PROGRESSIVE EDUCATION SOCIETY'S MODERN COLLEGE OF PHARMACY, NIGDI, PUNE

(AUTONOMOUS)

AFFILIATED TO

SAVITRIBAI PHULE PUNE UNIVERSITY

FACULTY OF SCIENCE AND TECHNOLOGY

RULES AND SYLLABUS

FIRST AND SECOND YEAR DOCTOR OF PHARMACY (PHARM D) COURSE-

2025 PATTERN (EFFECTIVE FROM ACADEMIC YEAR 2025-2026)

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Ministry of Health and Family Welfare (Pharmacy Council of India)

New Delhi, 10th May, 2008.

Pharm. D. Regulations 2008

Regulations framed under section10 of the Pharmacy Act, 1948 (8 of 1948).

(As approved by the Government of India, Ministry of Health vide, letter No.V.13013/1/2007 - PMS, dated the 13th March, 2008 and notified by the Pharmacy Council of India).

No.14-126/2007-PCI.— In exercise of the powers conferred by section 10 of the Pharmacy Act, 1948 (8 of 1948), the Pharmacy Council of India, with the approval of the Central Government, hereby makes the following regulations, namely:-

CHAPTER - I

1. Short title and commencement-

1) These regulations may be called the Pharm. D. Regulations 2008.

2) They shall come into force from the date of their publication in the official Gazette.

2. Pharm D. shall consist of a certificate, having passed the course of study and examination as prescribed in these regulations, for the purpose of registration as a pharmacist to practice the profession under the Pharmacy Act, 1948.

CHAPTER-II

3. Duration of the course–

a) Pharm. D: The duration of the course shall be six academic years (five years of study and one year of internship or residency) full time with each academic year spread over a period of not less than two hundred working days. The period of six years duration is divided into two phases-

Phase I - consisting of First, Second, Third, Fourth and Fifth academic year.

Phase I - consisting of internship or residency training during sixth year involving posting in speciality units. It is a phase of training wherein a student is exposed to actual pharmacy practice or clinical pharmacy services and acquires skill under supervision so that he or she may become capable of functioning independently.

b) Pharm. D. (Post Baccalaureate): The duration of the course shall be for three academic years (two years of study and one year of internship or residency) full time with each academic year spread over a period of not less than two hundred working days. The period of three years duration is divided into two phases

Phase I - consisting of First and Second academic year.

Phase II - consisting of Internship or residency training during the third year involving posting in speciality units. It is a phase of training wherein a student is exposed to actual pharmacy practice or clinical pharmacy services, and acquires skill under supervision so that he or she may become capable of functioning independently.

4. Minimum qualification for admission to -

a) Pharm. D. Part - I Course - A pass in any of the following examinations -

(1) 10+2 examination with Physics and Chemistry as compulsory subjects along with one of the following subjects:

Mathematics or Biology.

(2)A pass in D. Pharm course from an institution approved by the Pharmacy Council of India under section 12 of the Pharmacy Act.

(3)Any other qualification approved by the Pharmacy Council of India as equivalent to any of the above examinations.

Provided that a student should complete the age of 17 years on or before 31st December of the year of admission to the course.

Provided that there shall be reservation of seats for the students belonging to the Scheduled Castes, Scheduled Tribes and other Backward Classes in accordance with the instructions issued by the Central Government/State Government/Union Territory Administration as the case may be from time to time.

b) Pharm. D. (Post Baccalaureate) Course -

A pass in B. Pharm from an institution approved by the Pharmacy Council of India under section 12 of the Pharmacy Act.

Provided that there shall be reservation of seats for the students belonging to the Scheduled Castes, Scheduled Tribes and other Backward Classes in accordance with the instructions issued by the Central Government / State Government / Union Territory Administration as the case may be from time to time.

5. Number of admissions in the above said programs shall be as prescribed by the Pharmacy Council of India from time to time and presently be restricted as below -

i) Pharm. D. Programme – 30 Students.

ii) Pharm. D. (Post Baccalaureate) Programme – 10 Students.

6. Institutions running B. Pharm programme approved under section 12 of the Pharmacy Act will only be permitted to run Pharm. D. programme. Pharm. D. (Post Baccalaureate) programme will be permitted only in those institutions which are permitted to run Pharm. D. programme.

7. Course of study – The course of study for Pharm. D. shall include the subjects as given in the Tables below. The number of hours in a week, devoted to each subject for its teaching in theory, practical and tutorial shall not be less than that noted against it in columns (3), (4) and (5) below.

T A B L E S

First Year:

Sr. No	Name of Subject	No. of hours of Theory	No. of hours of Practical	No. of hours of Tutorial
(1)	**(2)**	**(3)**	**(4)**	**(5)**
1.1	Human Anatomy and Physiology	3	3	1
1.2	Pharmaceutics	2	3	1
1.3	Medicinal Biochemistry	3	3	1
1.4	Pharmaceutical Organic Chemistry	3	3	1
1.5	Pharmaceutical Inorganic Chemistry	2	3	1
1.6	Remedial Mathematics/Biology**	3	3*	1
	Total hours	**16**	**18**	**6 = (40)**

*For Biology

As per the circular from Pharmacy Council of India (PCI) Circular No 14-126/2009-PCI/5674-728 dated 5th June 2010, the examination and evaluation for the subject of Remedial Mathematics/ Biology can be carried out by the Institute. For the same, students should pass these subjects with minimum of 50 % passing. It is mandatory to qualify the subject to be eligible for the award of degree. Marks of said subject will not be considered for the award of Class for F.Y. Pharm D.

Second Year:

Sr. No	Name of Subject	No. of hours of Theory	No. of hours of Practical	No. of hours of Tutorial
(1)	**(2)**	**(3)**	**(4)**	**(5)**
2.1	Pathophysiology	3	-	1
2.2	Pharmaceutical Microbiology	3	3	1
2.3	Pharmacognosy & Phytopharmaceuticals	3	3	1
2.4	Pharmacology-I	3	3	1
2.5	Community Pharmacy	2	-	1
2.6	Pharmacotherapeutics-I	3	3	1
	Total Hours	**17**	**12**	**6= 35**

8. Syllabus. - The syllabus for each subject of study in the said Tables shall be as specified in Appendix - A to these regulations.
9. Approval of the authority conducting the course of study –

(1) No person, institution, society or university shall start and conduct Pharm. D or Pharm. D. (Post Baccalaureate) programme without the prior approval of the Pharmacy Council of India.

(2) Any person or pharmacy college to obtain permission under sub-section (1) of section 12 of the Pharmacy Act, shall submit a scheme as prescribed by the Pharmacy Council of India.

(3) The scheme referred to in sub-regulation (2) above, shall be in such form and contain such

particulars and be preferred in such manner and be accompanied with such fee as may be prescribed:

(4) Provided that the Pharmacy Council of India shall not approve any institution under these regulations unless it provides adequate arrangements for teaching regarding building, accommodation, labs. Equipment, teaching staff, non- teaching staff, etc., as specified in Appendix-B to these regulations.

10. Examination.–

(1) Every year there shall be an examination to examine the students.

(2) Each examination may be held twice every year. The first examination in a year shall be the annual examination and the second examination shall be supplementary examination.

(3) The examinations shall be of written and practical (including oral nature) carrying maximum marks for each part of a subject as indicated in Tables below :

T A B L E S

First Year Examination:

S. No.	Name of Subject	Maximum marks for Theory			Maximum marks for Practical's		
		Examination	**Sessional**	**Total**	**Examination**	**Sessional**	**Total**
1.1	Human Anatomy and Physiology	70	30	100	70	30	100
1.2	Pharmaceutics	70	30	100	70	30	100
1.3	Medicinal Biochemistry	70	30	100	70	30	100
1.4	Pharmaceutical Organic Chemistry	70	30	100	70	30	100
1.5	Pharmaceutical Inorganic Chemistry	70	30	100	70	30	100
1.6	Remedial Mathematics/ Biology**	70	30	100	70*	30*	100*
				600			**600=1200**

***For Biology**

As per the circular from Pharmacy Council of India (PCI) Circular No 14-126/2009-PCI/5674-728 dated 5th June 2010, the examination and evaluation for the subject of Remedial Mathematics/ Biology can be carried out by the Institute. For the same, students should pass these subjects with minimum of 50 % passing. It is mandatory to qualify the subject to be eligible for the award of a degree. Marks of said subject will not be considered for the award of Class for F.Y. Pharm D.

Second Year Examination:

Sr. No	Name of Subject	Maximum marks for Theory			Maximum marks for Practical's		
		Examination	**Sessional**	**Total**	**Examination**	**Sessional**	**Total**
2.1	Pathophysiology	70	30	100	-	-	-
2.2	Pharmaceutical Microbiology	70	30	100	70	30	100
2.3	Pharmacognosy & Phytopharmaceuticals	70	30	100	70	30	100
2.4	Pharmacology-I	70	30	100	70	30	100
2.5	Community Pharmacy	70	30	100	-	-	-
2.6	Pharmacotherapeutics-I	70	30	100	70	30	100
				600			**400 =1000**

The pattern for University theory examination question paper shall be as given below:

	SECTION 1	
Q.1.	10 marks X 1questions (out of two) =10 marks	(10)
Q.2.	03 marks X 5 questions (out of seven) =10 marks	(15)
Q.3.	05 marks X 2 questions (out of four) =10 marks	(10)
	SECTION 2	
Q.4.	10 marks X 1 questions (out of two) =10 marks	(10)
Q.5.	03 marks X 5 questions (out of seven) =10 marks	(15)
Q.6.	05 marks X 2 questions (out of four) =10 marks	(10)
	Total	= 70marks

11. Eligibility for appearing Examination: such students who produce a certificate from the Head of the Institution in which he or she has undergone the Pharm .D. or as the case may be, the Pharm .D. (Post Baccalaureate) course, in proof of his or her having regularly and satisfactorily undergone the course of study by attending not less than 80% of the classes held both in theory and in practical separately in each subject shall be eligible for appearing at the examination.

12. Mode of examinations. –

(1) The theory examination shall be of three hours and the practical examination shall be of four hours duration.

(2) Practical examination shall also consist of a viva-voce (Oral) examination.

(3) Clerkship examination – Oral examination shall be conducted after the completion of clerkship of students. An external and an internal examiner will evaluate the student. Students may be asked to present the allotted medical cases followed by discussion. Students' capabilities in delivering clinical pharmacy services, pharmaceutical care planning and knowledge of therapeutics shall be assessed.

13. Award of Sessional marks and maintenance of records:

(1) A regular record of both theory and practical class work and examinations conducted in an institution imparting training for Pharm D. or as the case may be, Pharm. D. (Post Baccalaureate) course, shall be maintained for each student in the institution and 30 marks for each theory and 30 marks for each practical subject shall be allotted as Sessional.

(2) There shall be at least two periodic sessional examinations during each academic year and the highest aggregate of any two performances shall form the basis of calculating sessional marks.

(3) The Sessional marks in practicals for all subjects shall be on the following basis:-

i. Actual performance in the Sessional examination (20marks);

ii. Day-to-day assessment in the practical class work, promptness, viva-voce record maintenance, etc. (10 marks)

Scheme of Sessional Practical Examination:

	Practical Marks
Synopsis	05
Major Experiment	10
Minor Experiment	05
Max Marks	**20**
Attendance/Journal/Viva	**10**
Total Sessional marks	**30**

The distribution of marks for theory Sessional examination shall be as follows:-

Q.1.	2 marks X 5 questions (out of seven=10 marks	(10)
Q.2.	5 marks X 2 questions (out of three)=10 marks	(10)
Q.3	10 marks X 1 questions (out of two)=10 marks	(10)
	Total	**=30 marks**

14. Minimum marks for passing examination. A student shall not be declared to have passed examination unless he or she secures at least 50%marks in each of the subjects separately in the theory examinations, including Sessional marks and at least50%marks in each of the practical examinations including Sessional marks. The students securing 60% marks or above in aggregate in all subjects in a single attempt at the Pharm. D. or as the case may be, Pharm. D. (Post Baccalaureate) course examination shall be declared to have passed in first class. Students securing 75% marks or above in any subject or subjects shall be declared to have passed with distinction in the subject or those subjects provided he or she passes in all the subjects in a single attempt.

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

    Those candidates who fail in one or more subjects shall have to appear only in the subject so failed, in the subsequent examinations.

Declaration of class

Class shall be awarded at the end of I, II, III, IV and V year of Pharm. D. 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%

The result of the successful candidate shall be classified at the end of the final year examination on the basis of the aggregate of all subjects, theory and practicals, secured by the candidate in I to V year examinations and completes the course in 5 years, as indicated below.

First Class: 60% and above

Second Class: 50%-59%

Candidate securing aggregate of 75% or above marks and have passed in all the subjects in a year in first attempt shall be declared to have obtained Distinction.

Passing certificate and degree certificate will be awarded only after successful completion of internship.

15. Academic progression rule for Pharm D:

A student shall be eligible to carry forward all the subjects of **First Year till Second Year Pharm. D examinations**. However, he/she shall not be eligible to attend the Third Year Pharm. D until all the subjects of First Year Pharm. D are completed.

A student shall be eligible to carry forward all the subjects of **Second Year till Third Year Pharm. D examinations.** However, he/she shall not be eligible to attend the Fourth Year Pharm. D until all the subjects of Second Year Pharm. D are completed.

16. Internship

(1) Internship is a phase of training wherein a student is expected to conduct actual practice of pharmacy and health care and acquires skills under the supervision so that he or she may become capable of functioning independently.

(2) Every student has to undergo one year internship as per Appendix-C to these regulations.

