (Wheat flour, milk and Potato)

6. Isolation of casein from milk.

7. Isolation of RNA from yeast.

8. Estimation of Blood glucose, Blood cholesterol, SGPT activity, SGOT activity.

9. Action of urease (Horse-gram powder) on urea. (Demonstration only).

10. Separation of amino acids by P.C.

11. Identification of sugars in fruit juices by TLC.

**REFERENCES**

1. Principles of Biochemistry by Lehninger.

2. Harper's Biochemistry

3. Biochemistry by Stryer

4. Text Book of Bio-Chemistry by Rama Rao.

5. Text Book of Bio-Chemistry by Deb.

6. Practical Bio-Chemistry by R.C. Gupta &S. Bhargavan.

7. Introduction of Practical Bio-Chemistry by David T. Plummer (II Edition)

8. Practical Bio-Chemistry for Medical students. By Rajagopal & Ramakrishna.

9. Hand Book of practical Bio-Chemistry by V.K. Malhotra.

## ADVANCED PHARMACEUTICAL ORGANIC CHEMISTRY

### THEORY

**1. Polynuclear Hydrocarbons:**

Preparation and chemical reactions of Diphenylmethane, Diphenylethance, Triphenylmethane, Naphthalene, Anthracene, Phenan threne, Structure of Naphthalence and Phenanthrene, skeleton structures of medicinally importance compounds belonging to the above series.

**2. a) Optical Isomerism:**

Streoisomerism, Definition, Tetrahedral carbon atom, conventions used in stereochemistry, elements of symmetry. Racemic modifications and properties, Resolution of racemic modifications. Conformational analysis.

**b) Geometrical Isomerism:**

Nature, rotation about a double bond. Modern theory of double bonds, Nomenclature of isomers. Determination of configuration, stereochemistry of cyclic compounds.

3. Stereochemistry of Biphenyl compounds & Nitrogen compounds:

Walden Inversion: Nature, factors affecting Mechanism, Asymmetric synthesis. Configuration of Biphenyl molecule, optical activity, hybridisation of orbitals. Stereochemistry of Nitrogen compounds, Amines and Oximes.

**4. Synthetic tools**

Catalytic hydrogenation, Dehydrogenation, Metalhydride reduction, Reduction with hydrazine and its derivatives, Birch reduction, clemmensen reduction, Meerwin-Pondroff reduction, Oxidation with perchloric acid, lead tetra acetate, Mercuric acetate and Seleuium Oxide, Beckmann rearrangement, Schmidt rearrangement and Darzein reaction.

## 5. Heterocycle Chemistry:

Classification of Heterocyclic compounds, nature and nomenclature. Preparation and important reactions of pyrrole, furan, thiophene, pyrazole, imidazole, oxazole, isoxazole, thiazole, pyridine, pyrimidine, indole, quinoline, Isoquinoline, acridine, phenothiazine, A study of the skeletin structure and medicinal uses of the following heterocyclic derivatives used in pharmacy-Phenazone, Nikethamide, Isoniazid, Mepyramine, Benzhexol, Iodoxyl, Diodone, Nicotinic acid, Propyliodone, chiniofoorm, chloroquine, primaquine, Histamine, Carbimazole, Tolazoline, Naphazoline, Antazoline, Phenytoin, Methoin, Pyrimethamine, Primidone, Piperazine, Methylthiouracil, Diethyl carbamazine, Mepacrine, Phenergan, Sulphathiazole.

## PRACTICALS

1. Synthesis of Organic compounds involving two step reactions including Heterocyclic compounds.

2. Assay of Pharmaceutical Organic compounds based on functional groups.

3. Qualitative analysis of mixture of organic compounds containing 2 compounds-methods of seperation and analysis.

4. Practical based on stereo-chemical aspects like Walden inversion (eg. sucrose).

## REFERENCES

1. Organic Chemistry by I.L. Finar.

2. Organic Chemistry by Morrison and Boyd.

3. Advanced Organic Chemistry by Jerry March.

4. Stereo Chemistry of Carbon Compounds by E.L. Eliel.

5.. Stereo Chemistry by Potapov.

# PHARMACY ADMINISTRATION & INDUSTRIAL BUSINESS MANAGEMENT

THEORY

**Economices:**

1. Principles of economics with special reference of the Laws of demand and supply. Demand schedules and demand curves. Consumption and organisation of production.

2. Labour distribution, labour problems, General conditions affecting demand for and supply of labour, Labour legislations, Labour Welfare, Trade, Unions.

3. Inland and Foreign trade, Procedure for exporting and importing of goods. Principles governing International trade. Theory of comparative cost. Foreign exchange.

4. Principles of Insurance. General, Fire and Marine Insurance.

5. Sales organisation in business house, factors governing sale, sales department, sales agencies and their control. Statistics, graphs and charts, their aid to sales control, co-operative sales, scientific advertising.

**Management:**

6. Organisation and working of commercial offices. Commercial correspondence, filling and indexing systems.

7. Factory organisation and Management.

8. Methods of marketing, departmental stores and multiple shops. Marketing and merchandising. Problems of Pharmaceutical manufacturers, wholesalers and retail Pharmacists. Market research.

9. General study of patent and trademarks Act, Law of contracts, Factory and Shops Establishments Act.

**Accountancy:**

10. Principles of accounting, Ledger posting and Preparation of Trial Balance, Capital and Revenue. Columnar cash book, Treatment of Bank account. Preparation of Profit and Loss Account and Balance Sheet, elements of Income Tax, Treatmentary Bills.

## REFERENCES


1. Management by James A.F. Stoner.

2. Statistics for Management by Richard I Levin.

3. Personnel Management by Arun Monappa.

4. Business Organisation and Office Management by Santhosh Bushan.

5. Business Management by Dinkar.

6. Modern Business correspondence by Lartside.

7. Business Administration by Hall.

8. Principles of Economics by V. Ganapathy.

9. The Industrial Economy of India by S.C. Kuchhal.

10. Accountancy and Commerce by B.S. Raman.

# PHYSICAL PHARMACEUTICS

THEORY

**1. Solutions:**

Solubility and factors affecting solubility, steady-state diffusion, dissolution, drug release, diffusion principles in biology systems, isotonic solutions and calculation involved.

**2. Colloids:**

Introduction, types of colloidal systems, optical properties of colloid, kinetic properties of colloids, electric properties of colloids, solubilisation.

**3. Coarse Dispersions:**

Suspensions, interfacial properties of suspended particles, settling in suspensions, formulation of suspensions, emulsion, theories of emulsification. Physical stability of emulsions, preservation of emulsions, rheologic properties of emulsions, phase equilibria and emulsion formulation, special emulsion system, semi solids and gels.

**4. Surface & Interfacial Phenomena.**

Liquid interfaces, adsorption at liquid interfaces, adsorption at solid interfaces, Electrical properties of interfaces, surface tension and its determination, classification of surfactants.

**5. Kinetics:**

Rates and orders of reaction, influence of temperature and other factors on rates, decomposition and stabilisation of medicinal agents, kinetics in the solid state, accelerated stability analysis, kinetics of drug transport in vivo.

**6. Thermodynamics:**

Concepts of laws, Macroscopic thermodynamic properties, Application, to closed and open systems. Microscopic approach to entropy. Equation of heat capacity status. Thermodynamics of nonreacting mixtures, Heat capacity.

Catalysts: Theory of Catalysts and its application, in Pharmacy.

**7. Micromeritics:**

Particle size and size distribution, methods of determining particle size, particle shape and surface area, methods of determining surface area, pore size, derived properties of powders.

**8. Rheology:**

Viscosity, newtonian and non newtonian fluids, thixotropy and its application, Rheology of disperse system, viscometers.

**9. Complexation & Protein Binding:**

Metal complexes, organic molecular complexes, inclusion compounds, methods of analysis, protein binding, complexation and drug action, crystalline structure of complexes, thermodynamic treatment of stability constants.

**10. Photochemistry:**

Introduction, sources of photochemical radiation, light absorption basic laws of photochemistry, photo chemical reactions and photosensitisation.

