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# **BACHELOR OF PHARMACY [B.PHARM]**

## **Regulation and Syllabus**



**J.N. MEDICAL COLLEGE**

**K L E UNIVERSITY**

Established under Section 3 of the UGC Act, 1956

MHRD. GOI No.F.9-19/2000-U.3(A) of 13/04/2006

**BELGAUM (Karnataka, India)**

## Mission Statement

Our mission is to contribute to the national programme of providing graduate trained Pharmaceutical manpower through prescribed training programme like D.Pharm, B.Pharm, M.Pharm, and Ph.D with Professional Pharmaceutical education and effective competency to undertake the national task of meeting social and pharmaceutical needs in industrial pharmacy, Medicare program, pharmaceutical education and research.

## AIMS AND OBJECTIVES

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

The objectives are covered under three headings namely:

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

### (a) Knowledge & Understanding

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

1. Adequate knowledge and scientific information regarding basic principles of Pharmaceutical chemistry, Pharmaceutics including cosmetics, Pharmacology and Pharmacognosy including Herbal drugs.
2. Adequate knowledge of practical aspects of synthesis, formulation and analysis of various pharmaceutical and Herbal medicinal agents.
3. Adequate knowledge of practical aspects of delivering a quality assured product as per pharmacopoeia, WHO and ISO standards.
4. Adequate knowledge of practical aspects of Pharmacological screening, biological standardization and *in-vivo* drug interactions.
5. Adequate knowledge of clinical studies for patient counseling leading to physical and social well being of patients.

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

(B) Skills

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

1. Able to synthesize, purify, identify and analyze medicinal agents.
2. Able to formulate, store, dispense, analyze the prescriptions and / or manufacture the medicinal agents at commercial level.
3. Able to learn and apply the quality assurance principles including legal and ethical aspects involving drugs.
4. Able to extract, purify, identify and know the therapeutic value of herbal / crude / natural products.
5. Able to screen various medicinal agents using animal models for pharmacological activity.

(c) Attitudes

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

1. Willing to apply the current knowledge of Pharmacy in the best interest of patients and the community.
2. Maintain a high standard of professional ethics in discharging professional obligations.
3. Continuously upgrade professional information and be conversant with latest advances in Pharmacy field to serve the community better.
4. Willing to participate in continuing education programmes of PCI and AICTE to upgrade knowledge and professional skills.
5. To help and to participate in the implementation of National Health Programmes.

**SECTION -II**  
**REGULATIONS GOVERNING B.PHARM COURSES**

**1. Eligibility**

1.1 Candidates who have passed two year P.U.C. examination of Karnataka P.U.C. Board or an equivalent examination of any other approved Board or university with not less than 50% marks in any combination comprising P.C.M. or P.C.B. or P.C.M.B, or P.C. and Computer Sciences or P.C. and Electronics.

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

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

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

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

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

2. **Duration of the course**

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

3. **Course of study**

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

4. **Attendance and progress**

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

Medium of Instruction and Examination shall be English. A candidate is required to put in at least 80% attendance in theory and practical subjects separately. The candidate shall complete the prescribed course satisfactorily to be eligible to appear for the respective examinations

5. **Examinations**

Internal Assessment Examination (Sessional):

Theory: Three sessional examinations evenly spread during the academic year shall be conducted by the affiliated colleges. The average marks of the best two examinations shall be computed out of a maximum of 30 marks and shall constitute the sessional award in theory. Provided further the colleges may conduct one special theory sessional examination towards the end of the academic session for those who might have missed any one of the regular sessional examination on genuine grounds. For special theory sessional examination, the portion prescribed shall be the entire syllabus of the subject.

Practical: Students are expected to perform the experiments listed in the respective syllabus. The number of experiments are also listed. Marks shall be awarded out of a maximum of 10 to each of the practical exercise and an average of those shall be computed out of maximum of 10 marks. In addition, three practical sessional examinations evenly spread during each academic year shall be conducted. The average marks of the best two practical examinations shall be computed out of a maximum of 20 marks. A total of 30 marks shall constitute the sessional award in practical. While awarding the sessional marks for practical experiments, the following considerations should be taken into account.

1. Preparation of the candidate.

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

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

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

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

### 5.3 Criteria for pass

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

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



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

- a) Out of seven subjects to be studied at I.B.Pharm course, there shall be an examination conducted by the college in respect of the following three subjects.
  - i. Mathematics – theory.
  - ii. Biology – theory and practical.
  - iii. Computer Science & Statistics for the candidates admitted on PUC / 12<sup>th</sup> Standard / Equivalent qualifications and for the candidates admitted to II.B.Pharm, admitted on the basis of D.Pharm.
- b) The candidates are required to score a minimum of 40% marks of the total marks prescribed for pass in all the above three subjects both in theory and practical separately including their sessional marks for a pass.
- c) Candidates of I B.Pharm are permitted to carryover all the failed subjects to II B.Pharm and appear for II B.Pharm examination concurrently along with failed subjects of I B.Pharm. However, these candidates have to pass all the failed subjects of I B.Pharm to become eligible to proceed to III B.Pharm.
- d) Similarly, candidates of II B.Pharm who have completely passed all the subjects of I B.Pharm but have failed in II B.Pharm are permitted to carryover all the failed subjects of II B.Pharm to III B.Pharm and appear for III B.Pharm concurrently along with failed subjects of II B.Pharm. However, these candidates have to pass all the failed subjects of II B.Pharm to become eligible to proceed to IV B.Pharm.
- e) Candidates of III B.Pharm who have completely passed all the subjects of II B.Pharm but have failed in III B.Pharm are permitted to carryover all the failed subjects of III B.Pharm and appear for IV B.Pharm examination concurrently along with failed subjects of III B.Pharm.
- f) The final B.Pharm candidates can appear for all the subjects of IV B.Pharm along with the failed subjects of III B.Pharm. However they have to pass all the subjects of III B.Pharm before the announcement of IV B.Pharm results.
- g) A candidate who has passed in all the subjects of IV B.Pharm will be eligible for the award of B.Pharm Degree, provided

he/she has passed in all the III B.Pharm subjects also in case of carryover and he/she has satisfactorily completed the practical training as mentioned under clause (6).

#### 5.3.4 Improvement of sessional marks

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

#### 5.3.5 Declaration of class

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

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

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

#### 6. Industrial tour and Training

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

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

**Industrial Tour:**

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

7. **Award of Degree and ranks**

Candidates who fulfill the requirements mentioned in 5.3.3(g) and (6) will be eligible for degree

Ranks and Medals shall be awarded on the basis of aggregate of all the four university examinations. However, candidates who fail in one or more subjects during the B.Pharm courses shall not be eligible for award of ranks.

Moreover, the candidates should have completed the B.Pharm course in minimum prescribed number of years, (four years) for the award of Ranks.

Courses of Study for B.Pharm  
(See clause 3)

**Table 1: First year B. Pharm**

Sl No.	Subject	Theory Hours/Week	Practical Hours/Week	Tutorials Per batch of 20 students Hours/Week
1.1	Human Anatomy & Physiology	03	03	01
1.2	Pharmaceutics (Dispensing & General Pharmacy)	02	03	01
1.3	Pharmacognosy & Phytochemistry	02	03	01
1.4	Pharmaceutical Organic Chemistry-I	03	03	01
1.5	Pharmaceutical Inorganic Chemistry	03	03	01
1.6	Mathematics OR Biology*	03 02	00 02	00 00
1.7	Computer Science and Statistics*	03	02	00
	Total Number of Working Hours**	16	17/19	05
			38 hours	

\* College Exams Only

\*\*Total number of working hours per week for students securing admission to I B.Pharm with P.C.M.B is 38 hours.  
Total number of working hours per week for students securing admission to I B.Pharm with P.C.B. is 41 hours  
Total number of working hours per week for students securing admission to I B.Pharm with P.C.M. is 42 hours

**Table II: Second year B.Pharm**

Sl No.	Subject	Theory Hours/Week	Practical Hours/Week	Tutorials Per batch of 20 students Hours/Week
2.1	Physical Pharmacy	03	03	01
2.2	Pharmaceutical Microbiology	03	03	02
2.3	Pathophysiology & Health Education	03	00	02
2.4	Biochemistry	03	03	01
2.5	Pharmaceutical Organic Chemistry-II	03	03	02
	Total Number of Working Hours	15	12	08
			35 hours	

**Note: 2.6** Maths / Biology and Computer Science for D.Pharm students (ER91) for PCB/PCM candidates only.

**Table III : Third year B.Pharm**

Sl No.	Subject	Theory Hours/Week	Practical Hours/Week	Tutorials Per batch of 20 students Hours/Week
3.1	Medicinal Chemistry	03	03	01
3.2	Pharmaceutical Jurisprudence & Drug Regulatory Affairs	02	00	01
3.3	Hospital & Clinical Pharmacy	03	03	01
3.4	Pharmaceutical Biotechnology & Engineering	03	03	01
3.5	Pharmacology	02	03	01
3.6	Pharmacognosy & Phytochemistry	02	03	01
	Total Number of working Hours	15	15	06
			36 hours	

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**Table IV: Fourth year B.Pharm**

<b>Sl. No.</b>	<b>Subject</b>	<b>Theory Hours/Week</b>	<b>Practical Hours/Week</b>	<b>Tutorials Per batch of 20 students Hours/Week</b>
4.1	Pharmaceutical Technology and Biopharmaceutics	03	03	01
4.2	Instrumental and Biomedical Analysis	02	03	01
4.3	Pharmacology and Toxicology	02	04	01
4.4	Pharmaceutical Marketing & Management	02	00	01
4.5	Pharmacognosy & Phytochemistry	02	03	01
4.6	<b>ELECTIVE *</b>			
	1. Cosmetic Technology	02	00	01
	2. Advanced Industrial Pharmacy	02	00	01
4.7	1. Pharmacokinetics & Therapeutic Drug Monitoring.	02	00	01
	2. Pharmacotherapeutics	02	00	01
	Total Number of Working Hours	15	13	07
			35 hours	

\* Students are given the option to select any two elective subjects of their choice.