17. Approval of examinations. - Examinations mentioned in regulations 10 to12 and 14 shall be held by the examining authority herein after referred to as the university, which shall be approved by the Pharmacy Council of India under sub-section (2) of section 12 of the Pharmacy Act, 1948. Such approval shall be granted only if the examining authority concerned fulfills the conditions as specified in Appendix–D to these regulations.
18. Certificate of passing examination. - Every student who has passed the examinations for the Pharm. D. (Doctor of Pharmacy) or Pharm. D. (Post Baccalaureate) (Doctor of Pharmacy) as the case may be, shall be granted a certificate by the examining authority.

APPENDIX-A

(See regulation 8)

PHARM. D. SYLLABUS

First Year:

1.1 T HUMAN ANATOMY & PHYSIOLOGY (THEORY)

Theory: 3 Hrs./Week

1. **Scope and Objectives:** This course is designed to impart a fundamental knowledge of the structure and functions of the human body. It also helps in understanding both homeostasis mechanisms and homeostatic imbalances of various body systems. Since a medicament, which is produced by pharmacist, is used to correct the deviations inhuman body, it enhances the understanding of how the drugs act on the various body systems in correcting the disease state of the organs.

2. **Upon completion of the course the student shall be able to:**

a. Describe the structure (gross and histology) and functions of various organs of the human body.
b. Describe the various homeostatic mechanisms and their imbalances of various systems.
c. Identify the various tissues and organs of the different systems of the human body;
d. Perform the hematological tests and record blood pressure, heart rate, pulse and respiratory volumes.
e. Appreciate coordinated working pattern of different organs of each system; and
f. Appreciate the interlinked mechanisms in the maintenance of normal functioning (homeostasis) of human body

Course materials:

Textbooks

a. Tortora Gerard J. and Nicholas, P. Principles of anatomy and physiology Publisher Harpercollins college New York.
b. Wilson, K. J. W. Ross and Wilson's foundations of anatomy and physiology. Publisher: Churchill Livingstone, Edinburg.

Reference books

a. Guyton13arthur, C. *Physiology of human body*. Publisher: Holtsaunders.
b. Chatterjee, C. C. *Human physiology*. Volume 1 & 11. Publisher: medical allied agency, Calcutta.
c. Peter L. Williams, Roger Warwick, Mary Dysonand Lawrence, H, *Gray's* London.

Unit No	Lecture wise program: Topics	3 hrs /Week
01	**Scope of anatomy and physiology:** basic terminologies used in this subject (Description of the body as such planes and terminologies)	**02**
02	**Structure of cell** – its components and their functions.	**04**
03	**Elementary tissues of the human body**: epithelial, connective, Muscular and nervous tissues-their sub-types and characteristics	**07**
04	a) **Osseous system**- structure, composition and functions of the Osseous system	**05**

	b) **Classification of joints**, Types of movements of joints and disorders of joints (Definitions only)	
05	**Haemopoetic System** (a) Composition and functions of blood (b) Haemopoesis and disorders of blood components (definition of disorder) (c) Blood groups (d) Clotting factors and mechanism (e) Platelets and disorders of coagulation	**07**
06	**Lymph** (a) Lymph and lymphatic system, composition, formation and circulation. (b) Spleen: structure and functions, Disorders (c) Disorders of lymphatic system (definition only)	**05**
07	**Cardiovascular system** a) Anatomy and functions of heart b) Blood vessels and circulation (Pulmonary, coronary and systemic circulatio c) Electrocardiogram (ECG) d) Cardiac cycle and heart sounds e) Blood pressure – its maintenance and regulation f) Definition of the following disorders Hypertension, Hypotension, Arteriosclerosis, Atherosclerosis, Angina, Myocardial infarction, Congestive heart failure, Cardiac arrhythmias	**09**
08	**Respiratory system** a) Anatomy of respiratory organs and functions b) Mechanism / physiology of respiration and regulation of respiration c) Transport of respiratory gases d) Respiratory volumes and capacities, and Definition of: Hypoxia, Asphyxia, Dybarism, Oxygen therapy and resuscitation.	**06**
09	**Digestive system** a) Anatomy and physiology of GIT b) Anatomy and functions of accessory glands of GIT c) Digestion and absorption d) Disorders of GIT (definitions only)	**05**
10	**Nervous system** a) Definition and classification of nervous system b) Anatomy, physiology and functional areas of cerebrum c) Anatomy and physiology of cerebellum d) Anatomy and physiology of mid brain e) Thalamus, hypothalamus and Basal Ganglia f) Spinal card: Structure & reflexes g) Cranial nerves – names and functions h) ANS – Anatomy & functions of sympathetic & parasympathetic N.S.	**08**
11	**Urinary system** a) Anatomy and physiology of urinary system b) Formation of urine c) Renin Angiotensin system – Juxta glomerular apparatus - acid base Balance d) Clearance tests and micturition	**03**

12	**Endocrine system** a) Pituitary gland b) Adrenal gland c) Thyroid and Parathyroid glands d) Pancreas and gonads	**07**
13	**Reproductive system** a) Male and female reproductive system b) Their hormones – Physiology of menstruation c) Spermatogenesis & Oogenesis d) Sex determination (genetic basis) e) Pregnancy and maintenance and Parturition f) Contraceptive devices	**07**
14	**Sense organs** a) Eye b) Ear c) Skin d) Tongue & Nose	**06**
15	**Skeletal muscles** a) Histology b) Physiology of Muscle contraction c) Physiological properties of skeletal muscle and their disorders (definitions)	**05**
16	**Sports physiology** a) Muscles in exercise, Effect of athletic training on muscles and muscle performance, b) Respiration in exercise, CVS in exercise, Body heat in exercise, Body fluids and salts in exercise, c) Drugs and athletics	**04**

1.1 P HUMAN ANATOMY & PHYSIOLOGY (PRACTICAL)

Practical: 3Hrs./Week

General Requirements: Dissection box, Laboratory Napkin, muslin cloth, record, Observation book (100pages), Stationary items, Blood lancet.

Course materials:

Text books

a. Goyal, R. K, Natvar M.P, and Shah S. A, Practical anatomy, physiology and biochemistry, latest edition, Publisher: B.S Shah Prakashan, Ahmedabad.

Reference books

a. Ranade V G, Textbook of practical physiology, Latest edition, Publisher: PVG, Pune
b. Anderson Experimental Physiology, Latest edition, Publisher: NA
c. Deshpande, S. A., Vyawahare, N. S., Amale, P. N., and Shirode, D. S. *Practical Book of Human Anatomy and Physiology,* Latest Edition, Publisher: Nirali Prakashan, Pune.

Sr. No.	List of Experiments
1.	Study of the Compound Microscope
2.	Study of tissues of human body (a) Epithelial tissue (b) Muscular tissue.
3.	Study of tissues of human body (a) Connective tissue (b) Nervous tissue.
4.	Study of appliances used in hematological experiments.
5.	Determination of W.B.C. count of blood.
6.	Determination of R.B.C. count of blood.
7.	Determination of differential count of blood.
8.	Determination of (a) Erythrocyte Sedimentation Rate. (b) Hemoglobin content of Blood. (c) Bleeding time & Clotting time.
9.	Determination of (a) Blood Pressure. (b) Blood group.
10.	Study of various systems with the help of charts, models & specimens (a) Skeleton system part I-axial skeleton. (b) Skeleton system part II- appendicular skeleton. (c) Cardiovascular system. (d) Respiratory system (e) Digestive system. (f) Urinary system. (g) Nervous system (h) Special senses (i) Reproductive system.
11.	Study of different family planning appliances.
12.	To perform pregnancy diagnosis test.
13.	Study of appliances used in experimental physiology.
14.	To demonstrate a Simple Muscle Curve using the Gastrocnemius Sciatic Nerve Preparation (by simulation)
15.	To demonstrate a Simple Summation Curve using the Gastrocnemius Sciatic Nerve Preparation (by simulation)
16.	To demonstrate the Effect of Temperature using the Gastrocnemius Sciatic Nerve Preparation (by simulation)
17.	To demonstrate the Effect of Load & After load using the Gastrocnemius Sciatic Nerve Preparation (by simulation)
18.	To demonstrate the Fatigue Curve using the Gastrocnemius Sciatic Nerve Preparation (by simulation)

Scheme for Practical Examination:

	Annual Marks
Synopsis/Identification	20
Major Experiment	20
Minor Experiment	15
Viva	15
Max Marks	**70**
Duration	**04hrs**

Note: Total Sessional marks are 30 (20 for practical Sessional plus 10 marks for regularity, promptness, viva-voce and record maintenance).

1.2 T PHARMACEUTICS (THEORY)

Theory: 2 Hrs./Week

1. **Scope and objectives:** This course is designed to impart a fundamental knowledge of the art and science of formulating different dosage forms. It prepares the students for most basics of the applied field of pharmacy.

2. **Upon completion of the course the student should be able to:**

a. Know the formulation aspects of different dosage forms.
b. Do different pharmaceutical calculation involved in formulation.
c. Formulate different types of dosage forms; and
d. Appreciate the importance of good formulation for effectiveness.

3. **Course materials:**

Textbooks

a. Cooper and Gunns Dispensing for pharmacy students.
b. A textbook Professional Pharmacy by N. K. Jain and S. N. Sharma.

Reference books

a. Introduction to Pharmaceutical dosage forms by Howard C.Ansel.
b. Remington's Pharmaceutical Sciences.
c. Register of General Pharmacy by Cooper and Gunn.
d. General Pharmacy by M. L. Schroff.

	Topics	2 Hrs /Week
1	**a. Introduction to dosage forms -** classification and definitions **b. Prescription:** definition, parts and handling and errors in prescription **c. Posology:** Definition, Factors affecting dose selection. Calculation of children and infant doses.	6
2.	Historical background and development of profession of pharmacy and pharmaceutical industry in brief.	2
3.	**Development of Indian Pharmacopoeia and introduction to other Pharmacopoeias** such as BP, USP, European Pharmacopoeia, Extra pharmacopoeia and Indian national formulary.	4
4.	**Powders and Granules:** Classification advantages and disadvantages, Preparation and evaluation of simple, compound powders, Insufflations, Dusting powders, Eutectic and Explosive powders, Tooth powder and effervescent powders and granules.	6
5.	**Monophasic Dosage forms:** Theoretical aspects of formulation including adjuvant like stabilizers, colorants, flavours with examples. Study of Monophasic liquids like Solutions, Syrup, Elixer, gargles, mouthwashes, Throat paint, Ear drops, Nasal drops, Liniments and lotions, Enemas and collodions.	6
6.	**Biphasic dosage forms:** Suspensions and emulsions, Definition, advantages and disadvantages, classification, test for the type of emulsion, formulation, stability and evaluation.	6

7.	**Suppositories and pessaries:** Definition, advantages and disadvantages, types of base, method of preparation, Displacement value and evaluation.	**4**
8.	**Galenical's:** Definition, equipment for different extraction processes like infusion, Decoction, Maceration and Percolation, methods of preparation of spirits, tinctures and extracts.	**6**
9.	**Pharmaceutical Calculations:** Freezing point, Molecular weight Weights and measures, Calculations involving percentage solutions, allegation, proof spirit, isotonic solutions	**8**
10	**Surgical aids:** Surgical dressings, absorbable gelatin sponge, sutures, ligatures and medi bandages.	**6**
11	**Incompatibilities:** Introduction, classification and	**6**

1.2 P PHARMACEUTICS (PRACTICAL)

Practical: 3 Hrs./Week

	List of Experiments
	Preparation and Evaluation of Following
1.	**Syrups** a. Simple Syrup I.P b. Syrup of Ephedrine HCl NF b. Syrup Vasaka IP d. Syrup of ferrous Phosphate IP
2.	**Elixir** a. Piperizine citrate elixir BP b. Paracetamol elixir BPC
3.	**Linctus** 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 d. Strong solution of ammonium acetate IP e. Mouthwash / Gargle f. Throat paint
5.	**Liniments** a. Liniment of turpentine IP* b. Liniment of camphor IP
6.	**Suspensions*** a. Calamine lotion b. Magnesium Hydroxide mixture BP
7.	**Emulsions*** a. Cod liver oil emulsion b. Liquid paraffin emulsion
8.	**Powders** a. Eutectic powder b. Explosive powder b. Dusting powder d. Insufflations
9.	**Suppositories** a. Boric acid suppositories b. Chloral suppositories
10.	**Incompatibilities** a. Mixtures with Physical incompatibilities b. Chemical & Therapeutic incompatibilities

Scheme of Practical Examination:

	Annual marks
Synopsis	15
Major Experiment	25
Minor Experiment	15
Viva	15
Max Marks	**70**
Duration	**04hrs**

Note: Total Sessional marks is 30 (20 for practical Sessional plus 10 marks for regularity, promptness, viva-voce and record maintenance).

1.3 T MEDICINAL BIOCHEMISTRY (THEORY)

Theory: 3 Hrs./Week

Scope of the Subject: Applied biochemistry deals with complete understanding of the molecular level of the chemical process associated with living cells. Clinical chemistry deals with the study of chemical aspects of human life in health and illness and the application of chemical laboratory methods to diagnosis, control of treatment, and prevention of diseases.

1. Objectives of the Subject (Know, do, appreciate):

The objective of the present course is to provide biochemical facts and the principles to the students of pharmacy. Upon completion of the subject student shall be able to

a. Understand the catalytic activity of enzymes and importance of isoenzymes in diagnosis of diseases.
b. Know the metabolic process of biomolecules in health and illness (metabolic disorders);
c. Understand the genetic organization of mammalian genome; protein synthesis; replication; mutation and repair mechanism.
d. Know the biochemical principles of organ function tests of kidney, liver and endocrine gland; and
e. Do the qualitative analysis and determination of biomolecules in the body fluids.