## PRACTICALS

1. Determination of Interfacial properties such as surface tension, CMC, power of surfactant.

2. Experiments covering viscosity and effect of viscosity on sedimentation rate.

3. Determination of rates of reaction.

4. Particle size distribution analysis and determination of particle size.

5. Study on suspension by controlling flocculation and stability evaluation.

6. Study on flow properties of powders (Angle of Repose etc.,)

7. Study on colloids: Some colloidal preparation & its stability on addition of Electrolytes.

8. Study on emulsions: Stability analysis & particle size analysis.

9. Experiments pertained to other theory chapters.

10. Comparison study on adsorbents in various pharmaceutical preparations (Ex.) Aromatic waters.

## REFERENCES

1. Physical Pharmacy by Martin.

2. Experimental Pharmaceutics by Eugene, Parott.

3. Tutorial Pharmacy by Cooper & Gunn.

# PREPARATIVE PHARMACY INCLUDING HISTORY OF PHARMACY

## THEORY

1. Pharmacy Profession: Pharmacy as a career, Pharmaceutical Education, Registration as a Pharmacist, Evolution of Pharmacy Profession-earlier period, middle ages, modern, European and American Pharmacy, Pharmacopoeia of India and other countries (B.P.U.S.P., International).

2. Metrology: Metric weights and Measures, Basic and derived S.I. weights and measures. Weighing-selection and care of weights and balances. Sensitivity, reciprocal and minimum weighable quantities. Density-absolute, apparent and relative, specific gravity, hydrometers, westphal balance, Specific volume.

3. Liquids: solutions, syrups, dry syrups, elixirs, spirits, aromatic waters, liquids for external use-lotions, liniments, ear drops, throat paints, gargles, eye drops, glycerines, collodions.

Definitions, general formulation, manufacturing procedures. Uses of official and other products in common use.

4. Semisolids: Ointments, creams, pastes, jellies, Definitions, bases, general formulations, manufacturing procedures and uses of official and other products in common use.

5. Suppositories: Ideal requirements, different bases, manufacturing procedures and uses of official and other important products.

6. Powders: Advantages and limitations as dosage form, manufacturing procedure and equipments, special care and problems in manufacturing powders, powders of I.P. and their uses, effervescent granules and salts and their specific uses.

7. Crude Extracts: Principles and methods of preparation of soft and liquid extracts of I.P. from fresh and dry drugs and their uses.

8. Allergenic extracts: Types of allergens, preparation, extracts, testing and standardistion of extracts, general preparations.

9. Medical Gases: Official medical gases and their uses, containers and fillings, handling and storage.

10. Radio Pharmaceuticals: Therapeutic and diagnostic uses, facilities and work area, preparation of radio pharmaceuticals.

**PRACTICALS**

**solutions:**

1. Iodine solutions
2. Lysol
3. Strong Ammonium acetate solution IP'66.

**Syrups:**

1. Syrup IP
2. Tolu syrup IP'66
3. Parrish's syrup
4. Syrup of Ferrous iodide
5. Any one commercially available cough syrup.

**Elixirs:**

1. Terpin hydrate elixir IP
2. Piperazine citrate elixir BPC

**Spirits:**

1. Peppermint spirit BPC
2. Chloroform spirit IP'66
3. Aromatic spirit of Ammonia

**Aromatic Waters:**

1. Camphor water IP'66
2. Chloroform water IP'66
3. Dill water BPC
4. Concentrated Dill water BPC
5. Concentrated Peppermint water BPC

**Lotions:**

1. Calamine lotion IP
2. Benzyl benzoate lotion USP

**Liniments:**

1. Turpentine liniment IP'66
2. Camphor liniment IP'66
3. White liniment BPC

**Ear Drops:**

1. Hydrogen peroxide ear drops BPC
2. Chloramphenicol ear drops BPC
3. Boric acid ear drops BPC

**Throat Paints:**

1. Mandl's paint
2. Tannic acid glycerine IP'66

**Gargles:**

1. Phenol gargle BPC
2. Phenol and potassium chlorate gargle BPC

**Eye Drops:**

1. Chloramphenicol Eye drops BP
2. Zinc sulphate eye drops BP
3. Ephedrine HCl eye drops BPC

**Glycerins:**

1. Borax Glycerin IP'66
2. Boric acid glycerin IP'66
3. Starch Glycerin IP'55

**Collodions:**

1. Pyroxylin IP'66
2. Collodion USP
3. Flexible collodion IP:66
4. Salicylic acid collodion IP'66

**Ointments:**

1. Simple ointment IP

2. Sulphur ointment IP

3. Cetrimide emulsifying ointment BPC

**Creams:**

1. Vanishing Cream

2. Cold Cream

**Pastes:**

1. Zinc and salicylic acid paste BP

2. Zinc Gelatin IP'66

**Jellies:**

1. Sulphaniamide Jelly BPC

**Suppositories:**

1. Indomethacin suppositories BP

2. Aminophylline Suppositories

3. Iodoform suppositories.

**Powders:**

1. Phenobarbitone powder

2. Digitalis powder

3. Compound powder of Tragacanth BPC

4. Compound Effervescent Powder BPC

5. Compound sodium chloride and Dextrose oral powder BP

6. Methyl cellulose granules BPC

7. Effervescent granules BPC

**Crude Extracts:**

1. Compound tincture of Benzoin IP'66
2. Tincture of orange IP'66
3. Digitalis tincture BPC
4. Liquid extract of Liquorice BPC

## REFERENCES


1. Tutorial Pharmacy by Carter.
2. Register of General Pharmacy by Carter
3. Remington's Pharmaceutical Sciences
4. Theory and Practice of Industrial Pharmacy by Lachman.
5. Cooper & Gunn's Despising for Pharmaceutical Students.
6. Indian Pharmacopoeia & British Pharmceia.
7. Introduction to Pharmaceutical Dosage forms by Ansel.

# PHARMACY PRACTICE (II B. PHARM)

1. Prescription Order: Definition, form, handling.

2. Weights and Measures in Metric system (all other systems are to be avoided), percentage calculations, calculation based on Alligation method (all about proof spirit, over proof, under proof and alcohol dilution, etc.)

3. Latin terms used in prescription, definition of posology, factors determining doses of drugs, adult doses of important drugs and their route of administration, methods of calculating children doses.

4. Dispensing and compounding procedures in a community pharmacy with regard to mixtures, emulsions, applications, inhalations spray solutions, powders, powders in hard gelatin capsules, (manual capsule filling machine to be taught), tablet triturate, mouth wash, gargles, eye lotions, douche, enteric coating of capsules using formalin.

5. Containers and closures for packaging products like mixtures emulsions, powders, tablets, lotions, liniments, applications, oinments,

6. Patient medication counselling.

Maintenance of records and pricing of the prescription.

7. Prescription refilling, copies of the prescription order and importance of patient compliance with prescribed medication, monitoring drug utilisation.

8. Incompatibility: definition, physical, chemical, therapeutics incompatibilities, pharmacist responsibility in overcoming such incompatibilities in prescriptions.

9. Safe use of medications in Hospital: Errors in medication factors contributing such errors, corrective measures.

10. Surgical supplies: An account of Surgical dressing like primary wound dressings, absorbents, bandage, adhesive tapes, protectives, sutures ad suture materials (method of preparation are to be avoided).

11. Community Pharmacy: Family Planning, first aid, communicable diseases, preventive measures, code of ethics for community pharmacists. Applications of computer in pharmacy.

**BOOKS RECOMMENDED**


1. Remington's Pharmaceutical Sciences.
2. Cooper and Gunn's Dispensing for Pharmaceutical students by Colin Gunn and S.J. Carter.
3. Dispensing of Medication by Robert E.Ling.
4. Introduction to pharmaceutical dosage forms by Ansel.
5. Goodman Gilman's The pharmacological basis of therapeutics.
6. Hospital Pharmacy by William. E. Hassan, Jr.
7. A text book of Hospital Pharmacy by S.H. Merchant 7 J.S Quadry


**PRACTICALS**

(Typical prescriptions are to be given for all exercises)

1. Dispensing and labelling of simple mixture, mixture containing diffusible and indiffusible medicaments, precipitate forming liquids, effervescent mixtures, mouth washes, gargles.
2. Dispensing and labelling of emulsions (all types), applications, inhalations, powders, powders in hard gelatin capsules (using manual capsule filling machine).
3. Giving number of exercises explaining physical, chemical and therapeutical incompatibilities and methods to overcome such incompressibilities. Dispensing such corrected prescription order and labelling.
4. Exercises based on percentage calculations. Alligation methods.