### Scheme of Study and Examination for B.Pharm course

**Table V**  
**Scheme of Study and Examination for First year B.Pharm course**

Code No	Subject	THEORY					PRACTICALS				Grand Total
		No. of Papers	Duration of papers (Hrs)	Sessional Maximum Marks	Max. Marks for written papers	Total	Duration of examination (Hrs)	Sessional maximum marks	Max. Marks for practical examination	Total	
1.1	Human anatomy & Physiology	1	03	30	70	100	04	30	70	100	200
1.2	Pharmaceutics	1	03	30	70	100	04	30	70	100	200
1.3	Pharmacognosy-I	1	03	30	70	100	04	30	70	100	200
1.4	Pharmaceutical Organic Chemistry - I	1	03	30	70	100	04	30	70	100	200
1.5	Pharmaceutical Inorganic Chemistry	1	03	30	70	100	04	30	70	100	200
1.6*	Mathematics	1	03	30	70	100	No Practicals				
	or Biology	1	03	30	70	100	04	30	70	100	
1.7 *	Computer Science & Statistics	1	03	30	70	100	04	30	70	100	

Total: Theory 500 Practical 500 Grand Total: 1000

\* College examinations only.

Table VI

**Scheme of Study and Examination for Second year B.Pharm course**

Code No	Subject	THEORY					PRACTICALS				Grand Total
		No. of Papers	Duration of papers (Hrs)	Sessional Maximum Marks	Max. Marks for written papers	Total	Duration of examination (Hrs)	Sessional maximum marks	Max. Marks for practical examination	Total	
2.1	Physical Pharmacy	1	03	30	70	100	04	30	70	100	200
2.2	Microbiology	1	03	30	70	100	04	30	70	100	200
2.3	Pathophysiology & Health Education	1	03	30	70	100	No Practicals				100
2.4	Bio-chemistry	1	03	30	70	100	04	30	70	100	200
2.5	Pharmaceutical Organic Chemistry - II	1	03	30	70	100	04	30	70	100	200

Total : Theory 500 Practical 400 Grand Total : 900



Table VII

## Scheme of Study and Examination for Third year B.Pharm course

Code No	Subject	THEORY					PRACTICALS				Grand Total
		No. of Papers	Duration of papers (Hrs)	Sessional Maximum Marks	Max. Marks for written papers	Total	Duration of examination (Hrs)	Sessional maximum marks	Max. Marks for practical examination	Total	
3.1	Medicinal Chemistry	1	03	30	70	100	04	30	70	100	200
3.2	Pharmaceutical Jurisprudence & Drug regulatory affairs	1	03	30	70	100	No Practicals				100
3.3	Hospital & Clinical Pharmacy	1	03	30	70	100	04	30	70	100	200
3.4	Pharmaceutical Biotechnology & Engineering	1	03	30	70	100	04	30	70	100	200
3.5	Pharmacology	1	03	30	70	100	04	30	70	100	200
3.6	Pharmacognosy & Phytochemistry	1	03	30	70	100	04	30	70	100	200

Total : Theory 600 Practical 500 Grand Total : 1100

**Table VIII**  
**Scheme of Study and Examination for Fourth year B.Pharm course**

Code No	Subject	THEORY					PRACTICALS				Grand Total
		No. of Papers	Duration of papers (Hrs)	Sessional Maximum Marks	Max. Marks for written papers	Total	Duration of examination (Hrs)	Sessional maximum marks	Max. Marks for practical examination	Total	
4.1	Pharmaceutical Technology & Biopharmaceutics	1	03	30	70	100	04	30	70	100	200
4.2	Instrumental & Biomedical Analysis	1	03	30	70	100	04	30	70	100	200
4.3	Pharmacology & Toxicology	1	03	30	70	100	04	30	70	100	200
4.4	Pharmaceutical Marketing & Management	1	03	30	70	100	04	30	70	100	200
4.5	Pharmacognosy & Phytochemistry	1	03	30	70	100	04	30	70	100	200
4.6	1) Cosmetic Technology	1	03	30	70	100	No Practicals				100
	2) Advanced Industrial Pharmacy	1	03	30	70	100	No Practicals				100
4.7	1) Pharmacokinetics & Therapeutic Drug Monitoring.	1	03	30	70	100	No Practicals				100
	2) Pharmacotherapeutics	1	03	30	70	100	No Practicals				100

Total : Theory 700 Practical 500 Grand Total : 1200

## First Year B.Pharm

### HUMAN ANATOMY AND PHYSIOLOGY (Theory)

**75 hours**

- |   |                           |
|---|---------------------------|
| 1. Scope of Anatomy and Physiology, basic terminologies used in this subject.   | 1                         |
| 2. Structure of cell – Its components and their functions   | 1                         |
| 3. Elementary tissues of the human body: epithelial, connective, muscular and Nervous tissues-their sub-types and characteristics   | 2                         |
| 4. a) Osseous system – structure, Classification of Bones, composition of Bones, functions of the skeleton.<br>b) Classification of joints, types of movements of joints and<br>c) Disorders of joints (definitions only) | 2                         |
| <b>5. Haemopoietic system</b>   |                           |
| a) Composition and functions of blood   | 6                         |
| b) Haemopoiesis and disorders of blood & its components (Definition of Disorders)   |                           |
| c) Blood groups   |                           |
| d) Clotting factors and mechanism   |                           |
| e) Platelets and disorders of coagulation   |                           |
| <b>6. Lymph</b>   |                           |
| a) Lymph and lymphatic system; composition, formation and circulation   | 3                         |
| b) Disorders of Lymph and lymphatic system (Definitions only)   |                           |
| c) Spleen: Physiology and function  |                           |
| <b>7. Cardio vascular system</b>  |                           |
| a) Anatomy of heart   | 8                         |
| b) Blood vessels and circulation  |                           |
| c) Pulmonary and systemic circulation   |                           |
| d) ECG  |                           |
| e) Cardiac cycle and Heart Sounds   |                           |
| f) Blood Pressure maintenance and regulation  |                           |
| Definitions of the following disorders  |                           |
| i) Hypertension   | ii) Hypotension           |
| iii) Arteriosclerosis   | iv) Atherosclerosis       |
| v) Angina   | vi) Myocardial infarction |
| vii) Congestive Heart failure and   | viii) Cardiac arrhythmias |

**8. Respiratory System**

- a) Anatomy of respiratory organs and functions 5
- b) Mechanism and regulation of Respiration
- c) Physiology of respiration: transport of respiratory gases
- d) Respiratory volumes and vital capacity
- e) Definitions of: Hypoxia, Asphyxia, Dysbarism, Oxygen therapy and Resuscitation

**9. Digestive System**

- a) Anatomy of Gastro Intestinal Tract (GIT) 6
- b) Secretions functions and anatomy of
  - i) Salivary glands
  - ii) Stomach
  - iii) Liver
  - iv) Pancreas
  - v) Intestine
- c) Disorders of GIT (definitions only)
- d) Digestion and absorption

**10. Nervous Systems**

- a) Definitions and classification of Nervous system 12
- b) Functional areas and functions of cerebrum
- c) Cerebellum
- d) Pons and Medulla
- e) Thalamus and Hypothalamus
- f) Basal ganglion
- g) Spinal cord: Structure and reflexes-Mono-Poly-Plantar
- h) Cranial Nerves-Names and functions
- i) ANS-anatomy and functions of sympathetic and parasympathetic nervous system

- 11. Urinary System** 6
- a) Parts of Urinary system and Gross structure of the kidney
  - b) Structure of Nephron
  - c) Formation of Urine
  - d) Rennin Angiotensin System- Juxta -Glomerular apparatus, Acid Base balance.
  - e) Clearance tests and Micturition
- 12. Endocrine System** 5
- a) Pituitary gland
  - b) Adrenal gland
  - c) Thyroid and parathyroid gland
  - d) Pancreas and gonads
- 13. Reproductive System** 7
- a) Male and female reproductive systems
  - b) Their hormones – physiology of menstruation
  - c) Spermatogenesis and Oogenesis
  - d) Sex determination (genetic basis)
  - e) Pregnancy and its maintenance and parturition
  - f) Contraceptive devices
- 14. Sense Organ-Structure and functioning of** 6
- a) Eye
  - b) Ear
  - c) Skin
  - d) Taste and Smell
- 15. Skeletal muscles** 3
- a) Histology
  - b) Physiology of muscle contraction
  - c) Physiological properties of skeletal muscle performance (Definition of the disorders)
- 16. Sports physiology** 2
- a) Muscles in Exercise
  - b) Effect of athletic training on muscles and muscle performance
  - c) Respiration in exercise
  - d) CVS in exercise
  - e) Body heat in exercise
  - f) Body fluids and salt in exercise
  - g) Drugs and athletics

## HUMAN ANATOMY AND PHYSIOLOGY (Practicals)

75 hours

1. Determination of hemoglobin content of blood
2. Determination of R.B.C. content of blood
3. Determination of W.B.C. content of blood
4. Determination of differential count of blood
5. Determination of blood groups
6. Determination of blood pressure
7. Determination of Bleeding time & clotting time
8. Determination of vital capacity
9. Study of appliances used in experimental physiology
10. Muscle physiology [simulated experiments]
  - a) To study simple muscle curve
  - b) To study the effect of temperature on muscle contraction
  - c) To study the effect of load and after load on muscle contraction
  - d) To study the fatigue curve
  - e) To study the summation muscle curve
11. Study of different systems with the help of charts and models
12. Study of histology slides of different tissues/organs
13. Study of human skeleton
14. Study of different family planning appliances
15. To perform pregnancy diagnosis tests

**SCHEME OF EXAMINATION**

1 Identification	-	10 Marks
2 Synopsis	-	10 Marks
3 Hematology (2 Expt.)	-	20 + 10 Marks
4 Muscle Physiology (simulated practicals)	-	10 Marks
5 Viva	-	10 Marks
Total	-	70 Marks

**HUMAN ANATOMY AND PHYSIOLOGY REFERENCE BOOKS**

<b>Recommended books(Latest Edition)</b>			
<b>Sl.No</b>	<b>Name of the book</b>	<b>Author</b>	<b>Publisher</b>
<b>01</b>	Ross and Wilson Anatomy and Physiology in Health and Illness	A. Waugh and A.Grant	Churchill Living Stone, Edinburgh,
<b>02</b>	Human Anatomy and Physiology	Bhise S.B. And Yadav P	Nirali Prakashan, Pune (India),
<b>03</b>	Human Physiology” (Vol. I & Vol. II)	C.C. Chatterjee	Medical Allied Agency, Calcutta,
<b>04</b>	Consise Medical Physiology	Chaudhry S.K	New Cenrtal Book Agency, Calcutta
<b>05</b>	Elements of Human Anatomy Physiology and Health Education	Thakaore B, P. Gandhi and H.R. Derasari	B.S. Shah Publishers, Ahmedabad,