Text books (Theory)

a. Harpers review of biochemistry - Martin
b. Text book of biochemistry - D. Satyanarayana
c. Text book of clinical chemistry - Alex Kaplan & Laverve L. Szabo

Reference books (Theory)

a. Principles of biochemistry - Lehninger
b. Textbook of biochemistry - Ramarao
c. Practical Biochemistry - David T. Plummer.
d. Practical Biochemistry - Pattabhiraman.

2. Lecture wise programme:

Sr no.	Topic	3 Hrs/ week
I	Introduction to biochemistry**:** Cell and its biochemical organization, transport process across the cell membranes. Energy rich compounds; ATP, Cyclic AMP and their biological significance.	**3**
II	Enzymes: Definition; Nomenclature; IUB classification; Factor affecting enzyme activity; Enzyme action; enzyme inhibition. Isoenzymes and their therapeutic and diagnostic applications; Coenzymes and their biochemical role and deficiency diseases.	**8**
III	Carbohydrate metabolism: Introduction, classification, chemical nature and biological role of Carbohydrate, Glycolysis, Citric acid cycle (TCAcycle), HMP shunt, Glycogenolysis, gluconeogenesis, glycogenesis. Metabolic disorders of carbohydrate metabolism (diabetes mellitus and glycogen storage diseases); Glucose, Galactose tolerance test and their significance; hormonal regulation of carbohydrate metabolism.	**8**
IV	Lipid metabolism**:** Introduction, classification, chemical nature and biological role of Lipid, Oxidation of saturated (B-oxidation); Ketogenesis andketolysis; biosynthesis of fatty acids, lipids; metabolism of cholesterol; Hormonal regulation of lipid metabolism. Defective metabolism of lipids (Atheroslerosis, fatty liver, hypercholesterolmiea).	8
V	Biological oxidation**:** Coenzyme system involved in Biological oxidation. Electron transport chain (its mechanism in energy capture; regulation and inhibition); Uncouplers of ETC; Oxidative phosphorylation;	7

VI	Protein and amino acid metabolism**:** Introduction, classification, chemical nature and biological role of Protein and amino acid, protein turn over; nitrogen balance; Catabolism of Amino acids (Transamination, deamination & decarboxylation). Urea cycle and its metabolic disorders; production of bile pigments; hyperbilirubinemia, porphoria, jaundice. Metabolic disorder of Amino acids.	8
VII	Nucleic acid metabolism**:** Introduction, classification, chemical nature and biological role of Nucleic acid, Metabolism of purine and pyrimidine nucleotides; Protein synthesis; Genetic code; inhibition of protein synthesis; mutation and repair mechanism; DNA replication (semiconservative /onion peel models) and DNA repair mechanism.	8
VIII	Introduction to clinical chemistry: Cell; composition; malfunction; Roll of the clinical chemistry laboratory.	4
IX	The kidney function tests**:** Role of kidney; Laboratory tests for normal function includes- ➢ Urine analysis (macroscopic and physical examination, quantitative and semi quantitative tests.) ➢ Test for NPN constituents. (Creatinine /urea clearance, determination of blood and urine creatinine, urea and uric acid) ➢ Urine concentration test ➢ Urinary tract calculi. (stones)	8
X	Liver function tests: Physiological role of liver, metabolic, storage, excretory, protective, circulatory functions and function in blood coagulation. a)Test for hepatic dysfunction-Bile pigments metabolism. b)Test for hepatic function test- Serum bilirubin, urine bilirubin, and urine urobilinogen. c)Dye tests of excretory function. d)Tests based upon abnormalities of serum proteins.	8
XI	Lipid profile tests: Lipoproteins, composition, functions. Determination of serum lipids, total cholesterol, HDL cholesterol, LDL cholesterol and triglycerides.	**7**
XII	Immunochemical techniques for determination of hormone levels and protein levels in serum for endocrine diseases and infectious diseases. Radio immuno assay (RIA) and Enzyme Linked Immuno Sorbent Assay (ELISA)	**7**
XIII	Electrolytes: Body water, compartments, water balance, and electrolyte distribution. Determination of sodium, calcium potassium, chlorides, and bicarbonates in the body fluids.	**6**

1.3 P MEDICINAL BIOCHEMISTRY (PRACTICAL)

Practical: 3 Hrs./Week

Sr.no	Title
1	Introduction of clinical chemistry laboratory
2	Introduction to instruments used in clinical chemistry laboratory
3	Detection And Identification of Substances of Biological Importance; Carbohydrate
4	Detection And Identification of Substances of Biological Importance; Protiens and Amino Acid
5	Detection And Identification of Substances of Biological Importance; Lipids
6	Qualitative analysis of normal constituents of urine.*
7	Qualitative analysis of abnormal constituents of urine.*
8	Quantitative estimation of urine sugar by Benedict's reagent method.**
9	Quantitative estimation of urine chlorides by Volhard's method.**
10	Quantitative estimation of urine creatinine by Jaffe's method.**
11	Quantitative estimation of urine calcium by precipitation method.**
12	Quantitative estimation of serum cholesterol by Libermann Burchard's method.**
13	Withdrwal of blood and Preparation of Folin Wu filtrate from blood.*
14	Quantitative estimation of blood creatinine.**
15	Quantitative estimation of blood sugar Folin-Wu tube method.**
16	Estimation of SGOT in serum.**
17	Estimation of SGPT in serum.**
18	Estimation of Urea in Serum.**
19	Estimation of Proteins in Serum.**
20	Determination of serum bilirubin**
21	Determination of Glucose by means of Glucoseoxidase.**
22	Enzymatic hydrolysis of Glycogen/Starch by Amylases.**
23	Study of factors affecting Enzyme activity. (pH and Temprature)**
24	Preparation of standard buffer solutions and its pH measurements(any two Buffer)*
25	Experiment on lipid profile tests**
26	Determination of sodium in serum. **
27	Determination of calcium in serum**
28	Determination of potassium in serum**
29	Examination of Sputum by Microscopic Method
30	Methods of Injecting of Drug by Various Route

** indicate major experiments & * indicate minor experiments

Scheme of Practical Examination:

	Annual marks
Synopsis	15
Major Experiment	25
Minor Experiment	15
Viva	15
Max Marks	**70**
Duration	**04hrs**

Note: Total Sessional marks is 30 (20 for practical Sessional plus 10 marks for regularity, promptness, viva-voce and record maintenance).

1.4 T PHARMACEUTICAL ORGANIC CHEMISTRY (THEORY)

Theory: 3 Hrs./Week

1. **Scope and objectives**: This course is designed to impart a very good knowledge about

a. IUPAC/Common system of nomenclature of simple organic compounds belonging to different classes of organic compounds;
b. Some important physical properties of organic compounds;
c. Free radical/ nucleophyllic [alkyl/ acyl/ aryl] /electrophyllic substitution, free radical/ nucleophyllic / electrophyllic addition, elimination, oxidation and reduction reactions with mechanism, orientation of the reaction, order of reactivity, stability of compounds;
d. Some named organic reactions with mechanisms; and
e. Methods of preparation, test for purity, principle involved in the assay, important medicinal uses of some important organic compounds.

2. **Course materials:**

Textbooks

a. T. R. Morrison and R. Boyd – Organic chemistry,
b. Bentley and Driver - Text book of Pharmaceutical chemistry
c. I. L. Finer – Organic chemistry, the fundamentals of chemistry

Reference books

a. Organic chemistry– J. M. Cram and D. J. Cram
b. Organic chemistry- Brown
c. Advanced organic chemistry – Jerry March, Wiley
d. Organic chemistry- Cram and Hammered, Pine Hendrickso

Lecture wise programme: Topics

Unit no.	Unit	3 Hrs /week
I	**STRUCTURES AND PHYSICAL PROPERTIES:** a. Polarity of bonds, polarity of molecules, Inter molecular forces, M.P, B.P, Solubility, nonionic solutes and ionic solutes, protic and aprotic Solvents, ion pairs b. Acids and bases, Lowry Bronsted and Lewis theories c. Isomerism	05
II	**NOMENCLATURE:** IUPAC nomenclature system of organic compound belonging to the following classes: Alkanes, Alkenes, Dienes, Alkynes, Alcohols, Aldehydes, Ketones, Amides, Amines, Phenols, Alkyl halides, Carboxylic Acid, Esters, Acid Chlorides and Cycloalkanes.	06
III	**FREE RADICALS CHAIN REACTIONS:** Mechanism, relative reactivity and stability **(Alkane)**	04
IV	**ALICYCLIC COMPOUNDS**: a. Preparations of Cyclo Alkanes b. Cyclo addition reactions c. Bayer strain theory and orbital picture of angle strain.	06
V	**NUCLOPHILIC ALIPHATIC SUBSTITUTION (Alkyl Halides):** Duality of mechanisms SN1 and SN2 Mechanisms – a. Mechanism, kinetics, order of reactivity of alkyl halides, b. Stereochemistry and rearrangement of carbocations. c. Factors affecting SN1 and SN2 reactions.	05

	d. SN1 versus SN2 Mechanisms e. SN1 Mechanism: role of solvent. Ion dipole bonds, f. SN2 Mechanism: role of solvent. Phase transfer catalysis g. Solvolysis. Nucleophilic assistance by the solvents.	
VI	**DEHYDROHALOGENATION OF ALKYL HALIDES**: 1, 2 elimination. E2 and E1 Mechanisms – a. Mechanisms, Kinetics, elimination via carbocation b. E2 Mechanism: evidence for E2 mechanism, absence of rearrangement, isotope effect, absence hydrogen exchange, the element effect, orientation and reactivity. c. E2 versus E1 d. Elimination versus Substitution, e. Dehydration of alcohol: ease of dehydration, acid catalysis, reversibility, orientation.	06
VII	**REACTION AT CARBON-CARBON DOUBLE BOND:** Electrophilic and free radicals addition: a. Hydrogenation, heat of hydrogenation and stability of alkenes, b. Addition of hydrogen halides: Markovnikov's rule c. Addition of hydrogen bromides: peroxide effect, d. Electrophilic addition: mechanism, rearrangement, orientation and reactivity e. Addition of halogen: mechanism, halohydrin formation f. Free radicals addition: mechanism of peroxide initiated addition of hydrogen bromide, orientation of free addition. g. cyclo addition reactions, additions of carbenes to alkenes (refer Unit no. IV)	07
VIII	**CARBON-CARBON DOUBLE BOND AS A SUBSTITUENT:** a. Free radical halogenations of alkenes: comparison of free radical substitution with free radical addition. b. Free radical substitution in alkenes: orientation and reactivity, allylic rearrangement.	03
IX	**THEORY OF RESONANCE:** a. Allyl radical as a resonance hybrid: stability, orbital picture, resonance stabilisation of allyl radicals, hyper conjugation. b. Allyl cation as a resonance hybrid. c. Nucleophyllicsubstitution in allylic substrate: SN1 reactivity, allylic rearrangement, resonance stabilization of allyl cation, hyper conjugation. d. Nucleophilic substitution in allylic substrate: SN2 e. Nucleophilic substitution in vinylic substrate: vinylic cation, f. Conjugated dienes: Structure and properties, stability g. Resonance in alkenes: hyper conjugation h. Ease of formation of conjugated dienes: orientation of elimination, i. Electrophilic addition to conjugated dienes: 1,4- addition, 1,2-versus 1,4-addition, rate versus equilibrium. j. Free radical addition to conjugated dienes: orientation and reactivity.	06
X	**ELECROPHILIC AROMATIC SUBSTITUTION:** a. Reaction and mechanism of nitration, sulphonation, halogenation, friedel craft alkylation, friedel craft acylation. b. Effect of substituent groups c. Determination of orientation d. Determination of relative reactivity e. Classification of substituent group f. Theory of Reactivity: activating and deactivating	05

	g. Theory of orientation: O,P,M directing groups h. Electron release via resonance i. Effect of halogen on electrophilic aromatic substitution j. Electrophilic aromatic substitution in alkyl benzene, side chain halogenation of alkyl benzene, resonance stabilization of benzyl radical.	
XI	**CARBOXYILIC ACIDS:** a. Ionization of carboxylic acids, acidity constants b. acidity of acids c. structure of carboxylate ions d. effect of substituent on acidity, e. Nucleophilic acyl substitution reaction: Role of carboxyl group, conversion of acid-to-acid chloride, esters, amide and anhydride. comparison of alkyl nucleophilic substitution with acyl nucleophilic substitution.	06
XII	**ALDEHYDES AND KETONES**: Nucleophilic addition reaction mechanism a. Nucleophilic addition using carbanions: Aldol condensation, crossed aldol condensation, Claisen condensation, Perkin condensation, Knoevenagel condensation, Wittig reaction. b. Other Nucleophilic addition reactions: Cannizzaro reaction, crossed Cannizzaro reaction, Michael addition, benzoin condensation, Reformatsky reaction.	06
XIII	**AMINES:** a. Basicity of amines b. Amines preparation: Hoffman rearrangement: Migration to electron deficient nitrogen, c. Amines reactions: Sandmeyer's reaction, diazotization and coupling **PHENOLS:** a. Acidity of phenols b. Reactions of Phenols: Williamson synthesis, Fries rearrangement. c. EAS in phenols: Kolbe reaction, Reimer - Tieman reaction.	08
XIV	**NUCLEOPHILIC AROMATIC SUBSTITUTION:** Bimolecular displacement mechanisms, orientation, comparison of aliphatic nucleophilic substitution with that of aromatic.	07
XV	**OXIDATION REDUCTION REACTION:** a. Introduction to Redox reactions, examples and applications of Oxidizing and Reducing agents in organic synthesis. b. Oxidation reaction: Oppenauer oxidation c. Reduction reaction: catalytic hydrogenation, Birch reduction, Wolff Kishner reduction.	05
XVI	**STUDY OF SOME OFFICIAL COMPOUNDS**: Preparation and medicinal uses of Chlorbutol, Dimercaprol, Glyceryl trinitrate, Urea, Ethylene diamine dihyrate, Vanillin, Paraldehyde, Ethylene chloride, Lactic acid, Tartaric acid, citric acid, salicylic acid, aspirin, methyl salicylate, ethyl benzoate, benzyl benzoate, dimethyl pthalate, sodium lauryl sulphate, saccharin sodium, mephensin.	05