# III-B. PHARMACY

## PHARMACOGNOSY AND PHYTOCHEMISTRY

THEORY

1. Introduction, historical background, present status and future scope Pharmacognosy.

2. a) General principles of cultivation, collection of vegetable drugs having commercial significance from wild and cultivated sources their merits and demerits.

b) Drugs improvements.

c) Drugs deterioration, causative factors and prevention.

d) Strong of crude drugs including manners and conditions of storage.

3. Methods of drug evaluation and standardisation (Wherever applicable) including quantitative microscopy for identification and detection of adulteration.

4. I) Detailed study of the drugs of biological origin or products from as given in IP & IPC, with suitable example of products used in Homeopathic, Ayurvedic and Unani systems of medicine. Main emphasis shall be on sources, cultivation and collection, preparation for the market, diagnostic characters (both macroscopical and microscopical - whichever applicable), constituents, chemicals tests, substitutes and adulterants.

The study shall be done also in the powdered condition of these drugs, and detection of their possible adulterants.

**ORGANISED DRUGS :**

| | | | |
|---|---|---|---|
| Barks | : a) Cinnamon | b) Cinchona | |
| Wood | : a) Quassia | | |
| Leaf | : a) Senna | b) Digitalis | |
| Flowers | : a) Saffron | b)Clove | c)Pyrethrum |
| Seeds | : a) Nuxvomica | b)Strophanthus | c)Linseed |
| Fruits | : a) Fennel | b) Coriander | c) Capsicum |
| | d) pepper | e) Cardamom | |
| Whole Plant | : a) Ephedra | b) Belladona | c) Henbane |
| | d) Stramonium | e) Datura | f) Mentha |
| | g) Vinca | h) Cannabis | i) ErgotRoots & |
| Rhizomes: | a) Liquorice | b) Ginger | |
| | c) Ipecacuanha | d) Rauwolfia | |

**UNORGANISED DRUGS:**

| | | |
|---|---|---|
| a) Opium | b) Aloes | c) Gelatin |
| d) Acacia | e) Indian Tragacanth | f) Starch |
| g) Asafoetida | h) Colophony | i) Benzoin |
| j) Balsam fo tolu | k) Balsam of Peru | l) Storax |
| m) Honey | n) Beeswax | o) Oil of clove |
| p) Oil of Lemon | q) Castor Oil | r) Olive oil |

II. Study of the following drugs with main emphasis on their sources, macroscopical characters, constituents, substitues and adulterants.

a) Cassia Bark b) Cascara Sagrada c) Rhubarb

d) Black & plate catech e) Buchu

| | | |
|---|---|---|
| f) Cocoa | g) Tea | h) Squill |
| i) Dioscorea | j) Nutmeg | k) Isphagul |
| l) Anise | m) Ajowan | n) Caraway |
| o) Kurchi | p) Cantharides | q) Chalmoogra oil |
| r) Cochineal | s) Suet | t) Turpentine Oil |
| u) Lard | v) Spermaceti | w) Woolfat |

III. Study of Sources, characters (Macroscopy & Microscopy) constituents and uses of:

a) Materials of mineral origin: Kieselgur, Kaolin, Bentonite, Talc and prepared chalk.

b) Powders of Natural occurrence: Lycopodium and Kamala.

c) Commercial Fibers used in pharmacy: Raw Cotton, Jute, Silk, Wool, Regenerated Cellulose, Nylon.

The list of drugs prescribed for study will be altered from time to time in accordance with current pharmaceutical practice.

## PRACTICALS

1. To recognise the drugs mentioned in 4 (i) and (ii) in the entire condition.
2. To identify the drugs mentioned in 4 (i) by means of sensory, macroscopical and microscopical characters including microscopical measurements.
3. Identification of individual and two component mixture of powders of crude drugs mentioned in 4 (i) by microscopical analysis.
4. To do simple physical tests to identify the crude drug and to detect substitutes and adulterants.
5. To perform experiment covering quantitative microscopy.

## REFERENCES


1. Pharmacognosy by G.E. Trease & W.C. Evans, ELBS.
2. Pharmacognosy by Varro E. Tyler, Lynn R. Brapy, James E. Robbers.
3. Textbook of Pharmacognosy by T.E. Wallis, CBS pub,Delhi.
4. Practical Pharmacognosy by Dr. C.K. Kokate
5. Pharmacognosy Question Bank by Dr. M.A. Iyanger
6. Powdered Crude Drugs by Dr. M.A.Iyanger
7. Practical pharmacognosy by Dr. P.K. Lala
8. Pharmacognosy by S. S. Handa & V.K. Kapoor, vala bh Prakashan, Delhi.

## III - B. PHARMACY

# CHEMISTRY OF SYNTHETIC DRUGS

1. Applications of Physico-chemical properties, such as (1) Solubility (2) Partition Coefficient (3) Hydrogen bonding (4) Chelation (5) Oxidation-reduction potential and (6) Surface activity in relation to Biological actions.

Steric relationship & drug action. Iso-sterism.

II. The following groups of Organic synthetic drugs are to be studied with a knowledge of their (1) Pharmacological classification (2) Chemical structure (3) Common names (4) Synthesis (5) Properties (6) Formulations (7) Storage conditions (8) Assay and (9) Therapeutic uses.

[ For those, recently introduced drugs marked to study all the above, except synthesis.]

### ANALYTIC

Amphetamine, Bemegride, Nikethamide, Doxapram, Ethyl and propyl Butamide, Methyl Phenidate, Piracetam.

### ANTI DEPRESSANTS

Phenelzine, Tranyl Cypromine, Isocarboxazid, Imipramine, Trimipramine, Clomipramine*, Amitriptyline, Nortriptyline, Doxein, Dothiepin, Trazodone, Fluoxetine*.

### GENERAL ANAESTHETICS

Ether, Trichloro Ethylene, Halothane, Nitrous Oxide, Cyclo propane, Thiopentone, Methohexitone, Ketamine.

## SEDATIVES AND HYNOTICS

Paraldehyde, Chloral hydrate, Triclofos, Butobarbitone, Secobarbitone, Pentobarbitone, Glutethimide, Methyprylone, Methaqualone, Diazeam, Nitrazepam.

## ANTI EPILEPTICS

Phenobarbitone, Mephobarbitone, Primidone, Phenytoin, Methoin, troxidone, Ethosuximide, Carbamazepine, Clonazepam, Phenacemide, Valproic Acid.

## ANTI PARKINSONIAN DRUGS

Levodopa, Carbidopa, Trihex Phenidyl, Amantadine, Selegiline*, Bromocriptine*.

## TRANQUILISERS

Chlorpromazine, Trifluroperazine, Thioridazine, Chlordiazepoxide, Oxazepam, Lorazepam, Haloperidol, Trifluperidol, Thiothixene, Meprobamate.

## NARCOTIC ANALGESICS & THEIR ANTAGONISTS

Pethidine, Methadone, Fentanyl, Dextro Propoxyphene, Pentazocine, Nalorphine, Levallorphan.

## NON-NARCOTIC ANALGESICS, ANTI PYRETICS & ANTI INFLAMMATORY DRUGS

Aspirin, Sodium Salicylate, Paracetamol, Analgin, Phenyl Butazone, Oxyphen Butazone, Indomethacin, Ibuprofen, Mephenamic Acid, Diclofenac Sodium, Piroxicam, Ketorolac.

## MUSCLE RELAXANTS

Gallamine Triethiodide, Succinyl Choline, Mephenesin, Methocarbamol, Pancuronium*, Dantrolene*

## LOCAL ANAESTHETICS

Benzocaine, Amethocaine, Procaine, Dibucaine, Lidocaine, Bupivacaine.