<b>Reference books(Latest Edition)</b>			
<b>Sl.No</b>	<b>Name of the book</b>	<b>Author</b>	<b>Publisher</b>
<b>01</b>	Illustrated Physiology	AB Mc Naught and Callander R	B.I. Churchill Living Stone, New Delhi
<b>02</b>	Text book of Medical Physiology	A. C. Guyton and J.E. Hall,	W.B. Saunders company,
<b>03</b>	Bailey`s TextBook of Microscopic Anatomy	Douglas E., Kelly, Richard Wood and Allen C. Enders	Williams and Wilkins publishers, London,
<b>04</b>	Human Anatomy and Physiology	E.N. Marieb,	Addison Wesley, New York,
<b>05</b>	Principles of Anatomy and Physiology	G. J. Torotoro,	John-Wiley & sons New York,
<b>06</b>	Text Book of Human Histology with Colour Atlas	Inderbir Singh,	Jaypee Brothers, New Delhi,
<b>07</b>	Preventive and Social Medicine	Park J.E. and Park K.,	Banarasidas Bhanot, India,

**LIST OF MINIMUM EQUIPMENT REQUIRED (For a batch of 20 students)**

1.	Microscopes		20
2.	Glass Slides		80
3.	Haemocytometer with Micropipettes		20
4.	Sahli`s haemocytometer		20
5.	Hutchinson`s spirometer		01
6.	Sphygmomanometer		20
7.	Stethoscope		20
8.	Permanent Slides for various tissues, Organs and endocrine glands	One pair of each tissue One model of each organ System	
9.	Models for various organs	One model for each organ System	
10.	Specimen for various organs and systems	One model for each organ System	
11.	Skeleton and Bones bones	One set of skeleton and one spare	
12.	Different contraceptive devices and models.	One set of each device	



**1.2: PHARMACEUTICS (Theory)****50 hours**

1. **Historical background** and development of profession of pharmacy and Pharmaceutical Industry, Pharmaceutical education in India in brief. 1
2. **Development** of Indian pharmacopoeia and introduction to other Pharmacopoeias such as B.P., U.S.P, European pharmacopoeia, Extra Pharmacopoeia and Indian National Formulary. 3
3. a) **Introduction to dosage forms:** Classification and definitions.  
 b) **Prescription:** Definition, parts of prescription and handling  
 c) **Posology:** Definition, factors affecting dose selection, calculation of children and Infant doses. Different types of weights and measures, calculations involving percentage of solutions, alligation, proof spirit, isotonic solutions. 8
4. **Introduction to different types of processes:** Fusion, desiccation, sublimation, exsiccation and ignition. Definition of evaporation, distillation and drying. Various types of Baths; Water bath, Steam bath, Oil bath and Solvent bath 4
5. **Galenicals:** Definition, equipment for different extraction processes: Expression infusion, decoction, maceration and percolation, method of preparation of spirits, tinctures, extracts, soxhlet extraction. 6
6. **Surgical aids:** Definition and types of surgical sutures and ligatures. Manufacture and standardization of surgical catgut. 3
7. **Powders and granules:** Classification, advantages and disadvantages, preparation of simple, compound powders, insufflations, dusting powders, Eutectic and explosive powders, tooth powders and effervescent granules. 5
8. **Monophasic dosage forms:** Theoretical aspects including commonly used vehicles, essential adjuvant like stabilizers, colorants, and flavors with examples. Study of following monophasic liquids like gargles, mouthwashes, throat paints, eardrops, nasal drops, liniments and lotions, enemas, colloidions, syrups, elixirs and solutions. 6
- 9 **Biphasic dosage forms:** Suspensions: Definition and classification, diffusible and indiffusible suspensions, advantages and disadvantages.  
 Emulsions: Definition, types of emulsions, identification tests emulsifying agents, creaming and cracking of emulsions. 7
10. **Suppositories and pessaries:** Definition, advantages and disadvantages, types of bases, method of preparation, displacement value. 4
11. **Incompatibilities:** Introduction, Physical and Therapeutic incompatibility and methods of overcome to same. 3

**PHARMACEUTICS (Practicals)****75 hours**

1. Syrups :
  - a) Simple syrup IP\*
  - b) Syrup of ephedrine hydrochloride NF\*
  - c) Orange syrup.
2. Elixir :
  - a) Piperazine citrate elixir BP\*
  - b) Paracetamol paediatric elixir BPC\*
3. Linctuses:
  - a) Simple linctus BPC\*
  - b) Pediatric simple linctus BPC\*
4. Solutions:
  - a) Solution of cresol with soap IP\*
  - b) Aqueous iodine solution IP\*
  - c) Strong solution of iodine IP\*
  - e) Weak iodine solution IP\*
  - f) Strong solution of ammonium acetate\*\*
5. Liniments:
  - a) Liniment of turpentine IP\*\*
  - b) Liniment of Camphor BPC\*\*
  - c) Soap liniment\*
6. Suspensions:
  - a) Calamine lotion IP\*\*
  - b) Magnesium hydroxide mixture BP\*\*
7. Emulsions:
  - a) Liquid paraffin emulsion, \*\*
  - b) Castor oil emulsion, \*\*
  - c) Cod liver oil emulsion\*\*
8. Powders:
  - a) Eutectic powder\*
  - b) Effervescent powder\*
  - c) Dusting powder\*
  - d) Effervescent granules\*\*
9. Suppositories:
  - a) Boric acid suppository \*\*
  - b) Zinc oxide suppository\*\*
10. Colloidion:
  - a) Salicylic acid colloidion
11. Gargle:
  - a) Potassium chlorate gargle\*
12. Mouthwash:
  - a) Antiseptic mouthwash.\*
13. Enema:
  - a) Any one\*.
14. Preparation of some pharmacopeial extracts and galenical products with different methods of extraction

**SCHEME OF EXAMINATION**

1. Synopsis		
2. Major Experiment (Experiments indicated by **)	-	30 Marks
3. Minor experiment (Experiments indicated by *)	-	15 Marks
4. Viva voce	-	10 Marks
	Total	70 Marks

**PHARMACEUTICS REFERENCE BOOKS**

<b>Recommended books(Latest Edition)</b>			
<b>Sl.No</b>	<b>Name of the book</b>	<b>Author</b>	<b>Publisher</b>
<b>01</b>	Cooper and Gunn's Dispensing for Pharmaceutical Students,	Carter S.J,	CBS Publishers, New Delhi,
<b>02</b>	Cooper and Gunn's Tutorial pharmacy	Carter S.J,	CBS Publishers , New Delhi,
<b>03</b>	Pharmaceutics The Science of Dosage Form Design	M.E.Aulton	Churchill Livingstone, Edinburgh,
<b>04</b>	Bentley's textbook of Pharmaceutics	E.A.Rawlins	English language book Society,

<b>Reference books(Latest Edition)</b>			
<b>Sl.No</b>	<b>Name of the book</b>	<b>Author</b>	<b>Publisher</b>
<b>01</b>	Pharmaceutical Dosage Forms and Drug Delivery Systems	H. C. Ansel et. al	Lippincott Williams and Wilkins, New Delhi,
<b>02</b>	Pharmaceutical Calculations	M.J. Stoklosa and H.C. Ansel,	B I Waverley Pvt. Ltd., New Delhi,
<b>03</b>	Remington The Science and Practice of Pharmacy, Vol: I and II	Alfonso R. Gennaro,	Lippincott Williams
<b>04</b>	Indian Pharmacopoeia 2007,	Govt.. of India	Published by The Controller of Publications, Delhi.

**LIST OF MINIMUM EQUIPMENTS REQUIRED**

1. Mechanical stirrers
2. Homogeniser
3. pH meter
4. Suppository moulds
5. Electronic balance

## I B.Pharm

## 1.3 PHARMACOGNOSY &amp; PHYTOCHEMISTRY I (Theory)

50 hours

1. Definition, history and scope of Pharmacognosy.
2. Sources of drugs-Biological, Marine, Mineral and Plant tissue cultures as sources of drugs.
3. Classification of drugs viz. alphabetical, morphological, chemical, pharmacological, taxonomical and chemo taxonomical methods
4. Cultivation, collection, processing and storage of crude drugs. Conservation of medicinal plants.
5. Study of morphological, microscopical and cell wall constituents of crude drugs:
  - a) Study of cell wall constituents and cell inclusions.
  - b) Study of morphology and microscopy of different plant parts.
    - i. Leaf: Datura, Senna
    - ii. Bark: Cinnamon (Cassia), Cinchona
    - iii. Wood: Quassia
    - iv. Stem: Ephedra
    - v. Root: Rauwolfia, Liquorice
    - vi. Rhizome: Ginger, Podophyllum
    - vii. Flower: Clove
    - viii. Fruits: Coriander, Fennel
    - ix. Seeds: Isapgol, Nux Vomica
6. Study of Natural Pesticides: Pyrethrum, Neem, Tobacco
7. Quality control of crude drugs: adulteration of crude drugs and their detection by organoleptic, microscopic, physical, chemical and biological methods of evaluation
8. An introduction to active constituents of crude drugs
9. a) Detailed study of primary cell constituents: Carbohydrates and related products.
  - b) Biological source, method of production, chemical constituents, tests, uses and adulterants of:
    - i) Isapgol    ii) Linseed    iii) Honey    iv) Acacia    v) Agar
    - vi) Sterculia    vii) Tragacanth    viii) Cellulose and its products
    - ix) Pectin    x) Guar gum    xi) Sodium alginate
10. Lipids:
  - a) Definition, method of extraction, chemistry and method of analysis
  - b) Study of method of production, chemical constituents, tests, uses and adulterants of the following oils:
    - i) Castor oil    ii) Shark liver oil    iii) Chamoeora oil    iv) Wool fat
    - v) Bees wax    vi) Spermaceti    vii) Coca butter    viii) Olive oil

11. Proteins:
  - a) Definition, Classification, Chemistry, method of analysis
  - b) Study of collagen, gelatin and its products.
12. Study of plant fibers used in surgical dressing and related products.