1.4 P PHARMACEUTICAL ORGANIC CHEMISTRY (PRACTICAL)

Practical: 3 Hrs./Week

Sr. No.	TITLE	TURNS
I.	Safety measures in an organic chemistry laboratory.	1
II.	Introduction to laboratory techniques: Calibration of thermometer, Determination of melting point, boiling point. Demonstration of distillation and Recrystallization	3
III.	Synthesis of the following compounds (at least 8 compounds to be synthesised): 1. Acetanilde / 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-napthol (Diazotisation and coupling) 6. M-dinitro benzene (Nitration) 7. Benzoic acid/ Salicylic acid from alkyl benzoate/ alkyl salicylate by hydrolysis reaction 8. 9, 10 – Antharaquinone (Oxidation of anthracene) / preparation of benzoic acid from toluene or benzaldehyde 9. M-phenylene diamine (Reduction of M-dinitrobenzene) / Aniline from nitrobenzene 10. Benzophenone oxime 11. Nitration of salicylic acid 12. Preparation of picric acid 13. Preparation of O-chlorobenzoic acid from O-chlorotolune 14. Preparation of cyclohexanone from cyclohexanol	8
IV.	Identification of organic compounds belonging to the following classes by Systematic qualitative organic analysis: Phenols, amides, carbohydrates, amines, carboxylic acids, aldehyde and ketones, Alcohols, esters, hydrocarbons, anilides, nitro compounds.	15
V.	Preparation of suitable solid derivatives from organic compounds.	2
VI.	Introduction to the use of stereo models: Methane, Ethane, Ethylene, Acetylene, Cis alkene, Trans alkene, inversion of configuration.	1

Scheme of Practical Examination:

	Annual marks
Synopsis	15
Major Experiment	25
Minor Experiment	15
Viva	15
Max Marks	**70**
Duration	**04hrs**

Note: Total Sessional marks is 30 (20 for practical Sessional plus 10 marks for regularity, promptness, viva-voce and record maintenance).

1.5 T PHARMACEUTICAL INORGANIC CHEMISTRY (THEORY)

Theory: 2 Hrs./Week

1. **Scope and objectives:** This course mainly deals with fundamentals of Analytical Chemistry and the study of inorganic pharmaceuticals regarding their monograph. The course deals with basic knowledge of analysis of various pharmaceuticals.

2. **Upon completion of the course student shall be able to**:

a. Understand the principles and procedures of analysis of drugs and regarding the application of inorganic pharmaceuticals.
b. Know the analysis of the inorganic pharmaceuticals their applications; and
c. Appreciate the importance of inorganic pharmaceuticals in preventing and curing disease.

3. **Course materials:**

Textbooks

a. A textbook Inorganic medicinal chemistry by Surendra N. Pandeya
b. A. H. Beckett and J. B. Stanlake's Practical Pharmaceutical Chemistry Vol-I & Vol-II
c. Inorganic Pharmaceutical Chemistry III – Edition P. Gundu Rao

Reference books

a. Inorganic Pharmaceutical Chemistry by Anand & Chetwal
b. Pharmaceutical Inorganic Chemistry by Dr. B. G. Nagavi
c. Analytical chemistry principles by John H. Kennedy
d. I.P.1985 and 1996, Govt. of India, Ministry of health

4. **Lecture wise programme: Topics**

Sr.No	Topics	Hrs
UNIT I	**Volumetric Analysis**	**25**
1	**Errors** Introduction to Errors, Types of Errors, Minimization of Errors, Accuracy and Precision, Significant Figures	**02**
2	**Basics of Volumetric Analysis** Introduction to Volumetric Analysis, Types of Volumetric Analysis, Normality, molarity, molality, Equivalent weight, Calculations for strength, % purity, and assay, Primary standards, Secondary standards, Importance of standardization before titration	**03**
3	**Acid-base Titrations** Theories of acid base indicators, classification of acid base titrations and neutralization curves.	**04**
4	**Redox Titrations** Concepts of oxidation and reduction, Types of redox titrations (Principles and applications) cerimetry, iodimetry, iodometry, bromometry, dichrometry, permagnatometry, and iodatometry.	**04**
5	**Non aqueous Titrations** Introduction, solvents, acidimetry and alkalimetry titration, indicators, and estimation of sodium benzoate	**03**
6	**Precipitation Titrations** Introduction, types of precipitation titration (Mohr's method, Gay Lussac's method, Volhard's, Modified Volhard's, Fajans method), indicators, and estimation of sodium chloride.	**03**

7	**Complexometric Titrations** Introduction, classification, metal ion indicators, masking and demasking reagents, and estimation of calcium gluconate.	**03**
8	**Theory of Indicators** Ostwald theory, chromophore theory, and physicochemical theory.	**03**
UNIT II Miscellaneous		**35**
1.	**Gravimetry** Principle and steps involved in gravimetric analysis. purity of the precipitate co-precipitation and post precipitation, and estimation of barium sulphate.	**02**
2.	**Limit Tests** Sources and types of impurities, principle involved in the limit test for chloride, sulphate, iron, arsenic, lead and heavy metals, and modified limit test for chloride and sulphate.	**03**
3.	**Medicinal Gases** Introduction to medicinal gases, storage and handling, and applications in pharmacy and medicine.	**03**
4.	**Acidifiers** Ammonium chloride and dil. HCl.	**01**
5.	**Antacids** Ideal properties of antacids, combinations of antacids, sodium bicarbonate, aluminium hydroxide gel, and magnesium hydroxide mixture.	**03**
6.	**Cathartics** Magnesium sulphate, sodium orthophosphate, kaolin, and bentonite.	**02**
7.	**Electrolyte Replenishers** Functions of major physiological ions, electrolytes used in the replacement therapy: sodium chloride, potassium chloride, calcium gluconate, oral rehydration salt (ORS), and physiological acid base balance.	**04**
8.	**Essential Trace Elements** Introduction to trace elements, essential trace elements (iron (Fe), zinc (Zn), copper (Cu), iodine (I), selenium (Se), chromium (Cr) manganese (Mn) cobalt (Co) molybdenum (Mo) fluoride (F)), clinical aspects, and therapeutic use.	**02**
9.	**Antimicrobials** Mechanism, classification, potassium permanganate, boric acid, hydrogen peroxide, chlorinated lime, iodine and its preparations.	**04**
10.	**Pharmaceutical Aids** Introduction, types of pharmaceutical aids and their uses.	**03**
11.	**Dental Products** Dentifrices, role of fluoride in the treatment of dental caries, desensitizing agents, calcium carbonate, sodium fluoride, and zinc eugenol cement.	**02**
12.	**Miscellaneous Compounds** Astringents: zinc sulphate, and potash alum Expectorants: Potassium iodide, Ammonium chloride	**03**
13.	**Radio Pharmaceuticals** Radio activity, measurement of radioactivity, properties of α, β, γ radiations, half-life, storage conditions, precautions and pharmaceutical application of radioactive substances.	**03**

1.5 P PHARMACEUTICAL INORGANIC CHEMISTRY (PRACTICAL)

Practical: 3 Hrs./Week

Sr. No	Title of Experiments	Turn
1	**Limit test** a. Limit test for chlorides b. Limit test for sulphates c. Limit test for iron d. Limit test for heavy metals e. Limit test for arsenic f. Modified limit tests for chlorides and sulphates	6
2	**Assays** a. Ammonium chloride- Acid-base titration b. Ferrous sulphate- Cerimetry c. Copper sulphate- Iodometry d. Calcium gluconate- Complexometry e. Hydrogen peroxide – Permanganometry f. Sodium benzoate – Non-aqueous titration g. Sodium chloride – Modified Volhard's method h. Assay of KI – KIO3 titration i Gravimetric estimation of barium as barium sulphate j. Sodium antimony gluconate or antimony potassium tartrate	10
3	**Estimation of mixture** a. Sodium hydroxide and sodium carbonate b. Boric acid and borax c. Oxalic acid and sodium oxalate	3
4	**Test for identity** a. Sodium bicarbonate b. Barium sulphate c. Ferrous sulphate d. Potassium chloride	4
5	**Test for purity (Any three exercises)** a. Swelling power in bentonite b. Acid neutralizing capacity in aluminium hydroxide gel c. Ammonium salts in potash alum d. Adsorption power heavy Kaolin e. Presence of Iodates in KI	3
6	**Preparations** a. Boric acids b. Potash alum c. Calcium lactate d. Magnesium sulphate	4

Scheme of Practical Examination:

	Annual marks
Synopsis	15
Major Experiment	25
Minor Experiment 1&2	15
Viva	15
Max Marks	**70**
Duration	**04hrs**

Note: Total Sessional marks are 30 (20 for practical Sessional plus 10 marks for regularity, promptness, viva-voce and record maintenance)

1.6 T REMEDIAL MATHEMATICS (THEORY)

Theory: 3 Hrs./Week

1. **Scope and objectives**: This is an introductory course in mathematics. These subjects' deals with the introduction to matrices, determinants, trigonometry, analytical geometry, differential calculus, integral calculus, differential equations, laplace transform.

2. **Upon completion of the course the student shall be able to:–**

a. Know Trignometry, Analytical geometry, Matrices, Determinant, Integration, Differential equation, Laplace transform and their applications;
b. Solve the problems of different types by applying theory; and
c. Appreciate the important applications of mathematics in pharmacy.

3. **Course materials:**

Textbooks

a. Differential calculus By Shantinarayan
b. Textbook of Mathematics for second year pre-university by Prof. B. M. Sreenivas

Reference books

a. Integral calculus By Shanthinarayan
b. Engineering mathematics By B. S. Grewal
c. Trigonometry Part-I By S. L. Loney

4. **Lecturewise programme**

Sr. No.	Topics	3hrs/ week
1.	**Algebra:** Determinants, Matrices.	14
2.	**Trigonometry:** Sides and angles of a triangle, solution of triangles	12
3.	**Analytical Geometry:** Points, Straightline, circle, parabola.	08
4.	**Differential calculus:** Limit of a function, Differential calculus, Differentiation of a sum, Product, Quotient Composite, Parametric, exponential, trigonometric and Logarithmic function. Successive differentiation, Leibnitz's theorem, Partial differentiation, Euler's theorem on homogeneous functions of two variables	20
5.	**Integral Calculus:** Definite integrals, integration by substitution and by parts, Properties of definite integrals.	14
6.	**Differential equations:** Definition, order, degree, variables eparable, homogeneous, Linear, heterogeneous, linear, differential equation with constant coefficient, simultaneous linear equation of second order.	14
7.	**Laplace transform:** Definition, Laplace transform of elementary functions, Properties of linearity and shifting.	08

1.6 T BIOLOGY (THEORY)

Scope and objectives: This is an introductory course in Biology, which gives detailed study of natural sources such as plant and animal origin. This subject has been introduces to the pharmacy course in order to make the student aware of various naturally occurring drugs and its history, sources, classification, distribution and the characters of the plants and animals. This subject gives basic foundation to Pharmacognosy.

Course materials:

Text books

a. Text book of Biology by S.B. Gokhale
b. A Text book of Biology by Dr. Thulajappa and Dr. Seetaram.

Reference books

a. A Text book of Biology by B. V. Sreenivasa Naidu
b. A Text book of Biology by Naidu and Murthy
c. Botany for Degree students By A. C. Dutta.
d. Outlines of Zoology by M. Ekambaranatha ayyer and T. N. Anantha krishnan.
e. A manual for pharmaceutical biology practical by S. B. Gokhale and C. K. Kokate.

Lecturewise programme: Topic

Sr.No	Title
	PART–A
1	Introduction
2	General organization of plants and its inclusions
3	Plant issues
4	Plant kingdom and its classification
5	Morphology of plants
6	Root, Stem, Leaf and Its modifications
7	In florescence and Pollination off lowers
8	Morphology of fruits and seeds
9	Plant physiology
10	Taxonomy of Leguminosae, umbelliferae, Solanaceae, Lilliaceae, Zinziberaceae, Rubiaceae
11	Study of Fungi, Yeast, Penicillin and Bacteria
	PART– B
12	Study of Animal cell
13	Study animal tissues
14	Detailed study of frog
15	Study of Pisces, Raptiles, Aves
16	General organization of mammals
17	Study of poisonous animals

1.6 P BIOLOGY (PRACTICAL)

Practical: 3Hrs./Week Title:

Sr. No.	Title of Experiments
1	Introduction of biology experiments
2	Study of cell wall constituents and cell inclusions
3	Study of Stem modifications
4	Study of Root modifications
5	Study of Leaf modifications
6	Identification of Fruits and seeds
7	Preparation of Permanent slides
8	T.S. of Senna, Cassia, Ephedra, Podophyllum.
9	Simple plant physiological experiments
10	Identification of animals
11	Detailed study of Frog
12	Computer based tutorials

Scheme of Practical Examination:

	Annual Marks
Identification	10
Synopsis	10
Major Experiment	20
Minor Experiment	15
Viva	15
Max Marks	**70**
Duration	**04hrs**

Note: Total Sessional marks are 30 (20 for practical Sessional plus 10 marks for regularity, promptness, viva-voce and record maintenance).