## CHOLINERGIC DRUGS

Carbachol, Bethanechol, Neostigmine, Pyridostigmine, Edrophonium.

## ANTI CHOLINERGIC DRUGS

Eucatropine, Tropicamide, Cyclopentolate, Propantheline, Oxyphenonium, Pralidoxime.

## ADRENERGIC DRUGS

Adrenaline, Noradrenaline, Isoprenaline, dopamine, Phenylephrine, Isoxsuprine Nylidrin, Xylometazoline, Salbutamol Terbutaline.

## ANTI ADRENERGIC DRUGS

Phenoxy Benzamine, Tolazoline, Phentolamine, Prazosin, Propranolol, Metoprolol, Atenolol.

## ANTI ARRHYTHMIC DRUGS

Procainamide, Disopyramide, Mexiletine

## ANTI HYPERTENSIVE DRUGS

Nifedipine, Captopril, Hydralazine, Sodium Nitroprusside, Clonidine, MethylDopa, Guanethidine.

## VASODILATORS

Amyl Nitrite, Glyceryl Trinitrate, Diltiazem*, Verapamil, Isosorbide di nitrate, Erythrity Tetranitrate, Pentaerythritol Tetranitrate.

## HYPOLIPIDEMIC DRUGS

Nicotinic Acid, Clofibrate, Colestipol*, Cholestyramine*, Gemfibrozil*, Lovastatin*.

## COAGULANTS

Calcium Salts, Vitamin K.

## ANTI COAGULANTS

Sodium Citrate, Sodium Oxalate, Sodium Edetate, Bis hydroxy coumarin, Ethyl Bis Coumacetate, Warfarin, Phenindione.

## DI URETICS

Frusemide, Bumetanide, Ethacrynic Acid, Acetazolamide, Chlorothiazide, Hydrochlorothiazide, Benzthiazide, Spironolac tone, Triam terene, Amiloride, Mannitol.

# ANTI-HISTAMINES

## H1 - ANTAGONISTS

Pheniramine, Chlor Pheniramine, Tri Prolidine, Di Phen hydramine, Dimenhydrinate, Doxylamine, Tripelenamine, Me pyramine, Promazine, Prochlor Perazine, Cyclizine, Chlorcyclizine, Meclizine, Phenindamine, Antazoline, Cyproheptadine, Methdilazine, Sodium Cromoglycate*.

## H2 - ANTAGONISTS

Cimetidne, Ranitidine*, Famotidine*.

## ORAL HYPOGLYCAMIC DRUGS

Tolbutamide, Chlorpropamide, Glibenclamide Phenformin, Metformin.

## ANTI THYROID DRUGS

Propy thoiuracil, Methimazole, Carbimazole, Mercazole

## ANTISEPTICS AND DISINFECTANTS

Phenol, Cresol, Chloroxylenol, Hexachlorophene, Potassium Permanganate, Hydrogen Peroxide, Iodine, Chlorine, Chlorhexidine, Cetrimide Benzalkonium Chloride, Ethanol, Formaldehyde, Boric Acid, Salic Cyclic Ammoniated Mercury, Phenyl Mercuric Nitrate, Silver Nitrate, Zinc Sulphate, Zinc Oxide, Calamine, Nitrofurazone, Sulphur, Benzyl Benzoate, Gamma Benzene Hexachloride, Dicophane.

## MEDICINAL DYES

Amaranth, Congored, Evans Blue, Brilliant Green, Crystal Violet, Phenolphthalein Fluorescein, Methylene Blue, Indigo Carmine proflavine, Acriflavine, Aminacrine.

## SULPHONAMIDES

Sulphanilamide, Sulphacetamide, Sulphadiazine Sulphamerazine, Sulphadimidine, Sulphatriad Sulphasomidine, Sulphatriad Sulphasomidine, Sulphadimethoxine, Sulphamethoxy Pyridazine, Sulphaphenazole, Sulphaguanidine, Succinyl Sulphathiazole, Phthalyl Sulphathiozole, Silver Sulphadiazine.

## ANTI HELMINITIC DRUGS

Thiabendazole, Mebendazole, Albendazole* Pyrantel, Piperazine, Niclosamide, Diethyl-carbamazine, Praziquantel.

## ANTI AMOEBIC DRUGS

Metronidazole, Tinidazole, Diloxanide, Iodochloro Hydroxyquin, Di Iodo Hydroxy Quin, Broxy Quinoline.

## ANTITUBERCULAR DRUGS

Isoniazid, Rifampicin*, Pyrazinamide, Ethambutol, Thiacetazone, Para Amino-Salicyclic Acid, Ethionamide.

## ANTI LEPROTIC DRUGS

Dapson, Solapsone, Clofazimine*

## ANTI FUNGAL DRUGS

Ketoconazole*, Fluconazole*, Flucytosine, Tolnaftate, Clotrimazole, Miconazole, Undecyclenic Acid.

## ANTI - CANCER DRUGS

Cyclophosphamide, Ifosfamide, Chlorambucil, Busulfan, Decarbazine, Methotrexate, 6-Mercaptopurine, 5-Fluorouracil, Azathioprine, Cisplatin, Carboplatin

## REFERENCES


* Text book of Pharmaceutical Chemistry by Bentley.
* Pharmaceutical Chemistry (Drug Synthesis) Vol. by Roth.
* Principles of Medicinal Chemistry Vol. I & II by Kadam.
* Essentials of Medical Pharmacology by Tripathi.

Chemistry of organic Medicinal Product, by Jenkins.

Remington's Pharmaceuticals Sciences.

Medicinal Chemistry by Ashutashkar.

# PHARMACOLOGY AND TOXICOLOGY

## THEORY

1. The mode of action of drugs in the body, the absorption distribution and fate with reference to how they may be modified.

2. The importance of suitable formulations of medicaments and how these may influence the rate of absorption and breakdown of the drug. Bio-availability and bioequivalance.

3. Concept of receptors, forces involved in drug receptors interaction drug receptor theories, principles of drug actic adverse drug reaction-structure activity relationship principle of drug design.

4. The depressants of the central nervous system, which are in frequent use of which are of toxicological importance, General anaesthetics, hypnotic, anticonvulsants, antiemetics, antipyretics, antiinflammatory, analgesics and ataraxics.

5. Local anaesthetics and particular reference to their general propertiesl, modes of action and methods of use, together with a more detailed account of those in frequent use in Medicine.

6. The stimulants of the central nervous system which are in frequent use or which are of toxicological importance.

7. Drugs which influence the working of the automatic nervous system which are in frequent use or which are of physiological or toxicological importance. Drugs with muscarinic and nicotinic actions, drugs with actions at adrenergic nerve endings, ganglion blocking drugs, anticholinesterases a hose various classes of substances which antagonise the ac s of the drugs mentioned above.

8. Drugs which are of therapeutic importance which influence neuromuscular conduction in skeletal muscle.

9. The Pharmacology of those drugs with an action on the alimentary canal. The general principles of their action and uses with a more detailed account of those in frequent use. Drugs acting on respiratory tract.

10. The action of drugs on the heart.

11. The action of drugs on the peripheral circulation is so far as they are of therapeutic importance.

12. The effects of drugs on the eye in so for as these are of therapeutic or toxicological importance.

13. The physiological and pathological importance of histamine 5HT, prostaglandins Kinins, renin and angiotensin in the body. And the antagonistic effect or antihistaminic substances in general with particular reference to those more commonly used substances.

14. Diuretics and antidiuretics of therapeutic importance.

15. Endocrinology and account of the physiological functioning and disfunctioning of the important endocrine glands and a more detailed account of those hormones and synthetic hormone analogue which have a well defined use in the rapeutics.

16. Chemotheraph of infectious diseases. The general principles of the chemotherapy of infections, together with a sample account the more generally successful modes of treatment of those infectious diseases which are of frequent occurrence in India.