### **PHARMACOGNOSY (Practicals)**

**75 hours**

1. Study of cell wall constituents and cell inclusions\*.
2. General morphological study of different parts of the plants including surgical fibers\*.
  - a) Leaf: Datura, Senna
  - b) Bark: Cinnamon (Cassia), Cinchona
  - c) Stem: Ephedra
  - d) Wood: Quassia
  - e) Flower: Clove
  - f) Fruits: Fennel, Coriander
  - g) Seeds: Isapgol, Nux Vomica
  - h) Root: Rauwolfia, Liquorice
  - i) Rhizome: Ginger, Podophyllum
3. Transverse sections of drugs mentioned in 2\*\*
4. Test for identification of / adulterants in\*:
  - a) Castor oil b) Shark Liver oil c) Wool fat d) Bees wax. e) Sesame oil
5. Chemical tests for identification of the following drugs and adulterants in them\*.
  - a) Acacia b) Agar c) Tragacanth d) Starch e) Honey f) Gelatin.
6. Analysis of fats and oils – Iodine values, Saponification values, Acid values and Ester values\*\*
  6. Preparation of Herbarium sheets.

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

1. Synopsis	- 10 Marks
2. Major Experiment**.	- 20 Marks
3. Minor Experiment*	- 15 Marks
4. Minor Experiment* .	- 15 Marks
5. Viva-Voce	- 10 Marks
<b>www.Pharmainfo.Net</b>	
Total	- 70 Marks

**PHARMACOGNOSY REFERENCE BOOKS**

<b>Recommended books (Latest Edition)</b>			
<b>Sl.No</b>	<b>Name of the book</b>	<b>Author</b>	<b>Publisher</b>
<b>01</b>	Pharmacognosy,	Trease G.E. and Evans, W.C.,	Bailliere Tindall, Eastbourne, U.K
<b>02</b>	Pharmacognosy	Kokate C.K., Purohit A.P. and Gokhale S.B	Nirali Prakasham,
<b>03</b>	Anatomy of Crude Drugs,	Iyengar M.A.and Nayak S.G.K.,	Manipal Power Press, Manipal.,
<b>04</b>	Practical Pharmacognosy,	Kokate C.K.,	Vallabh Prakashan, Delhi.,

<b>Reference books(Latest Edition)</b>			
<b>Sl.No</b>	<b>Name of the book</b>	<b>Author</b>	<b>Publisher</b>
<b>01</b>	Brady R Textbook of Pharmacognosy,	Tyler V.E.,	Lea and Febiger Philadelphia ,
<b>02</b>	Medicinal plants of India	Govt. of India	Indian Council of Medical Research, and New Delhi.
<b>03</b>	Indian Materia Media	Nadkarni, A.K.,	1-2 Popular Prakashan Pvt., Ltd., Bombay
<b>04</b>	Pharmacopoeia of India	Govt. of India	Government of India, New Delhi.
<b>05</b>	The chemotaxonomic of Plants	Smith P.M.,	Edinburgh,
<b>06</b>	The Wealth of India, Raw Materials (All Volumes)	CSIR	council of Scientific and Industrial Research, New Delhi.
<b>07</b>	The practical Evaluation of Phytopharmaceuticals	Brain, K.R.and Turner, T.D.,	Wright-Sciotechnica, Bristol.
<b>08</b>	Textbook of Pharmacognosy,	Wallis T.E.,	J.A., Churchill Limited, London.,
<b>09</b>	Industrial Gums, Polysaccharides and their derivatives,	Whistler R.L.,	Academic Press,New York
<b>10</b>	Phytochemical methods	Harborne J.B.,	Chapman and Hall, International Edition, London.

**LIST OF MINIMUM EQUIPMENTS REQUIRED**

1. Microscope with Stage	20
2. Balance	20
3. Reflux flask with condenser	20
4. Heating mantle	20
5. Water bath	20

**1.4 PHARMACEUTICAL ORGANIC CHEMISTRY I (Theory)****68 Hours**

1. Structure and physical properties:
  - a) Polarity and dipole moment: Hydrogen bonding and its applications and Protic and aprotic solvents.
  - b) Tautomerism, Keto-enol tautomerism.
  - c) Reaction intermediates -carbocations, carbanions and free radicals
  - d) Attacking reagents-electrophiles, nucleophiles.
  - e) Acids and bases: Lowry Bronsted and Lewis theories.
  - f) An introduction to Isomerism.

3
2. Nomenclature of organic compounds belonging to the following classes: alkanes, alkenes, dienes, alkynes, alcohols, aldehydes, ketones, amides, amines, phenols, alkyl halides, carboxylic acids, esters, acid chlorides and cycloalkanes. Concept of aromaticity, Huckel's rule nomenclature of aromatic compounds.
 

8
3. Free radical chain reactions of alkanes-mechanism, relative reactivity and stability.
 

3
4. Alicyclic compounds: Preparation of cycloalkanes, Bayer's strain theory, theory of strainless ring, molecular orbital concept.
 

4
5. Geometrical isomerism, its nature of formation, rotation about bonds: nomenclature of isomers, determination of configuration.
 

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

4
7. Electrophilic addition: Reactions at carbon-carbon double bond, hydrogenation, Markovnikov's rule, addition of hydrogen halides, Addition of hydrogen bromides-peroxide effect. Electrophilic addition mechanism. Mechanism of cycloaddition reactions with examples. Addition of carbenes to alkenes, Diel's Alder reaction.
 

5
8. Theory of resonance: allyl radical as a resonance hybrid, stability, and orbital picture. Resonance stabilization of allyl cations: hyper conjugation, stability of conjugated dienes, mechanisms of 1,2 and 1,4-additions with examples, effect of temperature on 1, 2 and 1,4 addition.
 

7

9. Electrophilic aromatic substitution; Effect of substituent groups, determination of orientation, determination of relative reactivity, classification of substituent groups. mechanism of nitration, sulphonation, halogenation, Friedel craft alkylation and Friedel craft's acylation, Reactivity and orientation, activating and deactivating (*o*, *m*, *p*, directing) groups, orientation and synthesis, orientation in disubstituted benzenes, theory of reactivity, theory of orientation, effects of halogens. 10
10. Nucleophilic additions in aldehydes and ketones, mechanisms with examples. Action of grignard reagent. Aldol condensation, crossed Aldol condensation, claisen condensation, cannizaro, crossed cannizaro reaction, benzoin's, perkins, knoevenagels and reformatsky reaction. 6
11. Nucleophilic acyl substitution in carboxylic acid derivatives, comparison with nucleophilic addition reaction, ionization of carboxylic acids, acidity of acids, structure of carboxylate ion, effect of substituents on acidity. Conversion of acids to acid chloride, amide, ester, anhydrides. 7
12. Migration to electron deficient nitrogen – Hofmanns, Beckmanns, Curtius, Smith. Diazotisation and Diazonium salts and its applications, Sandmeyers Diazocoupling reactions. Basicity of amines, effect of substituents on basicity. Acidity of phenols, effect of substituents on acidity. Kolbe's reaction, Reimer Tiemann reaction, Fries rearrangement, Williamson's synthesis. 7



**PHARMACEUTICAL ORGANIC CHEMISTRY I (Practicals)****75 hours**

1. Introduction to the various laboratory techniques through demonstrations involving synthesis of the following compounds (atleast 8 compounds to be synthesized). \*
  1. Acetanilide / Aspirin (acetylation)
  2. Benzanilide / Phenyl benzoate (Benzoylation)
  3. *p*-Bromo acetanilide / 2,4, 6 Tribromo aniline. (Bromination)
  4. Dibenzylidene acetone (condensation)
  5. 1-Phenylazo-2-naphthol (Diazotisation)
  6. Benzoic acid / Salicylic acid (hydrolysis of ester)
  7. *m*-Dinitro benzene (nitration)
  8. 9, 10- Anthraquinone (oxidation of anthracene) / preparation of benzoic acid from toluene or benzaldehyde.
  9. *m*-Phenylenediamine (reduction of *m*-dinitrobenzene)/aniline from nitrobenzene
  10. Benzophenone oxime (oxime formation)
  11. Nitration of salicylic acid
  12. Preparation of *o*-chloro benzoic acid from *o*-chloro toluene
  
2. Identification of organic compounds belonging to the following classes by systematic qualitative organic analysis including preparation of derivatives\*\*.
  1. Phenols
  2. Amides
  3. Carbohydrates
  4. Amines
  5. Carboxylic acids
  6. Aldehydes and ketones
  7. Alcohols
  8. Esters
  9. Hydrocarbons
  10. Anilides
  11. Nitro compounds
  
3. Introduction to the use of stereo models
  1. Methane
  2. Ethane
  3. Ethylene
  4. Acetylene
  5. *cis*-Alkene
  6. *trans*-Alkene
  7. Inversion of configuration
  
4. Determination of melting point and boiling point for some important pharmaceutical Organic compounds.

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

1. Synopsis	- 10 Marks
2. Major Experiment (Experiments indicated by **) (Systematic Qualitative Analysis)	- 35 Marks
3. Minor Experiment –I (Experiments indicated by)* (Preparation of Simple Organic Compound)	- 15 Marks
4. Practical viva	- 10 Marks
Total	- 70 Marks

**PHARMACEUTICAL ORGANIC CHEMISTRY I**

<b>Recommended books(Latest Edition)</b>			
<b>Sl.No</b>	<b>Name of the book</b>	<b>Author</b>	<b>Publisher</b>
<b>01</b>	Text of Organic Chemistry	T.R.Morrison and R.Boyd,	Prentice Hall of India Pvt. Ltd., New Delhi
<b>02</b>	Elementary Practical organic chemistry,	A.I. Vogel,	ELBS and Longman group Ltd., London.