1.7 T Democracy, Election and Governance

Theory: 2 Hrs./Week

Objectives:
1. To introduce the students meaning of democracy and the role of the governance
2. To help them understand the various approaches to the study of democracy and governance

Module 1 Democracy- Foundation and Dimensions
a. Constitution of India
b. Evolution of Democracy- Different Models
c. Dimensions of Democracy- Social, Economic, and Political

Module 2 Decentralization
a. Indian tradition of decentralization
b. History of panchayat Raj institution in the lost independence period
c. 73rd and 74th amendments
d. Challenges of caste, gender, class, democracy and ethnicity

Module 3 Governance
a. Meaning and concepts
b. Government and governance
c. Inclusion and exclusion

References:

1. Banerjee-Dube, I. (2014). A history of modern India. Cambridge University Press.
2. Basu, D. D. (1982). Introduction to the Constitution of India. Prentice Hall of India.
3. Bhargava, R. (2008). Political theory: An introduction. Pearson Education India.
4. Bhargava, R., Vanaik, A. (2010) Understanding Contemporary India: Critical Perspective. New Delhi: Orient Blackswan.
5. Chandhoke. N., Proyadardhi.P, (ed) (2009), 'Contemporary India: Economy, Society, Politics', Pearson India Education Services Pvt. Ltd, ISBN 978-81-317-1929-9.
6. Chandra, B. (1999). Essays on contemporary India. Har-Anand Publications.
7. Chaterjee, P. (1997). State and Politics in India.
8. Dasgupta. S., (ed) (2011), 'Political Sociology', Dorling Kindersley (India) Pvt. Ltd., Licensees of Pearson Education in south Asia. ISBN: 978-317-6027.
9. Deshpande, S. (2003). Contemporary India: A Sociological View, New Delhi:Viking Publication.
10. Guha, R. (2007). India After Gandhi: The History of the World's Largest. Democracy, HarperCollins Publishers, New York.
11. Guha, R. (2013). Gandhi before India. Penguin UK.
12. Jayal. N.G. (2001). Democracy in India.New Delhi: Oxford University Press.
13. Kohli, A. (1990). Democracy and discontent: India's growing crisis of governability. Cambridge University Press
14. Kohli, A., Breman, J., & Hawthorn, G. P. (Eds.). (2001). The success of India's democracy (Vol. 6). Cambridge University Press
15. Kothari, R. (1989). State against democracy: In search of humane governance. Apex Pr.
16. Kothari, R. (1970). Politics in India. New Delhi: Orient Blackswan.
17. Kothari, R. (1995). Caste in Indian politics. Orient Blackswan.

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Second Year:

2.1 T PATHOPHYSIOLOGY (THEORY)

Theory: 3 Hrs./Week

Scope and Objectives:

This course is designed to impart a thorough knowledge of the relevant aspects of pathology of various conditions with reference to its pharmacological applications and understanding of basic Pathophysiological mechanisms. Hence it will not only help to study the syllabus of pathology, but also to get baseline knowledge of its application in other subjects of pharmacy.

Upon completion of the course, the student shall be able to:

a. Describe the etiology and pathogenesis of the selected disease states
b. Name the signs and symptoms of the diseases
c. Mention the complications of the diseases.

Course materials:

Textbooks

a. Pathologic basis of disease by- Cotran, Kumar, Robbins
b. Textbook of Pathology- Harsh Mohan
c. Textbook of Pathology- Y.M. Bhinde

Reference books (Theory)

a. Clinical Pharmacy and Therapeutics; Second edition; Roger Walker; Churchill Livingstone publication
b. Dr. S.L. Bodhankar, Dr N.S. Vyawahare, A textbook of pathophysiology, Nirali Prakashan, Pune.

Sr No	Lecturewise program: Topics	Hrs
1.	**Basic principles of cell injury and Adaptation** a. Causes, Pathogenesis and morphology of cell injury b. Abnormalities in lipoproteinemia, glycogen infiltration and glycogen storage diseases	**08**
2.	**Inflammation** a. Pathogenesis of acute inflammation, Chemical mediators in inflammation, Types of chronic inflammation b. Repairs of wounds in the skin, factors influencing healing of wounds	**10**
3.	**Diseases of Immunity** a. Introduction to T and B cells b. MHC proteins c. Immune tolerance - Hypersensitivity - Hypersensitivity type I, II, III, IV, Biological significance, Allergy due to food, chemicals and drugs - Autoimmunity Criteria for autoimmunity, Classifications of autoimmune diseases in man, mechanism of autoimmunity, Transplantation and immunologic tolerance, allograft rejections, transplantation antigens, mechanism of rejection of allograft. - Acquired immune deficiency syndrome (AIDS) - Amyloidosis	**10**

4.	**Cancer** Differences between benign and malignant tumors, Histological diagnosis of malignancy, invasions and metastasis, patterns of spread, disturbances of growth of cells, classification of tumors, general biology of tumors, etiology and pathogenesis of cancer.	**16**
5.	Types of shock, mechanisms, stages and management	**02**
6.	Biological effects of radiation	**04**
7.	**Environmental and nutritional diseases** a. Air pollution and smoking- SO2, NO, NO2, and b. Protein calorie malnutrition, vitamins, obesity, pathogenesis of starvation.	**02**
8.	**Pathophysiology of common diseases** a. Parkinsonism b. Schizophrenia c. Depression and mania d. Hypertension e. Stroke (ischemic and hemorrhage) f. Angina, CCF, Atherosclerosis, Myocardial infarction g. Diabetes Mellitus h. Peptic ulcer and inflammatory bowel diseases i. Cirrhosis and Alcoholic liver diseases j. Acute and chronic renal failure k. Asthma and chronic obstructive airway diseases	**26**
9.	**Infectious diseases** Sexually transmitted diseases (HIV, Syphilis, Gonorrhea), Urinary tract infections, Pneumonia, Typhoid, Tuberculosis, Leprosy, Malaria, Dysentery (bacterial and amoebic), Hepatitis- infective hepatitis.	**12**

Assignments:

Title of the Experiment

1. Chemical Mediators of inflammation
2. Drug Hypersensitivity
3. Cigarette smoking & its ill effects
4. Biological Effects of Radiation
5. Etiology and hazards of obesity
6. Complications of diabetes
7. Diagnosis of cancer
8. Disorders of vitamins
9. Methods in Pathology-Laboratory values of clinical significance
10. Pathophysiology of Dengue Hemorrhagic Fever (DHF)

Format of the assignment

1. Minimum & Maximum number of pages.
2. Reference(s) shall be included at the end.
3. Assignment can be a combined presentation at the end of the academic year
4. It shall be computer draft copy.
5. Name and signature of the student
6. Time allocated for presentation may be 8+2 Min.

2.2 T PHARMACEUTICAL MICROBIOLOGY (THEORY)

Theory: 3 Hrs. /Week

1. **Scope of the Subject:** Microbiology has always been an essential component of pharmacy curriculum. This is because of the relevance of microbiology to pharmaceutical sciences and more specifically to pharmaceutical industry. Pharmaceutical biotechnology is the logical extension of pharmaceutical microbiology, which is expected to change the complete drug product scenario in the future. This course deals with the various aspects of microorganisms, their classification, morphology, laboratory cultivation identification and maintenance. It's also discussing sterilization of pharmaceutical products, equipment, media etc. The course further discusses immunological preparations, diseases transmission, diagnosis, control and immunological tests.

2. **Objectives of the Subject:**

Upon completion of the subject student shall be able to –

a. Know the anatomy, identification, growth factors and sterilization of microorganisms.

b. Know the mode of transmission of disease-causing microorganism, symptoms of disease, and treatment aspect.

c. Do estimation of RNA and DNA and there by identifying the source.

d. Do cultivation and identification of microorganisms in the laboratory.

e. Do identification of diseases by performing diagnostic tests; and

f. Appreciate the behavior of motility and behavioral characteristics of microorganisms.

g. Understand the role of microorganisms in infectious diseases, their diagnosis, prevention, and therapeutic management.

h. Interpret microbiological investigations including culture sensitivity reports, Molecular diagnostics, and rapid diagnostic tests for clinical application.

i. Apply principles of asepsis, sterilization, infection control, immunization, and Antimicrobial stewardship in hospital and pharmaceutical practice.

j. Appreciate the significance of antimicrobial resistance and participate in patient-Care related decision making is associated with infectious diseases.

Text books (Theory)

a. Vanitha Kale and Kishor Bhusari ― Applied Microbiology ‖ Himalaya Publishin house Mumbai.

b. Mary Louis Turgeon ― Immunology and Serology in Laboratory Medicines‖ 2nd edition, 1996 Mosby- Year book inc St. Louis Missouri 63146.

c. Harsh Mohan, ― Text book of Pathology‖ 3rd edition, 1998, B-3 Ansari road Darya ganj N. Delhi.

d. Bailey and Scott's Diagnostic Microbiology

e. Manual of Clinical Microbiology

f. Basic and Clinical Immunology

Reference books (Theory)

1. Prescot L.M., Jarley G.P Klein D.A - Microbiology‖ 2nd- edition Mc Graw Hill Company Inc

2. Rawlins E.A.‖Bentley's Text Book of Pharmaceutical‖s B ailliere T indals 24-28 London 1988

3. Forbisher - Fundamentals of Microbiology‖ Philidelphia W.B. Saunders.

4. Prescott L. M. Jarley G.P., Klein. D. A. - Microbiology.‖2nd edition WMC Brown Publishers, Oxford. 1993

5. War Roitt, Jonathan Brostoff, David male, - Immunology‖3rd edition 1996, Mosby-year book Europe Ltd, London.

6. Pharmacopoeia of India, Govt of India, 1996 to 2025.

7. WHO Guidelines on Infection Prevention and Control

Unit No.	Topics	Hrs
1	Introduction to the science of microbiology. Major divisions of microbial world and Relationship among them.	6
2	Different methods of classification of microbes and study of Bacteria, Fungi, virus, Rickettsiae, Spirochetes Brief introduction to emerging pathogens: MRSA ,VRE ,ESBL-producing organisms ,Overview of biofilms and antimicrobial resistance.	13
3	Nutritional requirements, growth and cultivation of bacteria and virus. Study of different important media required for the growth of aerobic and anaerobic bacteria & fungi. Differential media, enriched media and selective media, maintenance of lab cultures. clinical specimen collection, transport, and aseptic handling in hospitals.	6
4	Different methods used in isolation and identification of bacteria with emphasis to different staining techniques and biochemical reactions. Counting of bacteria - Total and Viable counting techniques. Interpretation of culture sensitivity reports and introduction to antibiogram.	6
5	Detailed study of different methods of sterilization including their merits and demerits. Sterilization methods for all pharmaceutical products. Detailed study of sterility testing of different pharmaceutical preparations. Brief information on Validation Hospital infection control practices, biomedical waste management, hand hygiene, and personal protective equipment (PPE).	12
6	Disinfectants- Study of disinfectants, antiseptics, fungicidal and virucidal agents factors affecting their activation and mechanism of action. Evaluation of bactericidal, bacteristatic, virucidal activities, evaluation of preservatives in pharmaceutical preparations. Role of disinfectants in hospital infection control, Surface disinfection in ICU and OT., Evaluation of sanitizer efficacy	7
7	Immunology - Immunity, Definition, Classification, General principles of natural immunity, Phagocytosis, acquired immunity (active and passive). Antigens, chemical nature of antigens structure and formation of Antibodies, Antigen-Antibody reactions. Bacterial exotoxins and endotoxins. Significance of toxoids in active immunity, Immunization programme, and importanceof booster dose. National Immunization Schedule, vaccine pharmacovigilance, recombinant vaccines, and adverse events following immunization (AEFI).	12
8	Diagnostic tests: Schick's Test, Elisa test, Western Blot test, Southern Blot PCR Widal, QBC, Mantaux Peripheral smear. Study of malarial parasite. Introduction to RT-PCR, rapid diagnostic tests, CRP, and Procalcitonin as recent advances in diagnostic microbiology.	8
9	Microbial culture sensitivity Testing: Interpretation of results Principles and methods of different microbiological assays, microbiological assay of Penicillin, Streptomycin and vitamin B2 and B12. Standardisation of vaccines and sera.	6
10	Study of infectious diseases: Typhoid, Tuberculosis, Malaria, Cholera, Hepatitis, Meningitis, Syphilis & Gonorrhea and HIV. Brief introduction to COVID-19, Dengue, hospital-acquired infections, and opportunistic infections, HPV.	14

2.2 P PHARMACEUTICAL MICROBIOLOGY (PRACTICAL)

Practical: 3 Hrs./Week

Sr. no	Title of the Experiment
1.	Study of apparatus used in experimental microbiology*.
2.	Sterilization of glass ware's. Preparation of media and sterilisation.*
3.	Staining techniques – Simple staining ; Gram's staining ; Negative staining**
4.	Study of motility characters*.
5.	Enumeration of micro-organisms (Total and Viable)*
6.	Study of the methods of isolation of pure culture.*
7.	Bio chemical testing for the identification of micro*-organisms.
8.	Cultural sensitivity testing for some micro-organisms.*
9.	Sterility testing for powders and liquids.*
10	Determination of minimum inhibitory concentration.*
11	Microbiological assay of antibiotics by cup plate method.*
12	Microbiological assay of vitamins by Turbidometric method**
13	Determination of RWC. **
14	Diagnostic tests for some common diseases, Widal, malarial parasite. **

* Indicate minor experiment & ** indicate major experiment

Assignments

1. Visit to some pathological laboratories & study the activities and equipment / instruments used and reporting the same.
2. Visit to milk dairies (Pasturization) and microbial laboratories (other sterization methods) & study the activities and equipment/instruments used and reporting the same.
3. Library assignments
4. Report of recent microbial techniques developed in diagnosing some common diseases.
5. Latest advancement developed in identifying, cultivating & handling of microorganisms
6. Antimicrobial resistance
7. Recent advances in diagnostic microbiology
8. Infection control practices in hospitals
9. Pharmacist role in antimicrobial stewardship

2.3 T PHARMACOGNOSY & PHYTOPHARMACEUTICALS (THEORY)

Theory: 3 Hrs. /Week

1. **Scope and objectives:** This subject has been introduced for the pharmacy course inordertomakethestudentawareofmedicinalusesofvariousnaturallyoccurringdrugs its history, sources, distribution, method of cultivation, active constituents, medicinal uses, identification tests, preservation methods, substitutes and adulterants.