17. Antineoplastic agents.

18. Toxicology, Types of poisoning, inhated poison, household poison and agricultural poison.

19. Cumulative poisoning: Systematic and local treatment

of poisoning and their treatment.

20. Indigenous plant poisons: Plumbago, Calotopis, cerbra, thevitia, nerium, datura.

21. Examination of toxic agents, principles of identification and estimation of poisons in biological materials.

22. The principles of biological assay with special reference to the assay of those substances which are used in therapeutics but, which are as yet not capable of being evaluated chemically.

N.B.: The officially listed drugs and their preparations in the B.P. & I.P. may be taken as guide.

23. Principles of clinical pharmacology and designs for testing of drugs in humans.

**PRACTICALS**

1. Experiments for studying the effect of the more important drugs like Histamine, Acetyl choline, 5HT on suitable isolated tissue preparations and their effect in the presence of antagonist.

2. Biological assays of Substances like Histamine, Acetyl Choline, 5 HT, d-Tubocurarine and insulin using suitable methods.

3. Experiments on CNS:

   a) General behavioral studies.

   b) Analgesis and anti-inflammatory activity.

   c) Anti-convulsant activity

   d) Sedative & Hypnotic activity

e) CNS Stimulant activity

4. Experiments on CVS:

   a) Effects of Various drug on isolated heart preparations of various animal models.

   b) Drugs acting on blood vessels.

5. Experiments on Gastro intestinal Tract:

   a) Study of Oesophagal motility.

**Toxicological Studies:**

1. LD 50 determination and Acute toxicity studies.
2. Experiments on Toxicities of Drugs and their antidotes.

   a) Organo phosphorous poisoning

   b) Heavy metal poisoning

   c) Barbiturate poisoning

   d) Opioid Poisoning

Local Anaesthetics: Study of Local Anaesthetic Activity By

a) Surface anaesthesia

b) Infiltration Anaesthesis

c) Nerve Block anaesthesia (Sollman Method)

General Pharmacology

a) Routes of Administration of Drugs.

b) Enzyme induction activity.

## REFERENCE


1. The Pharmacological basis of therapeutics edited by Louis S. Goodmann and Alfred Gilmann - 8th Edition.
2. Lewis Pharmacology by James Crossland, Publication, Churchill Livingston.
3. Pharmacology by Rang & Date. (ELBS)
4. Pharmacology & Pharmacotherapeutics by R.S. Batoskar & S.D. Bhandarker - Popular Prakashan, Bombay.
5. Introduction to the principles of Drug Design by Smith & Williams (Wright PSG)
6. Clinical pharmacology Molmom & Morrelli.
7. Hand book of experimental pharmacology by S.K. Kulkarni & P.C. Dandiya (Vallaph Prakashan, Delhi-52)
8. Text book of invitro practical Pharmacology by Iam kitchen Blackwell scientific publication.
9. Pharmacological experiments on Isolated preparation by Churchil Livingstone.
10. Pharmacological experiments on intact preparations by Churchill Livingstone.
11. Selected topics in experimental pharmacology by U.K. Sheth, N.K.Dadkar and Usha G. Kamat.
12. Fundamentals of experimental pharmacology by M.N. Ghosh.
13. Modern toxicology (in three volumes) by P.K. Gupta and D.K. Salunkhe (Metropolitan Book Co., (P) Ltd., Delhi.)

## HOSPITAL & CLINICAL PHARMACY (III B. PHARMACY)

1. Hospital and its organisation Defination of a hospital, types of Hospital, organisation and structure of a modern hospital.

2. Hospital Pharmacy: Typical organisational structure of a Hospital pharmacy department: Pharmacist's responsibilities towards ambulatory and impatients.

3. Pharmacy and therapeutics committee, objective, organisation and functions of the committee ensuring drug safety, in the adverse drug reaction monitoring programme, automatic stop order for dangerous drugs, development of emergency drug lists.

4. Hospital formulary systems; Guiding principles, preparation of the formulary.

5. Importance of proper communication in the pharmacy: Patient communication, inter departmental communication in a Hospital.

6. Patient compliance: Types of non compliance, factors associated with non compliance, consequences of non compliance methods of achieving patient compliance.

7. Distribution system of drugs in hospital for the inpatient and out patients and charging of prescribed drugs.

8. Dispensing of narcotics and other hazardous substances in a Hospital Pharmacy.

9. Concept of Clinical Pharmacy ( Patient oriented pharmacy services) in the safe & rational use of drugs to in patient and ambulatory patients. Functions of clinical pharmacist.

10. Design and optimization of dosage regimen-pharmacokinetic data, concept of bioavailability, urinary excretion, binding to plasma protein, clearance, volume of distribution, half

life, effective and toxic concentration, alterations of the above parameters in the individual patient.

11. The clinical pharmacolinetic basis of drug therapy: (Therapeutic drug monitoring) Structure and organisation of a clinical pharmacokinetics and Toxicology laboratory. Distribution dependent dosage adjustment, disposition dependent dosage adjustment, plasma level as determinants of dosage level: Specific examples with Cardiotonic drugs (Digcxin & Digitoxin), Anti arrhythmic drugs (propranolol, procainamide, duinidine), Bronchodilators (Theophylline), Antipsychotic drugs (Chlorpromazine), Anticoagulants (Warfarin), Antibiotics (Streptomycin, neomycin), Anticancer compounds (methotregate), Antirheumatics (Salicylaters).

12. Adverse drug reactions:

Classification, excessive Pharmacological effect, secondary pharmacological effect, idiosyncracy, allergic drug reactions, genetically determined toxicity, toxicity following drug withdrawal. Drug interaction - beneficial interaction, adverse interaction, pharmacokinetic drug interaction; methods of detecting adverse drug effects - spontaneous care reports, record linage studies.

Care - control studies. Specific examples: Phenytoin with phenotiazines, with phenylbutazones, Antidiabetics with corticosteriods.

13. Concept of medication history interviews, patient medication counselling, ward pharmacy.

14. Drug information centre: For pharmaceutical advice and consultation regarding drug therapy.

15. Role of Hospital pharmacist in Educational & Training programme.

16. Purchase, Inventory control and storage or Medicaments in a Hospital.

# FOR HOSPITAL AND CLINICAL PHARMACY

## FIELD WORK

1. Posting to Pharmacy (Drug stores) to know prescription handling, dispensing, storage, record keeping and to know various companies and their brand names (8 days-4 week ends). Submission of a report after the posting period is over.

2. Post to Hospitals (Private or Government):

   a) To know purchasing procedures, storage, record keeping, pharmacy service to in patients and out patients.

   b) To prepare a model hospital formulary.

   c) To go to wards along with Doctors and nurses to know about drug distribution.

Prescription charging, methods of suggesting dosage regimen, (8 days - 4 weeks ends).

After the period of posting, submission of an assignment about whatever drugs the candidate had learned in the hospital, the drug interactions of that drug with other drug from literature/ reference book.

## BOOKS RECOMMENDED FOR HOSPITAL AND CLINICAL PHARMACY.


1. Remington's Pharmaceutical Sciences, Eighteenth edition.

2. A text book of Hospital Pharmacy by S.H. Merchant & J.S. Qadry.

3. Hospital Pharmacy by William E. Hassan.

4. Text book of Biopharmaceutics and Clinical Pharmacokinetics by sartaray Hiage.

5. Clinical Pharmacokinetics Concepts and Application by Nalcom

Rowlani Thomas. H. Tozen.

6. Clinical Pharmacy and Hospital Drug Management by David H. Lawson & R. Michael E. Richard.

7. British National Formulary.

8. Text book of adverse drug reaction by D.M. Davies.

9. Drug interactions by Ivan H. Stockley.

10. Oxfords Textbook of Clinical Pharmacology and drug therapy by D.S. Grahame smith & J.K.Aronson.

# FORENSIC PHARMACY

THEORY

1. Definition and scope of Forensic Pharmacy. Pharmacist's role in drug treatment drug usage. Pharmacist as a member of health care team.

2. Pharmaceutical legislations in India. Historical development of pharmaceutical education in India and its present status. Professional ethics in Pharmacy practice, legal and ethical responsibilities of pharmacists.