<b>Reference books(Latest Edition)</b>			
<b>Sl.No</b>	<b>Name of the book</b>	<b>Author</b>	<b>Publisher</b>
<b>01</b>	Bentley and Driver's textbook of Pharmaceutical Chemistry.	L.M. Atherden,	Prentice Hall of India Pvt. Ltd., New Delhi
<b>02</b>	Organic Chemistry, the Fundamentals of Chemistry	I.L. Finar	Longman Publishers
<b>03</b>	Fundamentals of Organic Chemistry,	T.W.Graham Solomons,	John Wiley & Sons Inc., USA,
<b>04</b>	Organic Chemistry	J.M.Catm and D.J.Carm	Saunders college of Publishing,
<b>05</b>	Advanced Organic Chemistry,	Jerry and March,	Wiley Eastern Limited, New Delhi
<b>06</b>	Practical Organic Chemistry	Mann and Sounders,	ELBS and Longman group Ltd.,
<b>07</b>	Introduction to Organic Laboratory Techniques	D.L.Pavia, G.Lampman and G.D.Kriz.	ELBS and Longman group Ltd.,
<b>08</b>	Text Book of practical organic chemistry,	A. I. Vogel,	ELBS Longman, London,

**LIST OF MINIMUM EQUIPMENTS REQUIRED**

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

## I B. Pharm

## 1.5 PHARMACEUTICAL INORGANIC CHEMISTRY (Theory)

75 hours

1. Sources and effects of impurities in pharmacopoeial substances, importance of limit test, general principles and procedures for limit tests for chloride, sulphate, iron, arsenic, lead and heavy metals. Special procedures for limit tests. 10
2. General methods of preparation, assays<sup>\*</sup>, storage condition & medicinal uses of inorganic compounds belonging to the following classes. (Assays<sup>\*</sup>)
  - 2.1 **Medicinal Gases:** Oxygen, Nitrous oxide, Carbon dioxide 2
  - 2.2 **Gastrointestinal agents**  
 Acidifiers: dil HCl  
 Antacids: Aluminum hydroxide gel, Calcium carbonate, Sod. bicarbonate<sup>\*</sup>, Magnesium trisilicate, Magnesium carbonate (light and heavy), Magnesium hydroxide mixture<sup>\*</sup> and Zinc oxide<sup>\*</sup>.  
 Protective and adsorbents: Kaolin and Talc,  
 Cathartics: Magnesium sulphate<sup>\*</sup>, Sodium orthophosphate, Sodium sulphate. 7
  - 2.3 Major intra and extra cellular electrolytes, major physiological ions and electrolytes used for the replacement therapy, physiological acid base balance, electrolyte combination therapy ORS, Sodium chloride injection, Dextrose and Sodium chloride injection, Calcium gluconate injection. 6
  - 2.4 **Topical agents and dermatological preparations:**  
 Protective: Talc, Zinc oxide, Zinc stearate, Titanium dioxide.  
 Antimicrobials: Potassium Permanganate<sup>\*</sup>, chlorinated lime<sup>-</sup>, Iodine preparations, Boric acid<sup>\*</sup>, Borax. 6
  - 2.5 **Dental products:** Dentifrices, anticaries agents, desensitizing agents, calcium carbonate, sodium fluoride, Stannous fluoride, Zinc chloride, Zinc eugenol cement. 3

**2.6 Miscellaneous agents:**

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

Haematinics : Ferrous sulfate\*, Ferrous gluconate, Ferrous Fumarate, Iron dextran injection, Iron and Ammonium citrate.

Emetics : Copper sulphate\*.

Poisons and antidotes : Sodium thiosulphate, Charcoal, (activated)

Pharmaceutical Aids : Bentonite, Sodium metabisulphite, Barium sulphate\*.

4

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

5

4. Fundamentals of volumetric analysis, theory of indicators and methods of expressing concentration. Primary and secondary standards. Preparation, standardization and storage of various volumetric solutions like oxalic acid, sodium hydroxide, hydrochloric acid, sodium thiosulfate, potassium permanganate and Iodine solution.

8

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

10

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

4

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

5

**4.4 Principles of complexometric titrations,** different types of complexometric titrations, methods of detecting the endpoints in complexometric titrations with example and estimation of calcium Gluconate.

5

**PHARMACEUTICAL INORGANIC CHEMISTRY (Practicals)****75 Hours**

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

1. Limit tests (7 exercises)
  1. Limit test for chlorides\*
  2. Limit test for sulphate\*
  3. Limit test for Iron\*
  4. Limit test for heavy metals\*
  5. Limit test for Arsenic
  6. Modifications in limit tests\* for chloride and sulphates in potassium permanganate, sodium bicarbonate, sodium benzoate and sodium Salicylate.
  
2. Preparation and standardization of the following (4 exercises).
  1. 0.1N Sodium hydroxide
  2. 0.1N  $\text{KMnO}_4$
  3. 0.1N Ceric ammonium sulphate
  4. 0.1N  $\text{HClO}_4$
  5. 0.05M Di sodium EDTA
  
3. Assay of the following compounds (8 exercises)\*\*
  1. Ammonium chloride-acid base titration (Formal titration)
  2. Ferrous sulphate- (redox) Ceric ammonium sulphate titration
  3. Copper sulphate- (redox) Iodometry
  4. Calcium gluconate-complexometry
  5. Hydrogen peroxide- (redox -Permanganometry)
  6. Sodium benzoate-nonaqueous titration
  7. Sodium chloride-Modified Volhard's method
  8. Assay of KI- $\text{KIO}_3$  titration
  9. Assay of Zinc oxide (acid base back titration)
  
4. Test for identify for the following (3 exercises)
  1. Sodium bicarbonate
  2. Ferrous sulphate
  3. Potassium chloride
  4. Calcium chloride
  
5. Test for purity for the following (2 exercises)\*
  1. Swelling power in Bentonite
  2. Ammonium salts in Potash alum.
  3. Presence of Iodates in KI
  
6. Preparation of inorganic pharmaceuticals (2 exercises)\*
  1. Boric acid
  2. Potash alum
  3. Magnesium hydroxide.
  4. Magnesium sulphate

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

1. Synopsis	- 10 Marks
2. Major Experiment (Experiments indicated by **)	- 25 Marks
3. Minor Experiment –1 Limit Test	- 13 Marks
4. Minor Experiment-2 Test for Purity or Preparation	- 12 Marks
5. Practical viva	- 10 Marks
<b>Total</b>	<b>- 70 Marks</b>

Note:       \*\* Denotes major experiments  
              \* Denotes minor experiments

**PHARMACEUTICAL INORGANIC CHEMISTRY**

<b>Recommended books(Latest Edition)</b>			
<b>Sl.No</b>	<b>Name of the book</b>	<b>Author</b>	<b>Publisher</b>
<b>01</b>	Inorganic pharmaceutical chemistry	M.L.Schroff	Nirali Publication
<b>02</b>	Practical Pharmaceutical Chemistry Vol I & II,	A.H.Beckett & J.B. Stenlake	Stahlone Press of University of London,
<b>03</b>	Bentley & Drivers Text Book of Pharmaceutical Chemistry	A. Y Bentley	University Press, London.

<b>Reference books(Latest Edition)</b>			
<b>Sl.No</b>	<b>Name of the book</b>	<b>Author</b>	<b>Publisher</b>
<b>01</b>	Inorganic pharmaceutical chemistry	M.L.Schroff	Nirali Publication
<b>02</b>	Concise Inorganic chemistry.	J.D.Lee,	University Press, London.
<b>03</b>	Modern inorganic pharmaceutical chemistry.	C.A.Discher,	University Press, London.
<b>04</b>	Inorganic medicinal and pharmaceutical chemistry.	J.H.Block, E.B.Roche, T.O.Soine and C.O.Wilson,	University Press, London.
<b>05</b>	Analytical chemistry-principles.	John H.Kennedy,	Sunders college publication New York, .
<b>06</b>	Practical Pharmaceutical Chemistry Vol I & II,	A.H.Beckett & J.B. Stenlake's	Stahlone Press of University of London,

**LIST OF MINIMUM EQUIPMENTS REQUIRED**

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

**I B. Pharm****1.6: MATHEMATICS****75 hours**

- 1. Matrices:** Definition of matrices, Addition, Subtraction, multiplication of matrices, inverse of a square matrix, solution of linear simultaneous equations by matrix method, the characteristic equation of a matrix statement of Cayley-Hamilton Theorem (without proof) – examples pharmaceutical applications of determinations and matrices, Determinants of order two & order three, adjoint kramer's rule  
15
- 2. Trigonometry:**  
Relations between the sides and angles of a triangle, Solution of triangle.  
6
- 3. Analytical Geometry:**  
Point : Distance formula – Examples.  
Straight line : General form of the equation to a straight line, slope of the line. slope point form. Condition for two lines to be parallel and perpendicular, angle between two lines, Perpendicular distance form the point to the line, Distance between parallel lines  
Circle : General equation of a circle, finding center and radius of the circle.  
Parabola : Derivation of standard equation in the form :  $Y^2=4ax$ .  
10
- 4. Differential Calculus:**  
Limit of a function, derivative of a function, Differentiation of a sum, Product and quotient, Differentiation of composite functions, Implicit functions, parametric functions, Logarithmic differentiation, differentiation of exponentials, logarithmic, trigonometric, universe trigonometric functions, successive differentiation, Leibnitz Theorem for nth order derivative of a product, partial differentiation, Euler's theorem on homogeneous functions of two variables.  
15



**5. Integral Calculus:**

Indefinite integrals, integration by substitution and integration by parts important properties of definite integrals.

8

**6. Differential Equations:**

Definition formation of differential equations, differential equations of the first order and first degree, Methods of solving ordinary differential equations: variables separable, homogeneous, linear, exact. Differential equations and equations reducible to these forms, exact differential equations, linear differential equations with constant coefficients (higher order), homogeneous linear differential equations, simultaneous linear differential equations of the first order, pharmaceutical applications.

15

**7. Laplace Transforms:**

Definition, Laplace transforms of elementary functions, properties of linearity and shifting, applications of differential equations using Laplace transforms.