2. **Upon completion of the course student shall be able to:**

a. understand the basic principles of cultivation, collection and storage of crude drugs;
b. know the source, active constituents and uses of crude drugs; and
c. appreciate the applications of primary and secondary metabolites of the plant.

3. **Course materials:**

Text books

a. Pharmacognosy by G.E. Trease &W.C.Evans.
b. Pharmacognosy by C.K.Kokate,Gokhale&A.C.Purohit.
c. Quality Control Methods for Medicinal Plant Materials By WHO.

Reference books

a. Pharmacognosy by Brady&Tyler.E.
b. Pharmacognosy byT.E.Wallis.
c. Pharmacognosy by C.S. Shah &Qadery.
d. Pharmacognosy by M.A.Iyengar.

4. **Lecturewise programme:**

Sr.No	Topics	Hrs
1.	Introduction (Definition, history & scope of pharmacognosy), classification	04
	of crude drugs.	
2.	Introduction to traditional systems of medicine & formulation's (Asava,	05
	,aristha ,bhasma)	
3.	Study of:	05
	a) organised&unorganised crude drug	
	b) primary & secondary metabolite of crude drug	
4.	Cultivation, collection, processing & storage of crude drugs	10
5.	Study of natural pesticides (neem ,pyrethrum, tobacco, citronella oil)	04
6.	General introduction, occurrence, chemistry, classification, therapeutic uses, commercial applications, chemical test of following secondary metabolites:	
	a) Alkaloids – Datura ,Cinchona,Ephedra,Rauwolfia,Vinca	08
	b) Glycosides – Liquorice ,Senna ,Quassia ,Digitalis	07
	c) Volatile Oil – Clove,Fennel.Coriander ,Cassia Cinnamon	08
	d) Resins – Ginger ,Capsicum	03
	e) Carbohydrates – Isapgol,Acacia,Tragacanth,Agar,Starch	08
	f) Lipids – Castor Oil ,Sesame Oil,Shark Liver Oil ,Bees Wax	06
	g) Proteins – Gelatin,Casein	04
7.	Traditional Extraction techniques, Advanced Extraction techniques (Supercritical Fluid extraction, Microwave assisted extraction, Ultrasound assisted extraction), Quality Control study & applications of chromatographic & spectroscopic techniques	10
8.	Study of plant fibers used in surgical dressing & related products –	04
	cotton ,jute, wool	
9.	Various methods for Detection of adulteration in crude drugs	04

2.3 P PHARMACOGNOSY & PHYTOPHARMACEUTICALS (PRACTICAL)

Practical: 3 Hrs./Week

General Requirements: Laboratory Napkin, Observation Book 150 pages Zero brush, Needle, Blade, Match box.

List of experiments:

1. Introduction of Pharmacognosy laboratory and experiments.
2. Study of cell wall constituents and cell inclusions.
3. Macro, powder and microscopic study of Datura.
4. Macro, powder and microscopic study of Senna.
5. Macro, powder and microscopic study of Cassia.cinnamon.
6. Macro, powder and microscopic study of Cinchona.
7. Macro, powder and microscopic study of Ephedra.
8. Macro, powder and microscopic study of Quassia..
9. Macro, powder and microscopic study of Clove.
10. Macro, powder and microscopic study of Fennel.
11. Macro, powder and microscopic study of Coriander.
12. Macro, powder and microscopic study of Isapgol.
13. Macro, powder and microscopic study of Nux vomica.
14. Macro, powder and microscopic study of Rauwolfia.
15. Macro, powder and microscopic study of Liquorice.
16. Macro, powder and microscopic study of Ginger.
17. Macro, powder and microscopic study of Podophyllum.
18. Determination of Iodine value.
19. Determination of Saponification value and unsaponifiable matter.
20. Determination of Ester value.
21. Determination of Acid value.
22. Chemical tests for Acacia.
23. Chemical tests for Tragacanth.
24. Chemical tests for Agar.
25. Chemical tests for Starch.
26. Chemical tests for Lipids.(castor oil, sesame oil, shark liver oil, bees wax)
27. Chemical tests for Gelatin.
28. Hydro-distillation of Volatile oil.
29. Determination of Alcohol content in Asava & Arishta.
30. Determination of size of starch grains by Quantitative Micrometry Method
31. Isolation of Caffeine from Tea powder.
32. Separation of Curcuminoids from Turmeric extract by TLC.
33. Demonstration of Soxhlet Extraction method.

Scheme of Annual Practical Examination

	Sessional	**Annual**
Identification	05	10
Synopsis		10
Major Experiment	10	20
Minor Experiment	05	15
Viva	10	15
Max Marks	**30**	**70**
Duration	**03hrs**	**04hrs**

2.4 T PHARMACOLOGY – I (THEORY)

Theory: 3 Hrs. /Week

1. **Scope of the Subject:**
   This subject will provide an opportunity for the student to learn about the drug regarding classification, pharmacodynamic and pharmacokinetic aspects, adverse effects, uses, dose, route of administration, precautions, contraindications and interaction with other drugs. In this subject, apart from general pharmacology, drugs acting on autonomic nervous system, cardiovascular system, central nervous system, blood and blood forming agents and renal system will be taught. In addition to theoretical knowledge, the basic practical knowledge relevant to therapeutics will be imparted.
2. **Objectives of the Subject:**
   Upon completion of the subject student shall be able to (Know, do, appreciate) –

a. Understand the pharmacological aspects of drugs falling under the above mentioned chapters;
b. Handle and carry out the animal experiments;
c. Appreciate the importance of pharmacology subject as a basis of therapeutics; and
d. Correlate and apply the knowledge therapeutically.

Text books (Theory)

(Author, Title, Edition, Publication Place, Publisher, Year of Publication)

a. Tripathi, K. D. Essentials of medical pharmacology. 4th Ed, 1999. Publisher: Jaypee, Delhi.
b. Satoskar, R.S. and Bhadarkar, S.D. Pharmacology and pharmacotherapeutics. 16th edition (single volume), 1999. Publisher: Popular, Dubai.
c. Rang, H.P. & Dale, M.M. Pharmacology. 4th edition, 1999. Publisher: Churchill Living stone.

Reference books (Theory)

(Author, Title, Edition, Publication Place, Publisher, Publication Year)

a. Goodman Gilman, A., Rall, T.W., Nies, A.I.S. and Taylor, P. Goodman and Gilman's The pharmacological Basis of therapeutics. 9th Ed, 1996. Publisher Mc Graw Hill, Pergamon press.
b. Craig, C.R.&Stitzel, R.E. Modern Pharmacology. Latest edition. Publisher: Little Brown. Co
c. Katzung, B.G. Basic and clinical pharmacology. Latest edition. Publisher: Prentice Hall, Int.
d. Shargel and Leon. Applied Biopharmaceutics and pharmacokinetics. Latest edition. Publisher: Prentice Hall, London.

Text books (Practical) :

Kulkarni, S. K. and Dandia, P. C. Hand book of experimental pharmacology. Latest edition, Publisher: Vallab, Delhi.

Reference books (Practical)

a. Macleod, L.J. Pharmacological experiments on intact preparations. Latest edition, Publisher: Churchill livingstone.
b. b.Macleod, L.J. Pharmacological experiments on isolated preparations. Latest edition, Publisher: Churchill livingstone.
c. c.Ghosh, M.N. Fundamentals of experimental pharmacology. Latest edition,Publisher: Scientific book agency, Kolkata.
d. Ian Kitchen. Textbook of in vitro practical pharmacology. Latest edition,
e. Publisher: Black well Scientific.

Detailed syllabus and lecture wise schedule:

Title of the topic

1. General Pharmacology

a) Introduction, definitions and scope of pharmacology
b) Routes of administration of drugs
c) Pharmacokinetics (absorption, distribution, metabolism and excretion)
d) Pharmacodynamics

e) Factors modifying drug effects
f) Drug toxicity - Acute, sub- acute and chronic toxicity.
g) Pre-clinical evaluations
h) Drug interactions
I) Pharmacovigilance & ADR monitoring, reporting.

Note: The term Pharmacology used here refers to the classification, mechanism of action, pharmacokinetics, pharmacodynamics, adverse effects, contraindications, Therapeutic uses, interactions and doses and route of administration.

2. Pharmacology of drugs acting on ANS
a) Adrenergic and antiadrenergic drugs
b) Cholinergic and anticholinergic drugs
c) Neuromuscular blockers
d) Mydriactics and miotics
e) Drugs used in myasthenia gravis
f) Drugs used in Parkinsonism

3. Pharmacology of drugs acting on cardiovascular system
a) Antihypertensives
b) Anti-anginal drugs
c) Anti-arrhythmic drugs
d) Drugs used for therapy of Congestive Heart Failure
e) Drugs used for hyperlipidaemias

4. Pharmacology of drugs acting on Central Nervous System
a) Sedatives and hypnotics
b) General anaesthetics
c) Pharmacology of local anaesthetics
d) Anticonvulsants
e) Psychotropic drugs
f) Analgesic and anti-inflammatory agents
g) Alcohol and methyl alcohol
h) CNS stimulants and cognition enhancers
I) Drugs used in Alzheimer's Disease

5. Pharmacology of Drugs acting on Respiratory tract
a) Bronchodilators
b) Mucolytics
c) Expectorants
d) Antitussives
e) Nasal Decongestants

6. Pharmacology of Hormones and Hormone antagonists
a) Thyroid and Antithyroid drugs
b) Insulin, Insulin analogues and oral hypoglycaemic agents
c) Sex hormones and oral contraceptives
d) Oxytocin and other stimulants and relaxants

7. Pharmacology of autocoids and their antagonists
a) Histamines and antihistamines
b) 5-Hydroxytryptamine and its antagonists
c) Lipid derived autocoids and platelet activating factors

2.4 P PHARMACOLOGY – I (PRACTICAL)

Practical: 3 Hrs./Week

List of Experiments:

1. Introduction to commonly used instruments in experimental pharmacology.
2. Care and handling of common laboratory animals, animal welfare and introduction of CPCSEA and its guidelines, OECD guidelines.
3. Introduction to animal physiology with their biochemical reference values in various Animal species.
4. Study of various routes of drug administration
5. Study of various anaesthetics employed to anesthetize laboratory animals.
6. Introduction to the techniques of Euthanasia
7. Study of physiological salt solutions, drug solutions and use of molar solution in various animal experiments.
8. Study of various methods for collection of blood, body fluids and urine from Experimental animals.
9. Computer simulations of following experiments through computerized simulated Software programme using software such as Ex-Pharm, X-cology etc.
10. To record Concentration Response Curves (CRC) of Acetylcholine using suitable isolated tissue preparations
11. Study of the miotic and mydriatic effect of drugs using rabbit eyes.
12. To record Concentration Response Curves (CRC) of Acetylcholine using suitable Isolated tissue preparations
13. To record Concentration Response Curves (CRC) of Histamine using suitable isolated tissue preparations
14. Study of agonistic and antagonistic effects of drugs using Guinea -pig ileum preparation.
15. To study antihistaminic property of drug using histamine induced anaphylactic reaction in guinea pigs.
16. To study the effects of drugs using rat uterus preparation.
17. To study the effects of drugs on intestinal motility using frog's esophagus model.
18. To study the apomorphine-induced compulsive behavior (stereotypy) in mice.
19. To demonstrate the effect of various drugs on the blood pressure and respiration of anaesthetized dog.
20. To Study of locomotor activity of drug using actophotometer in mice.
21. To Study of analgesic activity of drugs using Eddy's hot plate analgesiometer/ tail flick analgesiometer in mice.
22. To study the anti-inflammatory property of indomethacin against carrageenan-induced paw oedema.
23. To study the anxiolytic effect of diazepam in mice using mirrored-chamber apparatus.
24. To Study of muscle relaxant property of drug using rotarod in mice.
25. To study the effect of anthelmintics on earthworms.
26. To study the taming effect of chlorpromazine.
27. To study the anticonvulsant property of drugs by using MES and PTZ rat models.
28. To study the effect of drugs on pesticide toxicity using rats as model.
29. To study the effect of drugs on heavy metal toxicity.

Note: Conduct minimum15 practicals to ensure the expected outcome.

Scheme for Practical Examination:

	Sessional	**Annual**
Synopsis	05	15
Major Experiment	10	25
Minor Experiment	05	15
Viva	10	15
Max Marks	**30**	**70**
Duration	**03hrs**	**04hrs**

***

2.5 T COMMUNITY PHARMACY (THEORY)

Theory: 2 Hrs. /Week

1. **Scope**: In the changing scenario of pharmacy practice in India, Community Pharmacists are expected to offer various pharmaceutical care services. In order to meet this demand, students will be learning various skills such as dispensing of drugs, responding to minor ailments by providing suitable, safe medication, patient counselling, health screening services for improved patient care in the community setup.

2. **Objectives:** Upon completion of the course, the student shall be able to–

a. know pharmaceutical care services.
b. know the business and professional practice management skills in community pharmacies.
c. do patient counselling & provide health screening services to the public in community pharmacy.
d. respond to minor ailments and provide appropriate medication.
e. show empathy and sympathy to patients; and
f. appreciate the concept of Rational drug therapy.

Textbooks:

a. Health Education and Community Pharmacy by N.S.Parmar.
b. WHO consultative group report.
c. Drug store & Business management by Mohammed Ali & Jyoti.