3. A detailed study and the understanding of the various acts and rules (as last amended) governing the pharmaceutical profession in India.

   a) Pharmacy Act.
   b) Drugs and Cosmetics Act 1940 and Rules 1945.
   c) Narcotics and Psychotropic substances Act.
   d) Drugs and Magic remedies (Objectionable advertisements) Act 1955.
   e) Poisons Act and Rules.
   f) New Drug Policy 1986.
   g) Medicinal & Toilet preparations (Excise Duties) Act & Rules.
   h) Shops and Establishment Act.
   i) Essential commodities Act.
   j) Drugs (Prince control) Order.
   k) Medical Termination of pregnancy Act.
   l) Prevention of cruelty to animal Act.
   m) Insecticide Act.
   n) Sales promotion employees (Condition of Service) Act.

## REFERENCES


1. Hand Book of Labour Laws by B.K.Bhar.
2. Factories Act by Government of India Publications.
3. Drugs and Pharmacy Laws in India by H.K.Bharathi.
4. Drugs and Cosmetics by Government of India Publications.
5. Medicinal & Toilet preparations Act 1955 by Government of India Publications.
6. Laws of Drugs by S.N. Katju.
7. Forensic Pharmacy & Ethics by S.C. Mahajan.
8. Laws relating to Drugs & Cosmetics by P.L. Malik.
9. Hand book of Drug Laws by M.L. Mehra.
10. Drugs Laws: A hand book of drug laws by M.C. Mehra.
11. Forensic Pharmacy & Ethics by Mehta.
12. Text book of Forensic Pharmacy by M.M. Mithal
13. Forensic Pharmacy by B.Suresh.
14. Forensic Pharmacy by B.S. Kuchekar.
15. Narcotic Drugs & Psychotropic substances by Government of India Publications.
16. Drugs Control by P.K. Dutta.
17. The Drugs & Cosmetics Act & Rules by The India Drug Manufacturers Association Publication.
18. Dangerous Drugs Act 1930 by Government of India Publications.
19. Drugs and Magic remedies by Government of India Publication.

III B. PHARM

# PHARMACEUTICAL TECHNOLOGY

1. Materials of plant construction.
2. Corrosion and its prevention.
3. Safety methods of Pharmaceutical laboratories and works.
4. Heat transfer and mass transfer.
5. Fluid flow: Basic equations of fluid flow, Reynold boundary layers, measurement Using different pressure meter, manometer venturimeter, Pitot tube, rotameter and rotating disc meter, pipe flow, empirical formula for loss due to friction, series and parallel arrangements, loss due to pipe fittings. Flow control: Study of gate valve, butterfly valve, ball valve, slope and needle valve, diaphragm valve, pumps - positive displacement pumps, reciprocating pumps, rotary pumps and centrifugal pumps.
6. Humidity and Air Conditioning : Humidity chart, measurements of Humidity, Humidifier and dehumidifier. Air conditioning Principles.
7. Refrigeration: Compression & Absorption type of refrigeration cycles, co-efficient of performance, refrigerators and their choices, Brine system, refrigeration load and its application in pharmacy.
8. The physical, Physico-chemical and engineering principles governing design, layout and operation of plats for the process employed in Pharmaceutical industry.
   i) Size reduction
   ii) Mixing
   iii) Compression & Tablet machines

a) Separation without change of phase of physical state:

i) Hydraulic separation

ii) Air separation

iii) Centrifugation

iv) Filtration

b) Separation with change of phase or physical state:

i) Extraction

ii) Evaporation

iii) Distillation

iv) Drying

v) Crystallisation

9. Container, closures and packaging materials.

10. Filling: Various machineries involved in filling and soft gelatin capsule & Hard gelatin capsules.

11. Design of fermentor and automation involved in it.

**REFERENCE**


1. Introduction to chemical engineering by Walter L.Badger.
2. Cooper & Gunn's Tutorial Pharmacy.
3. Theory and Practice of Industrial Pharmacy by Lachman.
4. Refrigeration and Air conditioning by L. Ballaney.

## CHEMISTRY OF NATURAL PRODUCTS THEORY

1. Structural elucidation of Natural products-General Methods.

2. Source, isolation, Structure, Chemistry, synthesis, uses, official, preparation, methods of estimation, test for identity other pharmacopial standards of the following:

   i. Alkaloids: Ephedrine, Nicotine, Atropa, Cinchona, Coca, opium, Ipeca, Nux Vomica, Curare and Rauwolfia alkaloids.

   ii. Purines: Constitution, synthesis of uric acid and caffeine inter relationship of caffeine, theobromine and theophylline and their medicinal importance.

   iii. Vitamins, Classification of vitamins, skeleton structure of vitamins, official in Indian Pharmacopoeia their constitution and synthesis, carotenoids, source, structure and conversion to Vit. A.

   iv. Carbohydrates : General chemistry of carbohydrates, Structure of glucose. Determination of configuration, ring structure for glucose, study of the chemical nature of fructose, sucrose, lactose, maltose and starch, cellulose and their derivatives.

   v. Proteins, Classification, general characteristics of proteins, Amino acids and essential Amino acids, synthesis of individual amino acids. Degradation of proteins, study of the test for purity and medicinal uses of following compounds of the pharmacopoeial, Gelatine, Gelatin sponge, zinc gelatin and silver protein.

   vi. Steroids : Nomenclature, tests for steroids skeleton structure of cholesterol, Ergosterol, Stigmasterol, Bile acids, androgens.

   Estrogens : Inter-relationship of estrone, esternol and

estradiol, constitution of estrone, preparation and Medicinal uses of synthetic non-steroid estrogenic compounds. Benzestrol, Hexestrol, Dienoestrol, Stilbestrol.

Progesterone : Skeleton structure, synthesis of progesterone from naturally occurring sapogenins structure and activity relationship, skeleton structure of important progesterone derivatives used as oral contraceptives.

Adrenal cortex hormones : Classification, Skeleton structure of cortisone, corticosterone, hydrocortisone. Synthesis of cortisone from naturally occurring sapogenins. Skeleton structure of important synthetic corticosteroid analogies such as alpha fluro compounds.

vii. Glycosides : Chemistry of amygdalin and salicin, A general study of cardiac glycosides of digitalis, strophanthus and squill, Anthraquinone glycosides and saponins.

viii. Antibiotic : Skeletal structure of penicillin, Degradation of penicillin, skeleton structure of Depot penicillin and newer synthetic penicillins, streptomycin, chloramphenicol and tetracyclines. Synthetics of chloramphenicol, anti-cancer and anti-fungal antibiotics.

ix. Terpenes : classification and pharmacopoeial examples. Geraniol and its constitution. Synthesis of linalool, inter relationship of limonene, dipentene, alphaterpeniol, terpin hydrate, cineole and carvone. Constitution of Menthol and thymol. Synthesis of camphor General Chemical composition of fixed oils, fats and waxes, A general study of the methods of analysis of fats, oils and waxes of Pharmacopoeia of India, test of adulteration.

## PRACTICALS

1. Test for purity of some official compounds belonging to the class of Natural Products.
2. Qualitative analysis and estimation of pure natural products and finished preparations.
3. Analysis of Fats, Oils and waxes.
4. Analysis of Proteins and carbohydrates.

## REFERENCES


1. Organic Chemistry- Vol. II by I.L.Finar.
2. Alkaloids Chemical and biological perspectives by S. William Pelletier.
3. Alkaloids by Manske.
4. Hormone chemistry by Butt.
5. Steroids by Fischer & Fischer.
6. Pharmacognosy by Trease and Evans.
7. Organic Constituents of higher plants by Robinson.