6

**MATHEMATICS**

<b>Recommended books(Latest Edition)</b>			
<b>Sl.No</b>	<b>Name of the book</b>	<b>Author</b>	<b>Publisher</b>
<b>01</b>	Differential calculus	Shantinakaran	Shym Lal charitable trust
<b>02</b>	Integral calculus	Shantinakaran	S.Chand & Co Pvt.Ltd

<b>Reference books(Latest Edition)</b>			
<b>Sl.No</b>	<b>Name of the book</b>	<b>Author</b>	<b>Publisher</b>
<b>01</b>	Engineering mathematics	Grewal	Nirali Publication
<b>02</b>	Trigonometry Part-I	S.L.Loney	Vallabh Prakashan
<b>03</b>	A Textbook of Mathematics for second year Pre-university	Prof.B.M.Sreenivasa Rao and S.Nagaraj	Vallabh Prakashan

**I B.Pharm****1.6: BIOLOGY (Theory)****50 hours****Part A. BOTANY**

- |   |   |
|---|---|
| 1. General organization of the plant and plant cell and its inclusions.   | 2 |
| 2. The plant tissues (Meristematic and permanent).  | 2 |
| 3. The broad classification of the plant kingdom.   | 2 |
| 4. Morphology of the plant parts like root, stem and leaf and their modifications.  | 2 |
| 5. Inflorescence , flower and its pollination.  | 2 |
| 6. Morphology of fruits and seeds.  | 2 |
| 7. <b>Plant taxonomy:</b> Study of different families viz. Leguminous, Umbelliferae, Solanaceae, Liliaceae, Zingiberaceae and Rubiaceae with special reference to medicinal plants. | 6 |
| 8. <b>Plant Physiology:</b> Transpiration , Photosynthesis, Respiration and Growth.   | 4 |
| 9. The study of 1) Fungi : eg. Yeast, Penicillin., 2) Bacteria.   | 3 |

**Part B. ZOOLOGY**

- |   |   |
|---|---|
| 1. The study of Animal Cell, Animal tissues, Differences between plant and animal cell.                     | 4 |
| 2. The detailed study of frog.  | 6 |
| 3. The study of representatives of Pices, Reptiles and Aves with special reference to the medicinal values. | 5 |
| 4. General organization of a mammal.  | 5 |
| 5. The study of poisonous animals.  | 5 |

**BIOLOGY (Practicals)****50 hrs****Part A. Botany**

The general organization of typical plant and morphological study of plant parts studies in theory(Roots, Stem, Leaves and their modifications).\*

1. Inflorescence and flower.\*
2. Fruits and seeds(Identifications).\*
3. Plant tissues through permanent slides\* and Histological preparations of roots, stems, and Leaves by Eosin or Saphranin stain.\*\*
4. Simple experiments on plant physiology.\*
5. Identification of cell inclusion.\*

**Part –B : Zoology**

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

**SCHEME OF EXAMINATION**

1. Synopsis	- 10 Marks
2. Study of any one system of frog	- 15 Marks
3. Transverse Section	- 15 Marks
4. Minor Experiment 1	- 10 Marks
5. Minor Experiment 2	- 10 Marks
6. Viva – Voce	- 10 Marks
Total	- 70 Marks

**BIOLOGY REFERENCE BOOKS**

<b>Recommended books(Latest Edition)</b>			
<b>Sl.No</b>	<b>Name of the book</b>	<b>Author</b>	<b>Publisher</b>
<b>01</b>	A class book of Botany	A.C.Dutta.	Oxford & IBH Publishing Co.

<b>Reference books(Latest Edition)</b>			
<b>Sl.No</b>	<b>Name of the book</b>	<b>Author</b>	<b>Publisher</b>
<b>01</b>	Functional Anatomy of a mammal	LEACH.	McGraw-Hill.
<b>02</b>	Baleys Histology	Copenhaver.W.M;Kelly.D.E.	The Williams & Wilkins Co.
<b>03</b>	A Text Book of Vertebrate zoology	S.N.Prasad	Kithab Mahal Alhabad

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**1.7: COMPUTER SCIENCE AND STATISTICS (Theory)****75 hours****PART A: STATISTICS**

1. Definition, data frequency, distribution, Classification of data. General graphical representation of the data: histogram, Frequency curve and frequency polygon and Ogive. Semilog line graph. Use of semilog scale-examples. 8
2. **Measures of central tendency:** Arithmetic mean, geometric mean and harmonic mean. Median, Mode, Calculation of quartiles and percentiles deciles. 6
3. **Measures of dispersion:** Range, quartile deviation, Mean deviation, Standard deviation, variance, coefficient of variation, skewness and curtosis. 9
4. **Correlation, Regression:** Linear correlation, coefficient of correlation: karlpearsons formula, spearman's rank method, curve fitting by the method of least squares: Fitting a straight line  $y = a + bx$ , Fitting a power curve  $y = ax^b$ , Fitting an exponential curve  $y = ab^x$ ,  $y = ae^{bx}$ , Regression analysis for lines. 12
5. **Definition of probability:** Random experiment, sample space, Addition and multiplication laws of probability (without proof), probability distribution: binomial, poisson's, normal and chi-square, Student test and Pharmaceutical examples. 10

**PART B: COMPUTER SCIENCE**

1. **Introduction to computers:**
  - a. History and evolution of computers, digital and analogue computers, major components of digital computers, word length of a computer, microprocessor, single chip micro computers(micro controllers), large and small computers, user interface, hard ware, soft ware and firm ware. Operating systems. DOS, windows.Introduction to Linux, batch processing, multi programming and multi user system.Computer network:LAN, WAN, Parallel processing, Flinn's classification of computers. 7

2. **Introduction to Programming:**
  - a. Definition of a programme, types of programming language : machine language, decimal number system, binary number or base 2 system, conversion of a binary number to decimal number, conversion of a decimal number to a binary number. Binary addition and subtraction, high level language, types of high level language. 4
  
3. **Language: Basics of programming: Algorithm, flow chart:**
  - a. Introduction to C language: Development of C, Features, constants and variables, data types, operators and expressions, library functions.I/O statements: Formatted and unformatted I/O, scan ( ), print f ( ), getchar ( ) and put char ( ) function
  - b. Control structures: conditional and unconditional, if, for, while, switch, break and continue, goto statement. Arrays: one and multidimensional arrays, strings and string functions, bubble sort, linear and binary search. Functions: definition, different types, calling a function, passing parameters, call by reference, and call by value, local and global variables, recursive function 17
  
4. Computer graphics, computer application and clinical studies 2

### **COMPUTER SCIENCE (Practicals)**

**50 hours**

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

## COMPUTER AND STATISTICS

<b>Recommended books(Latest Edition)</b>			
<b>Sl.No</b>	<b>Name of the book</b>	<b>Author</b>	<b>Publisher</b>
<b>01</b>	Mathematical statistics.	Kapoor and Saxena,	S.Chand & Co. Pvt. Ltd.,
<b>02</b>	Computer programming in Cobol.	V.Rajaraman and H.V.Sahasraboudhe,	Prentice-Hall of India. Pvt, Ltde.,
<b>03</b>	Fundamental of statistics.	M.K. Gupta,	The World Press Pvt. Ltd.,
<b>04</b>	Statistics,	B.K. Gotteti and K.S. Patricia,	Jones and Bartlet Publication London,

<b>Reference books(Latest Edition)</b>			
<b>Sl.No</b>	<b>Name of the book</b>	<b>Author</b>	<b>Publisher</b>
<b>01</b>	Computer Applications.	Sahni.A.	Indian Society Of Health Administrators
<b>02</b>	Applied stastics in the Pharmaceutical Industry	P. M. Steven. and K. Andreas	Springer
<b>03</b>	Statistical methods for health care research	B. H. Munrao	Lippinocott company publication, 2000
<b>04</b>	Principles of Biostastics,	M. Pagano, Kimberlee, Gauvreau.	Lib of American Publication,

## II B.PHARM

## 2.1: PHYSICAL PHARMACY (Theory)

75 hours

1. **Physical properties of drug molecules:** Refractive index, Optical rotation, Dielectric constant, Dipolemoment, dissociation constant, polymorphism, X-ray crystallography, Differential Thermal Analysis, determination and applications.  
8

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

3. **Solubility phenomena:** Solubility of liquids in liquids (binary solutions, ideal solutions, Raoult's law, real solutions, distillation of binary mixtures, azeotropic mixtures and fractional distillation. Partially miscible liquids (conjugate mixtures), critical solution temperatures, applications, phenol-water system, triethylamine-water system, nicotine-water system. Solubility of solids in liquids: Definitions, determinations, factors influencing the solubility.  
5

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

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

6. **Interfacial phenomenon:** Liquid interfaces, adsorption at liquid/solid interfaces, adsorption isotherms, concept of contact angle, hydrophile lipophile balance, spreading coefficient, Gibb's adsorption equation, electrical properties of interfaces, Surface tension and its determination.  
7

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

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

9. **Micromeritics:** Particle size distribution, methods for determining particle size, shape and surface area. Derived properties. Simple numerical problems.  
6

**10.Coarse dispersions: Suspensions:** Settling in Suspension, wetting, Controlled flocculation – flocculation in structured vehicles, Rheological consideration, preparation, physical stability and evaluation of suspensions.

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

6

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

6

**12.Complexation:** Types of complexes, metal complexes, organic molecular complexes, inclusion compounds, methods of analysis of complexes. 5

### PHYSICAL PHARMACY (Practicals)

75 hours

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

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

1. Synopsis	- 10 Marks
2. Major experiment (Experiments indicated by**)	- 30 Marks
3. Minor experiment (Experiments indicated by*)	- 20 Marks
4. Viva voce	- 10 Marks
Total	- 70 Marks

**PHYSICAL PHARMACY**

<b>Recommended books(Latest Edition)</b>			
<b>Sl.No</b>	<b>Name of the book</b>	<b>Author</b>	<b>Publisher</b>
<b>01</b>	Physical Pharmacy,	Alfred. Martin, P. Bustamante, A.H.C.Chun,	B.I.Waverly, Pvt.Ltd., New Delhi,
<b>02</b>	Bentley's textbook of Pharmaceutics,	E.A.Rawlins,	Bailliere Tindall.
<b>03</b>	Tutorial pharmacy,	Cooper and Gunn,	Carter S.J, CBS Publishers, New Delhi,
<b>04</b>	Physical Pharmaceutics,	C. V. S. Subrahmanium	Vallabh Prakash,

<b>Reference books(Latest Edition)</b>			
<b>Sl.No</b>	<b>Name of the book</b>	<b>Author</b>	<b>Publisher</b>
<b>01</b>	The Science and Practice of Pharmacy,	Alfonso R Gennaro, Remington:	Lippincott Williams and Wilkins, Philadalphia, USA, Vol I, II,

**LIST OF MINIMUM EQUIPMENTS REQUIRED**

1. Ostwald's viscometer	15
2. Stalagmometer	15
3. Digital pH meter	01
4. Microscopes	05
5. Stage and eye piece micrometers	05
6. Brookfield's viscometer	01
7. Digital Electronic Balance	03