Reference books:

a. Handbook of pharmacy – health care.Edt. Robin J Harman. The Pharmaceutical press.
b. Comprehensive Pharmacy Review – Edt. Leon Shargel. Lippincott Williams & Wilkins.

Special requirements:

1. Either the college has a model community pharmacy (meeting the schedule N requirement) or sign MoU with at least 4-5 community pharmacies nearby to the college for training the students on dispensing and counselling activities.
2. Special equipment like B.P apparatus, Glucometer, Peak flow meter, and apparatus for cholesterol estimation.

3. Scheme of evaluation (80 Marks)

1. Synopsis 10
2. Major Experiment 30

(Counselling of patients with specific diseases – emphasis should be given on Counselling introduction, content, process, and conclusion)

3. Minor Experiment (Ability to measure B.P/ CBG / Lung function) 15
4. Prescription Analysis (Analyzing the prescriptions for probable drug interaction and ability to tell the management) 15
5. Viva – Voce 10

Unit No.	Lecture-wise programme: Topics	Hrs.
1	**Definition, scope, of community pharmacy** **Roles and Responsibilities of Community pharmacist**	4
2	**Community Pharmacy Management** a) Selection of site, Space layout, and design b) Staff, Materials- coding, stocking c) Legal requirements d) Maintenance of various registers e) Use of Computers: Business and healthcare software	6
3	**Prescription**parts of prescription, legality & identification of medication-related problems like drug interactions	2
4	**Inventory control in community pharmacy** Definition, various methods of Inventory Control ABC, VED, EOQ, Lead time, safety stock	4
5	**Pharmaceutical care**Definition and Principles of Pharmaceutical care.	6
6	**Patient counselling**Definition, outcomes, various stages, barriers, Strategies to overcome barriers Patient information leaflets- content, design, & layouts, advisory labels	4
7	**Patient medication adherence**Definition, Factors affecting medication adherence, role of pharmacist in improving the adherence.	2
8	**Health Screening Services**Definition, importance, methods for screening Blood pressure/ blood sugar/ lung function and Cholesterol testing	8
9	**OTC Medication** Definition, OTC medication list & Counselling	6
10	**Health Education** WHO Definition of health, and health promotion, care for children, pregnant & breast-feeding women, and geriatric patients. Commonly occurring Communicable Diseases, causative agents, Clinical presentations and prevention of communicable diseases – Tuberculosis, Hepatitis, Typhoid, Amoebiasis, Malaria, Leprosy, Syphilis, Gonorrhea and AIDS Balance diet, and treatment & prevention of deficiency disorders Family planning – role of pharmacist	6
11	**Responding to symptoms of minor ailments** Relevant pathophysiology, common drug therapy for pain, GI disturbances (Nausea, Vomiting, Dyspepsia, diarrhea, constipation), Pyrexia, Ophthalmic Symptoms, worm infestations	4
12	**Essential Drugs concept and Rational Drug Therapy** Role of the community pharmacist	4
13	**Code of ethics for community pharmacists**	4

2.6 T PHARMACOTHERAPEUTICS - I (THEORY)

Theory: 3 Hrs. /Week

1. **Scope of the Subject:** This course is designed to impart knowledge and skills necessary for contribution to the quality use of medicines. Chapters deal with pathophysiology and mostly the therapeutics of various diseases. This will enable the student to understand the pathophysiology of common diseases and their management.

2. **Objectives:** At completion of this subject, it is expected that students will be able to understand –

a. The pathophysiology of selected disease states and the rationale for drug therapy.
b. The therapeutic approach to management of these diseases.
c. The controversies in drug therapy.
d. The importance of preparation of individualized therapeutic plans based on diagnosis.
e. Needs to identify the patient-specific parameters relevant in initiating drug therapy, and monitoring therapy (including alternatives, time-course of clinical and laboratory indices of therapeutic response and adverse effects);
f. Describe the pathophysiology of selected disease states and explain the rationale for drug therapy.
g. Summaries of the therapeutic approach to management of these diseases including reference to the latest available evidence.
h. Discuss the controversies in drug therapy.
i. Discuss the preparation of individualized therapeutic plans based on diagnosis; and
j. Identify the patient-specific parameters relevant in initiating drug therapy, and monitoring therapy (including alternatives, time-course of clinical and laboratory indices of therapeutic response and adverse effects).

Text Books

a. Clinical Pharmacy and Therapeutics - Roger and Walker, Churchill Livingstone publication.
b. Pharmacotherapy: A Pathophysiologic approach - Joseph T. Dipiro et al. Appleton & Lange.

Reference Books

a. Pathological basis of disease - Robins SL, W.B.Saunders publication.
b. Pathology and therapeutics for Pharmacists: A Basis for Clinical Pharmacy Practice - Green and Harris, Chapman and Hall publication.
c. Clinical Pharmacy and Therapeutics - Eric T. Herfindal, Williams and Wilkins Publication.
d. Applied Therapeutics: The clinical Use of Drugs. Lloyd Young and Koda-Kimble MA
e. Avery's Drug Treatment, 4th Edn, 1997, Adis International Limited.
f. Relevant review articles from recent medical and pharmaceutical literature.
g. All National and Global Standard Treatment Guidelines as applicable

Unit No.	Lecture-wise programme: Topics	Hrs
1	**Introduction to Rational Drug Use:** a. Definition and overview b. Essential Medicine concept c. Standard Treatment Guidelines d. Rational drug formulations e. Role of Pharmacist	2
2	**General Prescribing guidelines for** a. Paediatric patients b. Geriatric patients c. Pregnancy and Breast feeding	6
3	**Cardiovascular system:** a. Hypertension b. Congestive cardiac failure c. Angina Pectoris d. Myocardial infarction e. Hyperlipidaemias f. Electrophysiology of Heart g. Arrhythmias	36
4	**Endocrine system:** a. Diabetes b. Thyroid diseases c. Oral contraceptives d. Hormone replacement therapy e. Osteoporosis	24
5	**Respiratory system:** a. Introduction to Pulmonary function test b. Asthma c. Chronic Obstructive airways disease d. Drug induced pulmonary diseases	14
6	**Ophthalmology:** a. Glaucoma b. Conjunctivitis- Viral & Bacterial	8

2.6 P PHARMACOTHERAPEUTICS - I (PRACTICAL)

Practical:3 Hrs./week

Practicals:

Hospital postings in various departments designed to complement the lectures by providing practical clinical discussion, attending ward rounds; follow up the progress and changes made in drug therapy in allotted patients; case presentation upon discharge. Students are required to maintain a record of cases presented; this record should be submitted at the end of the course for evaluation. A minimum of 20 cases should be presented and recorded, covering the most common diseases.

Assignments:

Students are required to submit written assignments on the topics given to them. Topics allotted should cover recent developments in the drug therapy of various diseases. A minimum of THREE assignments [1500 – 2000 words] should be submitted for evaluation.

Format of the assignment:

1. Minimum & Maximum number of pages.
2. Reference(s) shall be included at the end.
3. Assignment can be a combined presentation at the end of the academic year.
4. It shall be a computer draft copy.
5. Name and signature of the student.
6. Time allocated for presentation may be 8+2 Min.

Scheme for Practical Examination:

	Sessional	**Annual**
Synopsis	05	15
Major Experiment	10	25
Minor Experiment	03	15
Viva	02	15
Max Marks	**20**	**70**
Duration	**03 hrs.**	**04 hrs.**

Note: Total sessional marks are 30 (20 for practical sessional plus 10 marks for regularity, promptness, viva-voce and record maintenance).

APPENDIX-B

(See regulation 9)

CONDITIONS TO BE FULFILLED BY THE ACADEMIC TRAINING INSTITUTION

1) Any authority or institution in India applying to the Pharmacy Council of India for approval of courses of study for Pharm.D. and Pharm.D. (Post Baccalaureate) under sub-section (1) of section 12 of the Pharmacy Act, 1948 shall comply with the infrastructural facilities as prescribed by the Pharmacy Council of India from time to time.

2) Pharm.D. and Pharm.D. (Post Baccalaureate) programmes shall be conducted only in those institutions which -

a) Are approved by the Pharmacy Council of India for B. Pharm course as provided under section 12 of the Pharmacy Act, 1948;

b) Have 300 bedded hospital attached to it.

(i) Hospital Details

1. Institution with their own hospital of minimum 300 beds.
2. Teaching hospital recognised by the Medical Council of India or University, or a Government hospital not below the level of district headquarter hospital with 300 beds with clearly defined Memorandum of Understanding including housing pharmacy practice department with minimum carpet area of 30 square feet per student along with consent to provide the professional manpower to support the programme.
3. Corporate type hospital with minimum 300 beds with clearly defined Memorandum of Understanding including housing pharmacy practice department with minimum carpet area of 30 square feet per student along with consent to provide the professional manpower to support the programme.
4. Number of institutions which can be attached to one hospital shall be restricted by the student pharmacist to bed ratio of 1:10.

(ii)Speciality

a) Tertiary care hospitals are desirable

b) Surgery 2. Pediatrics

c) 3. Gynecology and obstetrics 4. Psychiatry

d) 5. Skin and VD 6. Orthopedics

e) 7. **Cardiology** **8. Nephrology**

f) **9. Respiratory medicine**

(iii) Location of the Hospital - Within the same limits of Corporation or Municipality or Campus with Medical Faculty involvement as adjunct faculty.

3) TEACHING STAFF REQUIREMENT

i) Staff Pattern: All faculty shall be fulltime. However part time preceptors in hospital shall be allowed.

ii) Subject wise specialization of the Teaching Staff:

Sr. No.	Subject	Specialisation required
1.	Pharmacy Practice	M. Pharm in Pharmacy Practice or Pharmacology or Pharmaceutics or Pharm. D
2.	Human Anatomy & Physiology	M. Pharm in Pharmacology or Pharmacy Practice or Pharm. D
3.	Pharmaceutics (Dispensing & General Pharmacy)	M. Pharm in Pharmaceutics or Pharm. D
4.	Pharmacognosy-I	M. Pharm in Pharmacognosy or Pharm. D
5.	Pharmaceutical Organic Chemistry-I	M. Pharm in Pharmaceutical chemistry or Pharmaceutical Analysis or Quality assurance or Bulk Drug or Pharm. D
6.	Pharmaceutical Inorganic Chemistry	M. Pharm in Pharmaceutical chemistry or Pharmaceutical Analysis or Quality assurance or Bulk Drug or Pharm. D
7.	Pharmaceutical microbiology	M. Pharm in Pharmaceutics or Pharmaceutical Biotechnology or Pharm. D
8.	Pathophysiology	M. Pharm Pharmacy practice or Pharmacology or Pharm. D
9.	Applied Biochemistry & Clinical Chemistry	M. Pharm in Pharmacology or Pharmacy practice or Pharmaceutical chemistry or Pharm. D
10.	Pharmacology-I	M. Pharm in Pharmacology or Pharmacy Practice or Pharm. D
11.	Pharmaceutical Jurisprudence	M. Pharm in Pharmaceutics or Pharm. D
12.	Pharmacology-II	M. Pharm in Pharmacology or Pharmacy Practice or Pharm. D
13.	Pharmaceutical Dosage Forms	M. Pharm in Pharmaceutics or Industrial Pharmacy or Pharm. D
14.	Pharmacotherapeutics–I, II and III	M. Pharm Pharmacy practice or Pharmacology or Pharm. D
15.	Community Pharmacy	M. Pharm in Pharmacy practice or Pharmacology or Pharmaceutics or Pharm. D
16.	Hospital Pharmacy	M. Pharm in Pharmacy practice or Pharmacology or Pharmaceutics or Pharm. D
17.	Clinical Pharmacy	M. Pharm in Pharmacy practice or Pharm. D
18.	Computer Science or Computer Application in pharmacy	MCA
19.	Mathematics	M.Sc.(Maths)

iii)**Teaching Staff:**

Department/Division	Name of the post	No.
Department of Pharmaceutics	Professor	1
	Asst. Professor	1
	Lecturer	2
Department of Pharmaceutical Chemistry (Including Pharmaceutical Analysis)	Professor	1
	Asst. Professor	1
	Lecturer	3
Department of Pharmacology	Professor	1
	Asst. Professor	1
	Lecturer	2
Department of Pharmacognosy	Professor	1
	Asst. Professor	1
	Lecturer	1
Department of Pharmacy Practice	Professor	1
	Asst. Professor	2
	Lecturer	3

iv) Prescribed qualifications and experience for Professor, Assistant Professor, Lecturer and others:

Sl. No.	CADRE	QUALIFICATIONS	EXPERIENCE
1.	Lecturer	i. Basic degree in pharmacy (B. Pharm). ii. Registration as a pharmacist under the Pharmacy Act. iii. First Class Master's degree in appropriate branch of iv. specialization in Pharmacy (M. Pharm)	No minimum requirement.
2.	Assistant Professor	i) Basic degree in pharmacy (B. Pharm). ii) Registration as a Pharmacist under the Pharmacy Act. iii) Master's degree in appropriate branch of specialization in Pharmacy (M. Pharm)	Three years experience in Teaching or Research at the level of Lecturer or equivalent.
		iv) Ph.D. degree (with First Class degree either at Bachelor's or Master's level) in the appropriate branch of specialization in Pharmacy.	
3.	Professor	i) Basic degree in Pharmacy (B. Pharm).	i)Ten years experience in Teaching or Research.

		ii) Registration as a pharmacist under the Pharmacy Act.	ii) Out of which five years must be as Assistant Professor.
		iii) Master's degree in appropriate branch of specialization in Pharmacy (M. Pharm).	
		iv) Ph.D. degree (with first Class either at Bachelor's or Master's level) in appropriate branch of specialization in Pharmacy.	
4.	Director or Principal or Head of institute	i) Basic degree in pharmacy (B. Pharm) ii) Registration as a pharmacist under the Pharmacy Act. iii) Master's degree in appropriate branch of specialization in Pharmacy (M. Pharm) iv) Ph. D. degree (with first Class degree either at Bachelor's or Master's level in the appropriate branch of specialization in Pharmacy.	i) Fifteen years experience in Teaching or Research. ii) Out of which five years must be as Professor or above in Pharmacy. Desirable: Administrative experience in responsible position. The maximum age for holding the post shall be 65 years.