## PHARMACEUTICAL BIOTECHNOLOGY THEORY

1. A study of bacteria, yeasts, moulds including their morphology, habit variation, reproduction, nutrition, cultivation, isolation and identification.
2. Preparation of culture media.
3. Microbial Growth : Bacterial mass, total count, counting chamber, stained film, viable count, microbial growth measurement techniques, dry weight, wet weight , trurbidimetry, multiplication and death, batch culture, continuous culture, synchronous culture, cell dif entiation sporulation, dormancy.
4. Stains and staining techniques.
5. Sterilisation and tests for sterility.
6. Biosafety methods & good laboratory practice : Techniques in the use of pipette and pipetting aids, techniques to avoid dispersal of infectious material, techniques to use biological safety cabinet techniques to avoid ingestion of infectious material, techniques to avoid injection of infectious material, techniques for separating serum, techniques for the use of centrifuges, homogenisers and shakers.
7. Immunology : Immunity - types of immunity, immunisation and immunisation methods. Manufacture and standardisation of vaccines of bacterial viral and rickettsial origin.

a) Production of vaccines, sera and immunoglobulins of bacterial origin. Maintenance of seed strains, production and pu fication methods of tetanus and diphtheria toxoids production o yphoid and cholera vaccines, production of BCG vaccine, production of sera and immunoglobulins for diagnostic, therapeutic and protective purposes, advances in making better bacterial vaccines.

b) Production of vaccines, sera and immunoglobulins of viral origin : Production of ora polio and killed polio vaccines, production of rabies vaccine, production of Japanese Encephalitis, yellow fever, hepatitis-B and MMR group of vaccines, vaccines against respiratory virus, advances in making newer viral vaccines.

c) Blending and containerisation of Vaccines : Techniques of blending and equipment designing adjuvants and their use preparation of certain important adjucants such as aluminium phosphate and aluminium hydroxide, containerisation principles and techniques.

d) Principles, criteria and standardisation methods of quality control of vaccines, sera and immunoglobulins : Sterility test, identity test hydrogenion concentration, biochemical tests visual assessment, immunity test, potencytest, stability test and raw material testing, preparation and use of laboratory animals for inViVo testing.

**8. Injections of Biological Origin:**

a) Injection of ACTH
b) Injection of Heparin
c) Injection of insulin & its products
d) Oxytocin injection
e) Vasopressin injection
f) Injection of Penicillin
g) Injection of procaine

Blood products & Plasma substitutes : Collection, processing and storage of whole human blood, concentrated human R.B.C., dried human plasma, human plasma protein fraction, dried human serum human fibrinogen, human thrombin, human normal immunoglobulin

human fibrin foam, control of blood products as per I.P., plasma substitutes-idel requirements, dextran, PVP.

10) Sutures and Ligatures; Types, preparation, standards and evaluation.

11) General Principles of Microbiological Assays: With reference to vitamins and antibiotics: Preparation of Primary, standardbred and their units, preparation of inoculum, pharmacopoeial methods of biological assay.

12) Disinfectants Bactericides and Bacteriostatics : Factors influenting disinfection, dynamics of disinfection, classification with examples, evaluation of disinfectants. classification with examples, evolution of disinfectants.

13) Fermentation Technology : Principle of fermentation, types of process, surface culture protected culture, solid state fermentation, microbial transformation, their limitations and advantages. Preparations alcohol, citric acid, lactic acid, penicillin, streptomycin, riboflavin, diastase and cystine mohohydr chloride.

14) Advances in Biotechnology: A broad study of techniques of genetic engineering and its applications in Pharmaceutical bio-technology. Viz. No. Recombinant DNA techniques, monoclonal antibodies, insulin production by micro-organisms and genetic engineering.

**PRACTICALS**

1. Animalcules observation study from various natural sources.
2. Preparation of various culture medias and sterilization procedures.

3. Preparation of some specific media for particular identification of some organisms and for biochemical reactions.
4. Practising various inoculation methods over liquid and solid culture medias.
5. Carrying out various biochemical tests related to identification of various group of organisms (particularly Bacteria).
6. Study on motility of bacteria by various methods.
7. Comparison of sensitivity of antibiotics over different groups of Micro-organisms.
8. Isolation of soil microbes by successive plating techniques of finding its antibiotic property over other organisms.
9. MICROBIAL Assay methods.
10. Standardization of some biological products.
11. Study on fundamentals of bio-reactors on lab scale.
12. Preparation of some products by using laboratory fermentors.

**REFERENCES**


1. Bently's Textbook of pharmaceutics.
2. Practical Medical Microbiology by Mackie & Mc. Kathey.
3. Practical Medial Microbiology by Breach & Becket.
4. Microbiology - Essential and applications by Judy Kandel.
5. The principles of Fermentation Biotechnology by P. Stanbury.
6. Microbiology by Pelzer.
7. Fermentation of Enzyme kinetics by co oney.
8. Biotechnology text book by P. Stanbury.

# FORMULATIVE & INDUSTRIAL PHARMACY

1. Performulation studies :

1. Dosage from Necessities : Antioxidants, preservatives colouring flavoring and diluting agents, solvents and others.

2. Formulation : Importance, physical properties, physical form, particle size, crystal form, Bulk control, solubility wetting flow cohesiveness, compressibility, organoleptic properties, chemical properties, hydrolysis, oxidation, racemization, polymerisation, formulation additives, stabilizers, suspending and dispersing agents, dyes solid excipients etc.

**II. Stability testing:**

1. Stability of formulated products : Requirements, products stability, shelf life, overage, containers, closures.

2. Kinetic Principles of stability testing: Reaction rate and, order, acid base catalysis, decomposition reactions, stabilization and stability testing.

**III. Capsule technology**

Advantages of capsules, Hard gelatin capsules, shell formulation and manufacturing, size, storage, printing, filling, cleaning, binding, general formulation of contents, evaluation. Soft gelatin capsules, shell formulation, content formulation and filling. Micro capsules-advantages, coating materials, methods of manufacture of Microcapsules IF, and other important formulations.

**IV. Tablet technology**

Types, ideal requirements, granulation methods, general formulation, difficulties in preparation and evaluation, Sugar coating, compression coating, film coating and enteric coating IP Formulations.

**V. Parenteral: (Products requiring sterile packaging)**

Definition, types, advantages and limitations, general formulation, vehicles, containers, production procedure, production facilities, controls, tests, selected IP injections, sterile powders, implants emulsions, suspensions.

**VI. Pharmaceutical aerosols:**

Definition, types, propellants, general formulation, manufacturing, aerosol containers and packaging methods, pharmaceutical applications.

**VII. Ophthalmic Preparation :**

Eye ointments and eye drops, requirements, formulation methods of preparation, containers, evaluation, IP and other important products.

**VIII. Cosmetic formulation:**

Formulation and preparation of dentifrices, hair creams, lipsticks, face powders, baby and bath powders, shaving preparation, skin cream, shampoo, hair' dyes depilatories, manicure preparations.

**IX. Prolonged action pharmaceuticals:**

Benefits, limitations, oral products terminology, drug elimination rate, types and construction of products, evolution, parenteral products absorption and evaluation.

**X. Novel Drug delivery systems:**

Transdermal delivery systems, Osmoticdrug delivery systems, liposomes.

**XI. Biopharmaceutics & Pharmacokinetics:**

1. Biopharmaceuties: Rate of drug absorption after administration, drug concentration in blood, biological factor

in drug absorption, physico-chemical factors, dosage from consideration for gastrointestinal absorption, drug distribution, site seeking, drug elimination.

2. Pharmacokinetics: Compartment models, A brief study of parameters like biological half life, apparent volume of distribution renal clearance, total body clearance, absorption and elimination rate constants, significance of the date.

3. Bioavailability and bioequivalency testing: Definitions, dosage form dissolution rate, bioequivalence testing.

**Practicals**

Experiments devised to study the formulation of dosage forms, stability testing of formulated dosage forms, evaluation of dosage forms, evaluation of dosage form necessities (additives) in the stable formulation of dosage forms, bioavailability testing and other to illustrate topics mentioned in theory.

**References**


1. Pharmaceutical Dosage forms: Tablets Vol. - 3 by Liberman & Lachman.
2. Pharmaceuticals Dosage forms: Parenteral medications Vol. I & II by Liberman & Lachman.
3. Pharmaceutical Dosage forms: Disperse systems by Liberman & Lachman Vol. I
4. Remingtons' Pharmaceutical Sciences.
5. Modern Pharmaceutics by Banker & Gilberts.
6. Theory and Practice of industrial Pharmacy by Lachman.
7. Hard Capsules by Ridgway. K. Pharmaceutical press, London.