## II B.Pharm

## 2.2: PHARMACEUTICAL MICROBIOLOGY (Theory)

67 hours

1. Introduction to the science of microbiology. Major divisions of microbial world, and relationship among them.
2. Classification of microbes and study of bacteria, fungi, yeasts, actinomycetes, virus, rickettsia and spirochaetes. Study of mode of transmission and treatment of microbial diseases like, Cholera, Typhoid, Tuberculosis, Diphtheria, Tetanus, Syphilis and AIDS. 10
3. Nutritional requirements, growth and cultivation of bacteria and virus. Study of different important media required for the growth of aerobic and anaerobic bacteria and fungi. Differential media, enriched media and selective media, maintenance of laboratory cultures. 6
4. Different methods used in isolation and identification of bacteria with emphasis on different staining techniques and biochemical reactions. Counting of bacteria. Total and viable count. Bacteriological analysis of drinking water. 5
5. Detailed study of different methods of sterilization including their merits and demerits. Sterilization of equipments, validation of sterilization. Sterilization methods for all pharmaceutical products. Detailed study of sterility testing of different pharmaceutical preparations. 11
6. **Disinfectants:** study of disinfectants, antiseptics, fungicidal and virucidal agents. Factors affecting their activities and mechanism of action. Evaluation of bactericidal, bacteriostatic, virucidal activities, evaluation of preservatives in pharmaceutical preparations. 6
7. Introduction to genetics, Phenotypic and genotypic changes in bacteria, Mutations, genetic exchange in bacteria-transformation, transduction and conjugation.
8. **Immunology:** Antigens, structure and formation of antibodies, antigen antibody reactions. Diagnostic tests such as Shick's test, Elisa test (HIV), Widal, Mantoux and VDRL. Methods involved in production of Vaccines- Polio myelitis, BCG, Typhoid, Diphtheria and Tetanus toxoid and production of Sera- Diphtheria antitoxin. 8
9. **Fermentation:** Introduction to fermentation technology. Methods of production of Penicillin, Streptomycin, Riboflavin and Cyanocobalamine. 4
10. Principles and methods of different microbiological assays including sensitivity testing, microbiological assay of Cephelexin, Streptomycin and Vitamin B<sub>12</sub>. Standardisation of vaccines [www.Pharmainfo.Net](http://www.Pharmainfo.Net) 4

**PHARMACEUTICAL MICROBIOLOGY (Practicals)****66 hours**

1. Study of apparatus used in experimental microbiology.
2. Sterilisation of glasswares, Preparation and Sterilisation of media.
3. Staining techniques – Simple staining\* , Gram’s staining. \*\*
4. Motility testing\*
5. Total and viable count\*.
6. Isolation and maintenance of pure culture\*.
7. Sensitivity testing.\*
9. Determination of MIC\*
10. Microbiological assay of antibiotics by cup plate method\*.
11. Sterility testing by direct transfer and membrane filtration technique\*.

**SCHEME OF EXAMINATION**

1. Synopsis	- 10 Marks
2. Major Experiment**	- 20 Marks
3. Major Experiment**-	- 20 Marks
4. Minor Experiment*	- 10 Marks
5. Viva-Voce	- 10 Marks
Total	- 70 Marks

**Pharmaceutical Microbiology**

<b>Recommended books(Latest Edition)</b>			
<b>Sl.No</b>	<b>Name of the book</b>	<b>Author</b>	<b>Publisher</b>
<b>01</b>	Tutorial Pharmacy	Cooper & Gunn’s	CBS Publisher and Distribution,

<b>Reference books(Latest Edition)</b>			
<b>Sl.No</b>	<b>Name of the book</b>	<b>Author</b>	<b>Publisher</b>
<b>01</b>	Pharmaceutical Microbiology	W.B Hugo and Russel	Blackwell Scientific Publications, London.,
<b>02</b>	Fundamentals of Microbiology	Frobishers,	Toppan Company Ltd. Tokyo. Japan.
<b>03</b>	Microbiology	Pelczar Reid,	Tata MC Graw- Hill Publishers company ,
<b>04</b>	INDIAN PHARMACOPOEIA	Govt. of India	Ministry of Health & Family Welfare.
<b>05</b>	Harley and Klein's Microbiology	Prescott,	W. C Brown Publishers,
<b>06</b>	Immunology	Roitt,	Harwood academic publishers, Mosby, London.
<b>07</b>	Pharmaceutical Biotechnology,	S.P. Vyas,and V.K.Dixit	CBS Publishers & distributors, New Delhi,
<b>08</b>	Pharmaceutical Biotechnology, Fundamentals and Applications,	S.S Kori	Vallabh Prakashan, New Delhi
<b>09</b>	General Microbiology	Stanier, Ingraham,	Wheelies and Painter.
<b>10</b>	Bentley's Text Book of Pharmaceutics	D.K.Rawlins,	ELBS publication,
<b>11</b>	Recombinant DNA Technology	Watson J.D.	Scientific American Books Limited,
<b>12</b>	Text Book of Microbiology,	Ananth Narayan and Pannicker,	Orient-longman, Chennai,

#### **LIST OF MINIMUM EQUIPMENTS REQUIRED**

1. Autoclave	02
2. Hot air oven	01
3. B.O.D. Incubator	01
4. Refrigerator	01
5. Laminar air flow	01
6. Colony counter	02
7. Zone reader	01
8. Spectrophotometer	01
9. Microscope with stage and oil immersion objective	20
10. Balances	20
11. Sterility testing unit	01

**II B. Pharm****2.3: PATHOPHYSIOLOGY & HEALTH EDUCATION (Theory)****75 hours**

- 1. Basic principles of cell injury and adaptation:**
  - i) Causes, pathogenesis and morphology of cell injury 3
  - ii) Abnormalities in lipoproteinaemia, glycogen infiltration and glycogen storage disease 3
  
- 2. Inflammation:**
  - A)
    - i) Pathogeneses of acute inflammation
    - ii) Chemical mediators in inflammation.
    - iii) Pathogenesis of chronic inflammation 5
  
  - B) Repairs of wounds in the skin,  
Factors influencing healing of wounds. 2
  
- 3. Diseases of Immunity:**
  - i) Introduction to T and B cells
  - ii) MHC proteins or transplantation antigens.
  - iii) Immune Tolerance 3
  
  - A) Hypersensitivity:**
    - i) Hypersensitivity type I.II.III, IV
    - ii) Biological significance of hypersensitivity.
    - iii) Allergy due to food, chemicals and drugs. 4
  
  - B) Auto-immunity:**
    - i) Mechanism of Autoimmunity.
    - ii) Classification of autoimmune diseases in man.
    - iii) Transplantation and allograft reactions, mechanism of rejection of allograft. 5
  
  - C) Acquired Immune Deficiency Syndrome (AIDS)** 2
  
  - D) Amyloidosis** 1
  
- 4. Cancer:**

Disturbances of growth of cells,  
 General biology of tumors,  
 Differences between benign and malignant tumors  
 Classification of tumors  
 Histological diagnosis of malignancy  
 Etiology and pathogenesis of cancer  
 Invasions, metastasis, patterns of spread of cancer. 10

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<b>5. Shock:</b> Types, mechanism, stages and Management	2
<b>6. Biological effects of radiation:</b>	1
<b>7. Environment and Nutritional diseases:</b>	
i) Air pollution and smoking – SO <sub>2</sub> , NO, NO <sub>2</sub> , CO	
ii) Protein calorie malnutrition, vitamins, obesity, starvation.	5
<b>8. Pathophysiology of common diseases:</b>	
i) Parkinsonism	
ii) Schizophrenia	
iii) Depression and Mania	
iv) Stroke (Ischemic and Hemorrhage)	
v) Hypertension	
vi) Angina	
vii) Myocardial Infarction	
viii) CCF	
ix) Atherosclerosis	
x) Diabetes Mellitus	
xi) Peptic ulcer and inflammatory bowel disease	
xii) Cirrhosis and Alcoholic liver diseases	
xiii) Acute and chronic renal failure	
xiv) Asthma and chronic obstructive airway diseases	19
<b>9. Health Education :</b>	
i) WHO definition of health and health promotion .	
ii) Care for children, pregnancy & Breast feeding.	
iii) Women and geriatric patients.	
iv) Commonly occurring communicable disease, causative agents, clinical manifestations and prevention of communicable diseases: Tuberculosis, Hepatitis , Typhoid, Malaria, Leprosy, Syphilis, Gonorrhoea & AIDS .	
v) Balance diet and treatment & prevention of deficiency disorders.	10

**PATHOPHYSIOLOGY**

<b>Recommended books(Latest Edition)</b>			
<b>Sl.No</b>	<b>Name of the book</b>	<b>Author</b>	<b>Publisher</b>
<b>01</b>	General Pathology	Y.M. Bhende, S,G. Deodhare, S.S. Kelkar	Popular Prakashan.
<b>02</b>	Essential Pathology	Emanuel Rubin,.	John L., Farber J.B. Lippincott company
<b>03</b>	Text book of Robbins Pathology Basis of Disease	Robins, Cotran, Kumar, Prism Indian Edition.	Orient Longman.
<b>04</b>	Pocket comparison to Robbins Pathologic Basis of Disease, 5th Edition	Robbins, Cotran, Kumar,	Prism Indian Edition.

**2.4 BIOCHEMISTRY (Theory)****75 hours**

1. **Bio chemical organization** of the cell and transport processes across cell membranes. 3
2. **Bio energetics**
  - a) Concept of free energy and its determination; redox potential;
  - b) Energy rich compounds; ATP; Cyclic AMP; their biological significance 6
3. **Biological Oxidation** 5
  - a) Electron transport chain (its mechanism and role)
  - b) Inhibitors and Uncouplers of ETC
  - c) Oxidative phosphorylation
  - d) Substrate level phosphorylation and oxidative phosphorylation
4. **Enzymes and Coenzymes** 14
  - a) Definition ; Nomenclature ; IUB Classification
  - b) Properties of enzymes;
  - c) Factors effecting enzyme activity;
  - d) Enzyme kinetics ( Michaelis plot ; Line Weaver Burke plot)
  - e) Enzyme Inhibition (with examples)
  - f) Iso-enzymes
  - g) Enzyme Induction; repression
  - h) Applications of enzymes
  - i) Coenzymes, categories of reactions requiring coenzymes;
    - a. Structure of, its coenzyme, and biochemical role of
    - b. Vitamins - water soluble, fat soluble
5. **Carbohydrate metabolism** 12
  - a) Introduction
  - b) Glycolysis,
  - c) Glycogenesis glycogenolysis,
  - d) TCA cycle; (Amphibolic nature of TCA cycle)
  - e) Gluconeogenesis
  - f) Various shuttle systems (glycerol phosphate; Malate aspartate)
  - g) HMP Shunt Pathway;
  - h) Uronic acid pathway and galactose metabolism
  - i) Glucose tolerance test and blood glucose regulation.
6. **Lipid metabolism** 10
  - a) Introduction
  - b)  $\beta$ -Oxidation of saturated (palmitic acid) fatty acids
  - c)  $\beta$ -Oxidation of unsaturated fatty acids ( $\alpha$ -linolenic acid)
  - d) Formation and fate of ketone bodies
  - e) Cholesterol metabolism,
  - f) Biosynthesis of fatty acids (*de novo*)
  - g) Phospholipids and sphingolipids.