Note: If a class or division is not awarded at Master's level, a minimum of 60%marks in aggregate or equivalent cumulative grade point average shall be considered equivalent to first class or division, as the case may be.

v) Workload of Faculty:

Professor - 8 hrs. per week

Assistant Professor - 12 hrs. per week

Lecturers -16 hrs. per week

vi) Training of Pharmacy Practice Faculty:

a) Teaching staff will be trained as per the module prescribed by the Central Council.
b) Duration of training – Minimum 3 months.
c) Training sites – Institutions running pharmacy practice or Programmes for at least five years.
d) Trainer - Professor or Assistant Professor with minimum of five years of clinical pharmacy teaching and practice experience.

4) NON-TEACHING STAFF:

Sr. No.	**Designation**	**Required (Minimum)**	**Required Qualification**
1	Laboratory Technician	1 for each Dept	D. Pharm
2	Laboratory Assistants or Laboratory Attenders	1 for each Lab (minimum)	SSLC
3	Office Superintendent	1	Degree
4	Accountant	1	Degree

5 1)	Storekeeper	1	D. Pharm or a Bachelor degree recognized by a University or institution.
6	Computer Data Operator	1	BCA or Graduate With Computer Course
7	Office Staff I	1	Degree
8	Office Staff II	2	Degree
9	Peon	2	SSLC
10	Cleaning personnel	Adequate	---
11	Gardener	Adequate	---

5) ACCOMMODATION:

Suitable and sufficient accommodation with adequate ventilation, lighting and other hygienic conditions should be provided to the rooms for Principal or the Head of the department, office, class rooms, library, staff, staff common room, students common room, museum, laboratories, stores, etc.

At least two lecture halls along with eight laboratories as specified below should be provided for:

1.Pharmaceutics and Pharmacokinetics Lab -2
2.Life Science (Pharmacology, Physiology, Pathophysiology) -2
3.Phytochemistry or Pharmaceutical Chemistry -2
4.Pharmacy Practice -2

Total= 8

In addition to the laboratories, balance room, aseptic room or cabinet, animal house and a machine room shall also be provided.

Floor area of the laboratory should not be less than 30 square feet per student required to work in the laboratory at any given time subject to a minimum of 750 square feet.

Laboratories should be fitted and constructed in a manner that these can be kept reasonably clean. Gas and water fittings, shelves, fuming cupboards be provided wherever necessary.

6. EQUIPMENT AND APPARATUS:

Department wise list of minimum equipments

A. DEPARTMENT OF PHARMACOLOGY:

I. Equipment:

S. No.	Name	Minimum required Nos.
1	Microscopes	15
2	Haemocytometer with Micropipettes	20
3	Sahli's haemocytometer	20
4	Hutchinson's spirometer	01

5	Spygmomanometer	05
6	Stethoscope	05
7	Permanent Slides for various tissues	One pair of each tissue Organs and endocrine glands One slide of each organ system
8	Models for various organs	One model of each organ system
9	Specimen for various organs and systems	One model for each organ system
10	Skeleton and bones	One set of skeleton and one spare bone
11	Different Contraceptive Devices and Models	One set of each device
12	Muscle electrodes	01
13	Lucas moist chamber	01
14	Myographic lever	01
15	Stimulator	01
16	Centrifuge	01
17	Digital Balance	01
18	Physical/ Chemical Balance	01
19	Sherrington's Kymograph Machine or Polyrite	10
20	Sherrington Drum	10
21	Perspex bath assembly (single unit)	10
22	Aerators	10
23	Computer with LCD	01
24	Software packages for experiment	01
25	Standard graphs of various drugs	Adequate number
26	Actophotometer	01
27	Rotarod	01
28	Pole climbing apparatus	01

29	Analgesiometer (Eddy's hot plate and Radiant heat methods)	01
30	Convulsiometer	01
31	Plethysmograph	01
32	DigitalpH meter	01

II. Apparatus:

S. No	Name	Minimum required Nos.
1	Folin-Wu tubes	60
2	Dissection Tray and Boards	10
3	Haemostatic artery forceps	10
4	Hypodermic syringes and needles of size 15,24,26G	10
5	Levers, cannulae	20

NOTE: Adequate number of glassware commonly used in the laboratory should be provided in each laboratory and department.

B. DEPARTMENT OF PHARMACOGNOSY:

I. Equipment:

Sr. No.	Name	Minimum required Nos.
1	Microscope with stage micrometer	15
2	Digital Balance	02
3	Autoclave	02
4	Hot air oven	02
5	B.O.D. incubator	01
6	Refrigerator	01
7	Laminar air flow	01
8	Colony counter	02
9	Zone reader	01
10	Digital pH meter	01
11	Sterility test in gunit	01
12	Camera Lucida	15
13	Eye piece micrometer	15
14	Incinerator	01
15	Moisture balance	01
16	Heating mantle	15
17	Flourimeter	01
18	Vacuum pump	02
19	Micro pipettes (Single and multi channeled)	02
20	Micro Centrifuge	01
21	Projection Microscope	01

II. Apparatus:

S. No	Name	Minimum required Nos.
1	Reflux flask with condenser	20
2	Water bath	20
3	Clavengers apparatus	10
4	Soxhlet apparatus	10
6	TLC chamber and sprayer	10
7	Distillation unit	01

NOTE: Adequate number of glassware commonly used in the laboratory should be provided in each laboratory and department.

C. DEPARTMENT OF PHARMACEUTICAL CHEMISTRY:

I. Equipment:

S. No.	Name	Minimum required Nos.
1	Hot plates	05
2	Oven	03
3	Refrigerator	01
4	Analytical Balances for demonstration	05
5	Digital balance 10mg sensitivity	10
6	Digital Balance (1mg sensitivity)	01
7	Suction pumps	06
8	Muffle Furnace	01
9	Mechanical Stirrers	10
10	Magnetic Stirrers with Thermostat	10
11	Vacuum Pump	01
12	Digital pH meter	01
13	Microwave Oven	02

II. Apparatus:

S.No.	Name	Minimum required Nos.
1	Distillation Unit	02
2	Reflux flask and condenser single necked	20
3	Reflux flask and condenser double/ Triple necked	20
4	Burettes	40
5	Arsenic Limit Test Apparatus	20
6	Nesslers Cylinders	40

NOTE: Adequate number of glassware commonly used in the laboratory should be provided in each laboratory and department.

D. DEPARTMENT OF PHARMACEUTICS:

I. Equipment:

S.No	Name	Minimum requiredNos.
1	Mechanical stirrers	10
2	Homogenizer	05
3	Digital balance	05
4	Microscopes	05
5	Stage and eye piece micrometers	05
6	Brookfield's viscometer	01
7	Tray dryer	01
8	Ball mill	01
9	Sieve shaker with sieve set	01
10	Double cone blender	01
11	Propeller type mechanical agitator	05
12	Autoclave	01
13	Steam distillation still	01
14	Vacuum Pump	01
15	Standard sieves, sieve no. 8, 10, 12,22,24, 44, 66, 80	10 sets
16	Tablet punching machine	01
17	Capsule filling machine	01
18	Ampoule washing machine	01
19	Ampoule filling and sealing machine	01
20	Tablet disintegration test apparatus IP	01
21	Tablet dissolution test apparatus IP	01
22	Monsanto's hardness tester	01
23	Pfizer type hardness tester	01
24	Friability test apparatus	01
25	Clarity test apparatus	01
26	Ointment filling machine	01
27	Collapsible tube crimping machine	01
28	Tablet coating pan	01
29	Magnetic stirrer, 500ml and 1liter Capacity with speed control	05 EACH 10
30	Digital pH meter	01
31	All purpose equipment with all accessories	01
32	Aseptic Cabinet	01
33	BOD Incubator	02
34	Bottle washing Machine	01
35	Bottle Sealing Machine	01
36	Bulk Density Apparatus	02
37	Conical Percolator (glass/copper/ stainless steel)	10

38	Capsule Counter	02
39	Energy meter	02
40	Hot Plate	02
41	Humidity Control Oven	01
42	Liquid Filling Machine	01
43	Mechanical stirrer with speed regulator	02
44	Precision Melting point Apparatus	01
45	Distillation Unit	01

II. Apparatus:

S.No	Name	Minimum required Nos.
1	Ostwald's viscometer	15
2	Stalagmometer	15
3	Desiccator*	05
4	Suppository moulds	20
5	Buchner Funnels (Small,medium, large)	05each
6	Filtration assembly	01
7	Permeability Cups	05
8	Andreason's Pipette	03
9	Lipstick moulds	10

NOTE: Adequate number of glassware commonly used in the laboratory should be provided in each laboratory and department.

E. DEPARTMENT OF PHARMACEUTICAL BIOTECHNOLOGY:

S. No.	Name	Minimum required Nos.
1	Orbital shaker incubator	01
2	Lyophilizer (Desirable)	01
3	Gel Electrophoresis (Vertical and Horizontal)	01
4	Phase contrast / Trinocular Microscope	01
5	Refrigerated Centrifuge	01
6	Fermenters of different capacity (Desirable)	01
7	Tissue culture station	01
8	Laminar air flow unit	01
9	Diagnostic kits to identify infectious agents	01
10	Rheometer	01
11	Viscometer	01
12	Micropipettes (single and multi channeled)	01each
13	Sonicator	01
14	Respinometer	01

15	BOD Incubator	01
16	Paper Electrophoresis Unit	01
17	Micro Centrifuge	01
18	Incubator water bath	01
19	Autoclave	01
20	Refrigerator	01
21	Filtration Assembly	01
22	Digital pH meter	01

NOTE: Adequate number of glassware commonly used in the laboratory should be provided in each laboratory and department.

F. DEPARTMENT OF PHARMACY PRACTICE:

i. Equipment:

S.No	Name	Minimum required Nos.
1	Colorimeter	2
2	Microscope	Adequate
3	Permanent slides (skin, kidney, pancreas, smooth muscle, liver etc.,)	Adequate
4	Watch glass	Adequate
5	Centrifuge	1
6	Biochemical reagents for analysis of Normal and pathological constituents in urine and blood facilities	Adequate
7	Filtration equipment	2
8	Filling Machine	1
9	Sealing Machine	1
10	Autoclave sterilizer	1
11	Membrane filter	1Unit
12	Sintered glass funnel with complete filtering assemble	Adequate
13	Small disposable membrane filter for IV admixture filtration	Adequate
14	Laminar air flow bench	1
15	Vacuum pump	1
16	Oven	1
17	Surgical dressing	Adequate
18	Incubator	1
19	PH meter	1
20	Disintegration test apparatus	1
21	Hardness tester	1
22	Centrifuge	1
23	Magnetic stirrer	1
24	Thermostatic bath	1

NOTE:

1. Computers and Internet connection (Broad band), six computers for students with internet and staff

computers as required.

2. Adequate number of glassware commonly used in the laboratory should be provided in each laboratory and the department.

G. CENTRAL INSTRUMENTATION ROOM:

S.No.	Name	Minimum required Nos.
1	Colorimeter	01
2	Digital pH meter	01
3	UV-Visible Spectrophotometer	01
4	Flourimeter	01
5	Digital Balance (1mgsensitivity)	01
6	Nephelo Turbidity meter	01
7	Flame Photometer	01
8	Potentiometer	01
9	Conductivity meter	01
10	Fourier Transform Infra Red Spectrometer (Desirable)	01
11	HPLC	01
12	HPTLC (Desirable)	01
13	Atomic Absorption and Emission spectrophotometer (Desirable)	01
14	Biochemistry Analyzer (Desirable)	01
15	Carbon, Hydrogen, Nitrogen Analyzer (Desirable)	01
16	Deep Freezer (Desirable)	01
17	Ion-Exchanger	01
18	Lyophilizer (Desirable)	01

APPENDIX - D

(See regulation 17)

CONDITIONS TO BE FULFILLED BY THE EXAMINING AUTHORITY

1. The Examining Authority shall be a statutory Indian University constituted by the Central Government/State Government/Union Territory Administration. It shall ensure that discipline and decorum of the examinations are strictly observed at the examination centers.

2. It shall permit the Inspector or Inspectors of the Pharmacy Council of India to visit and inspect the examinations.

3. It shall provide:-

(a) Adequate rooms with necessary furniture for holding written examinations;
(b) well-equipped laboratories for holding practical examinations;
(c) an adequate number of qualified and responsible examiners and staff to conduct and invigilate the examinations; and
(d) Such other facilities as may be necessary for efficient and proper conduct of examinations.

4. It shall, if so required by a candidate, furnish the statement of marks secured by a candidate in the examinations after payment of prescribed fee, if any, to the Examining Authority.

5. It shall appoint examiners whose qualifications should be similar to those of the teachers in the respective subjects as shown in Appendix–B.

6. In pursuance of sub–section (3) of section 12 of the Pharmacy Act, 1948, the Examining Authority shall communicate to the Secretary, Pharmacy Council of India, not less than six weeks in advance the dates fixed for examinations, the time-table for such examinations, so as to enable the Council to arrange for inspection of the examinations.

7. The Examining Authority shall ensure that examiners for conducting examination for Pharm. D. and Pharm. D. (Post Baccalaureate) programmes shall be persons possessing pharmacy qualification and are actually involved in the teaching of the Pharm. D. and Pharm. D. (Post Baccalaureate) programmes in an approved institution.