# ADVANCED PHARMACOGNOSY

## THEORY

1. Study of various systems of classification of drugs from biological origin including chemotaxonomy and serotexonomy.
2. a) Introduction to plant physiology and plant biochemistry with special references to basic metabolic pathways.

   b) Biosynthesis of medicinal significance like tropane alkaloids and steroidal glycosides.

   c) Study of the utilisation of radio active isotopes investagastion of biogenetic studies.

   d) Study of plant growth regulators and their role in the production of secondary metabolites.
3. Study of modern of extraction, application of latest techniques like chromatoghraphy and electrophoresis in the isolation, purification and identification of phytocostituents of crude drugs.
4. Study of industrial production and utilisation of phytoconstituents like citric acid, menthol, quinine, vinca alkaloids, senna glycosides, cardiac glycosides.
5. Study of sources, characters ( Macroscopy and Microscopy) constituent and preparation for pharmaceutical uses of the following important materials:

   a) Essential oils: Oils from umbelliferous fruits.

   b) Marine Natural Products: Alginate, Agar, Shark & Cod liver Oils.

   c) Sùrgical dressings: Absorbent Cotton, Absorbent lint, Viscose rayon, absorbent wool, Gelatin sponge, oxidized

cellulose, alginate dressings, surgical catguts, ligatures.

d) Pharmaceutical enzymes: Pectinase, papain and pepsin.

6. A study of the plant tissue culture and its application in pharmacognosy with special importance to the production of secondary metabolites.
7. Study of Fermentation Technology and its application in the production of antibiotics, vitamins etc.
8. Export potential of medicinal plants and their derivatives from India.
9. Principles involved in the preparation & standardization of Ayurvedic formulations such as Asawas, Aristas, Avaleha, Churna.
10. Quality control of crude drugs:

    a) Proximate analysis including Ash & extractive values. Crude fibre content, UV & Flourescence analysis of drugs in powdered form.

    b) Quantive microscopy & chemical microscopy-including microchemical analysis.

    c) Detection of common adulterants & insects in whole & powdered drugs.

**Practicals**

1. Identification of crude drugs mentioned in (5) by means of sensory, macroscopical and microscopical characters and by chemical tests.
2. Experiments using T.L.C. column and paper chromatography as applied to certain alkaloids, glycosides, amino acids, containing drugs.

3. Exercise involving isolation of active principles:
   a) Caffeine - from tea dust
   b) Quinine - from cinchona bark
   c) Citric acid - from lemon
   d) Casein - from milk
   e) Resin - from jalap
   f) Starch - from potato
4. Quantitative estimation of industry & therapeutically important phyto constituents.
   a) Anthracene derivative in senna.
   b) Tropane alkaloids of Datura.
   c) Eugnol content of clove.
5. a) Plant tissue culture.
   b) Growth regulators.
6. Experiments involving standardisation of certain Ayurvedic formulations.
7. Monograph exercise as per I.P.
   a) Castor oil.
   b) Shark live oil
   c) Oil of Turpentine.
   d) Oil of Eucalyptus.
   e) Honey

## References


1. Pharmacognosy by Trease G.E & W.C. Evans. EIBS.
2. Pharmacognosy by Varro E. Tyler, Lynn R. Brady, James E. Robbers.
3. Pharmacognosy by T.E. Wallis, CBS Pub. Delhi.
4. Antibiotics Isolation & Seperation by Weinsten M.I. Wagmon G.H.
5. Burgers Medical Chemistry by Wolff. M.E
6. Wilson and Gisvolds Text book of Organic Medicinal & Pharmaceutical Chemistry by Doerge.
7. Industrial Microbiology by Casida. I.E.
8. Plant tissue culture by Pitmann.
9. Plant tissue culture theory & Practise by Bhajwani, S.S.
10. Powdered crude drugs by Dr. M.A. Iyengar.
11. Practical Pharmacognosy by Dr. C.K. Kokate.
12. Practical Pharmacognosy by Dr. P.K. Lala.
13. Phytochemical methods of chemical analysis by Harborne.
14. Jenkins quantitative Pharmaceutical Chemistry by Knevell, A.M.
15. An Introduction to Practical Biochemistry by Plummber, D.I

## MODERN METHODS OF PHARMACEUTICAL ANALYSIS

### THEORY

Sources of the errors in analysis, uses of significant figures and correct uses.

1. Study of the separations and determinations involving the following techniques and their applications in pharmacy.

   a) chromatography:

   Column Chromatography : Adsorption and partition Theory, preparation, procedure, methods of detection.

   Thin Layer Chromatography : Theoretical consideration, preparation, procedure, detection of compounds.

   Paper Chromatography : Theory of partition, different techniques employed, filter papers used, Quantitative and qualitative detection.

   Gas Chromatography : Introduction, Fundamental column operation, detection.

   Ion Exchange : Types of exchanges, Mechanism of Ion exchange, column operation.

   b) Counter current extraction, ultra centrifuge, high pressure liquid chromatography and get filtration.

2. A study of the following as described therein :

   U.V. and Visible spectrophotometry : Principles, Beer Lambert's Law, classification of methods, study of the working principles of a one cell colorimeter and two cell calorimeter. Applications in Pharmacy, Theory of U.V. spectrophotometry. important study of the working principles of instruments used for analysis, applications in pharmacy.

3. Flurimetry : Introduction, Theory of fluorescence and chemical structure, factors affecting the intensity. Study of working principles of the instrument used for fluorescence analysis. Applications in Pharmaceutical analysis.

4. TURBIDIMETRY AND NEPHELOMETRY : Theory of light scattering, Nephlometry, Turbidimetry for practical Analysis of dispersions, study of the working principles of instrument used for analysis. Applications in pharmacy.

5. Potentiometric Titrations : Introduction, Electrochemical cells and Half cells, Electrodes Measurements of Potenial, application in Pharmaceutical Analysis.

6. Conductometric Titrations : Basic concepts, different types of conductometric titrations, apparatus used. Applications in Pharmaceutical analysis.

7. Polarography : Basic concept, Theoritical considerations, Basic instrumentation, Apparatus and principles, general polarographic analysis, applications in Pharmaceutical analysis.

8. Amperometric titrations with one polarized electrode, general procedure, titration curves, applications.

9. Assay procedure of advanced types from the pharmacopeia of India with special reference to the procedure and techniques involving the following :

Non-aqueous titration, oxidation-reduction, reaction involving the use of titanous chloride, ceric ammonium, diazotization methods, complexometric methods.

10. A preliminary introductory study of the following topics in an elementary manner.

a) Mass spectroscopy

b) N M R

c) E S R

d) Infra Red spectroscopy.

## PRACTICALS

1. Volumetric including newer methods of non-aqueous, complexometric titration, redox and diazotisation.
2. Limit tests for Halides, sulphates using Nephelo-turbidity
3. Determination of physical constants used as criteria of purity like melting and boiling points, weight per ml., refractive index and viscosity.
4. Preparation of Buffer solution and determination of pH using indicators and pH meter.
5. Quantitative analysis of compounds which absorb radiation in visible and uv region and determination extinction co-efficient.
6. Applications of the instruments studied in theory with special reference to official procedures of colorimeter, spectrophotometer, refractometer, polarimeter, flamephotometer, pH meter and fluorimeter.
7. Conductometric, potentiometric, polarographic, amperometric titrations and deadstop end point technique.
8. Chromatographic techniques and ion-exchange resins in separation and estimation.
9. Experiments on Electrophoresis

## REFERENCES


1. Practical pharmaceutical Chemistry by Beckett and Stenlake.
2. Quantitative analysis of drugs by D.C. Garatt.
3. Pharmaceutical Chemistry by M.L. Schroff.
4. Pharmaceutical Chemistry by. L.G. Chattan.
5. Instrumental Methods of Analysis by Willard, Meritt, Dean and Settle.
6. Quantitative pharmaceutical chemistry by Jenkins.