7. **Amino acid metabolism** 11
- a) Amino acids definition, classification and significance
  - b) General reactions of amino acids: Transamination, Deamination and decarboxylations of amino acids
  - c) Urea cycle
  - d) Metabolism of sulphur containing amino acids
  - e) Catabolism of tyrosine, tryptophan, phenylalanine
  - f) Synthesis & significance of biologically important substances: creatine, histamine, 5-HT, dopamine, noradrenaline, adrenaline.
  - g) Porphyrins, Bile Pigments; Hyperbilirubinemia
8. **Nucleotides and Nucleic acids** 12
- a) Introduction
  - b) Purine nucleotides biosynthesis
  - c) Pyrimidine nucleotides biosynthesis
  - d) Catabolism of purines and pyrimidines
  - e) DNA structure, significance as genetic material
  - f) RNA types, structure and significance
  - g) DNA replication
  - h) Mutation and repair of DNA
  - i) Transcription or RNA synthesis
  - j) Genetic code
  - k) Translation or protein synthesis and its Inhibition
10. **Principles and significance for following Biochemical tests** 5
- a) Kidney function tests
  - b) Liver function tests
  - c) Lipid profile

**APPLIED BIOCHEMISTRY (Practical)****75 hours**

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

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

- |                            |                   |
|----------------------------|-------------------|
| 1. Synopsis                | - 10 Marks        |
| 2. Urine Analysis          | - 15 Marks        |
| 3. Titrimetric Experiment  | - 20 Marks        |
| 4. Colorimetric Experiment | - 15 Marks        |
| 5. Viva                    | - 10 Marks        |
| <b>Total</b>               | <b>- 70 Marks</b> |

**APPLIED BIOCHEMISTRY**

<b>Recommended books(Latest Edition)</b>			
<b>Sl.No</b>	<b>Name of the book</b>	<b>Author</b>	<b>Publisher</b>
<b>01</b>	Harpers Review of Biochemistry	Martin.D.W; Mayes.P.A.	Lange Medical Publications.
<b>02</b>	Text Book of Biochemistry	Ram Rao	UBS Publisher & Distributors

<b>Reference books(Latest Edition)</b>			
<b>Sl.No</b>	<b>Name of the book</b>	<b>Author</b>	<b>Publisher</b>
<b>01</b>	Principals of Biochemistry	Lehninger	CBS Publishers & Distributors.
<b>02</b>	Outlines of Biochemistry	Conn and Stump	John Wiley & Sonc, INC.
<b>03</b>	Text Book of Biochemistry	Harron and Mazur	W.B. Saunders.
<b>04</b>	Hawk's Physiological Chemistry	Oser	Tata McGraw-Hill Publishing Company. Ltd.,

**LIST OF MINIMUM EQUIPMENTS REQUIRED**

1) Colorimeter	01
2) Centrifuge	01
3) Electronic Balance	01
4) Physical/Chemical Balance	01
5) pH meter	01
6) Water bath	
a) Temperature controlled	01
b) Ordinary	01
7) Volumetric flasks	60
8) Pipettes	
a) Graduated	--
b) Bulb	--
9) Burettes	20
10) Conical flasks	20
11) China dish	20
12) Burners	20
13) Glass wares such as measuring cylinders, reagent bottles, glass rods, tubes etc.	--
14) Folin-Wu tubes	120

## II B.Pharm

## 2.5: PHARMACEUTICAL ORGANIC CHEMISTRY-II (Theory)

75 hours

The subject is to be treated in the light of modern perspective giving stress wherever possible on the following aspects-structure, nomenclature, preparation, properties, energy of activation, transition state, resonance, stereochemistry, optical isomerism, Geometric isomerism and mechanism of reaction.

**I. Stereochemistry:**

1. Stereo isomerism, tetrahedral optical activity, enantiomerism, diastereoisomerism, meso structures, elements of symmetry, chirality, chiral centers, reaction of chiral molecules, configuration, specification of D and L configuration. Nature of E and Z forms. Racemic modification and resolution of racemic mixture, conformational isomers, asymmetric synthesis.

12

2. Stereo selective and stereospecific reactions. Stereochemical mechanisms for the following reaction such as addition of halogen to alkenes, E<sup>1</sup> and E<sup>2</sup> reactions, *syn* and *anti* reactions, and nucleophilic substitution reactions. 4

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

3

**II. Heterocyclic Chemistry:**

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

a) Pyrrole, Furan and Thiophene

7

b) Fused ring systems involving Pyrrole, Furan, Thiophene, Indole and Benzofuran

4

c) Pyridine

4

d) Quinoline, Isoquinoline, acridine

3

e) Pyrazole, Imidazole, Oxazole, Isoxazole

4

f) Pyrimidine, Pyrazine, Pyridazine, Purine, benzodiazepines

2) Effect of physicochemical properties of drug molecules on biological activities 2

3) Study of basic structures, compounds having pharmacological activity/medicinal compounds of tricyclic hetero ring systems-phenothiazines, and . Study of SAR and mechanism of action, synthesis of compounds underlined

a) SAR of Benzodiazepines, Chlordiazepoxide, Diazepam Oxazepam

b) SAR of Barbiturates , Barbital Methabarbital phenobarbital

Pentobarbital

c) SAR of Local Anaesthetics, Benzocaine Procaine Lidocaine

d) SAR of Narcotic Analgesics

15

4) Structure and medicinal uses of the following official compounds

1. Phenazone
2. Nicotinic acid
3. Nikethamide
4. Isoniazid
5. Mepyramine
6. Benzhexol
7. Chloroquine
8. Histamine
9. Carbimazole
10. Pyrimethamine
11. Piperazine
12. Diazepam
13. Diethylcarbamazine citrate
14. Sulphadiazine
15. Metronidazole.

3

**III. Nucleophilic aliphatic substitution mechanism:** nucleophiles, and leaving groups, kinetics of second and first order reaction. Mechanism and Stereochemistry of  $SN^2$  reaction, Mechanism and Stereochemistry of  $SN^1$  reaction. Rearrangement of carbocation,  $SN^2$  versus  $SN^1$  reactions, Reactivity of alkyl halides in  $SN^1$  and  $SN^2$ ,

7

**IV Dehydrohalogenation of alkyl halides:** 1, 2 elimination, kinetics,  $E_2$ ,  $E_1$  mechanisms,  $E_2$  versus  $E_1$ , elimination versus substitution. Dehydration of alcohols and its mechanism, 3

**VI Chemistry of bio molecules of pharmaceutical importance:**

1. Proteins and Amino acids:

Introduction, definition, classification of proteins and amino acids and their properties, reactions, synthesis of amino acids (Gabriel's Phthalimide, synthesis, Strecker's synthesis, Koop's and Erlenmeyer's azalactone synthesis). .

4

**PHARMACEUTICAL ORGANIC CHEMISTRY-II (Practicals)****75 hours**

(Following experiments to be in 25 different classes)

**I. Quantitative determination of organic compounds via functional groups \*\***

1. Phenolic group by bromination method.
2. Alcoholic group by acetylation method.
3. Carbonyl group by hydroxylamine hydrochloride-pyridine method.
4. Aldehyde group by sodium sulphite-sulphuric acid procedure.
5. Carboxyl group by acid-base method.
6. Determination of acetone by sodium hypoiodide method
7. Amino group by bromination method.
8. Amino acid Formal titration method.

**II. Analysis of oils and fats: (I.P. Method).**

1. Acid value.
2. Saponification value.
3. Iodine value.

**III. Synthesis/ preparation involving more than one step\***

1. *p*-bromoaniline from acetanilide.
2. *p*-Nitroaniline from acetanilide.
3. *p*-Nitrophenyldrazine from *p*-nitroaniline.
4. 3-methyl-1-phenyl-5-pyrazole from ethyl acetoacetate.
5. Benzilic acid from benzene.
6. Pthalimide from benzophenone.
7. Pthalimide from pthalic acid.
8. Benzyl benzoate from benzaldehyde. (Cannizzaro's reaction)
9. Synthesis of 2, 3-Diphenyl quinoxaline.
10. Preparation of 2, 5, -Dimethyl thiophen.
11. Preparation of 2, 5, -Dimethyl pyrole.
12. Preparation of 2, 5, -Dimethyl furan.

**PHARMACEUTICAL ORGANIC CHEMISTRY-II**

<b>Recommended books(Latest Edition)</b>			
<b>Sl.No</b>	<b>Name of the book</b>	<b>Author</b>	<b>Publisher</b>
<b>01</b>	Elementary Practical organic chemistry,	A.I. Vogel,	ELBS and Longman group Ltd., London.
<b>02</b>	Text Book of practical organic chemistry,	A. I. Vogel,	ELBS Longman, London,

<b>Reference books(Latest Edition)</b>			
<b>Sl.No</b>	<b>Name of the book</b>	<b>Author</b>	<b>Publisher</b>
<b>01</b>	Practical Organic Chemistry	Mann and Sounders,	ELBS and Longman group Ltd.,
<b>02</b>	Introduction to Organic Laboratory Techniques	D.L.Pavia, G.Lampman and G.D.Kriz	Saunders College Publishing.
<b>03</b>	Indian Pharmacopeia	Govt. of India	Government of India Ministry of Health.

**LIST OF MINIMUM EQUIPMENTS REQUIRED**

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

**SCHEME OF EXAMINATION**

1 Synopsis	- 10 Marks
2 Major Experiment (**)	- 30 Marks
3 Minor Experiment (*or oil analysis)	- 20 Marks
4 Viva	- 10 Marks
<b>Total</b>	<b>- 70</b>

