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इस भाग में भिन्न पृष्ठ संख्या दी जाती है जिससे कि यह अलग संकलन के रूप में रखा जा सके।

(Separate paging is given to this Part in order that it may be filed as a separate compilation)

भाग III—खण्ड 4

[PART III—SECTION 4]

[सांविधिक निकायों द्वारा जारी की गई विविध अधिसूचनाएं जिसमें कि आदेश, विज्ञापन और सूचनाएं सम्मिलित हैं]

[Miscellaneous Notifications including Notifications, Orders, Advertisements and Notices issued by Statutory Bodies]

भारतीय रिज़र्व बैंक

मुंबई-400001, दिनांक 9 अप्रैल 2008

सदर्भ : बैंपविवि. सं. आईबीडी.-14241/23.13.048/2007-08--भारतीय रिज़र्व बैंक अधिनियम, 1934 (1934 का 2) की धारा 42 की उप-धारा (6) के खण्ड (ग) के अनुसरण में भारतीय रिज़र्व बैंक इसके द्वारा निदेश देता है कि उक्त अधिनियम की दूसरी अनुसूची में निम्नलिखित परिवर्तन किये जाएं :--

''अरब बांगलादेश बैंक लिमिटेड'' शब्दों के स्थान पर ''एबी बैंक लिमिटेड'' शब्द होंगे।

आनन्द सिन्हा

कार्यपालक निदेशक

[PUBLISHED IN THE GAZETTE OF INDIA, No.19, PART III, SECTION 4]

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

New Delhi, 10th May, 2008.

Pharm.D. Regulations 2008

Regulations framed under section 10 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 II – 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 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 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 programmes 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 :

S.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

Second Year:

S.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	-	1
2.5	Community Pharmacy	2	-	1
2.6	Pharmacotherapeutics-I	3	3	1
	Total Hours	**17**	**9**	**6 = 32**

Third Year:

S.No.	Name of Subject	No. of hours of Theory	No. of hours of Practical	No. of hours of Tutorial
(1)	**(2)**	**(3)**	**(4)**	**(5)**
3.1	Pharmacology-II	3	3	1
3.2	Pharmaceutical Analysis	3	3	1
3.3	Pharmacotherapeutics-II	3	3	1
3.4	Pharmaceutical Jurisprudence	2	-	-
3.5	Medicinal Chemistry	3	3	1
3.6	Pharmaceutical Formulations	2	3	1
	Total hours	**16**	**15**	**5 = 36**

Fourth Year:

S.No.	Name of Subject	No. of hours of Theory	No. of hours of Practical/ Hospital Posting	No. of hours of Tutorial
(1)	(2)	(3)	(4)	(5)
4.1	Pharmacotherapeutics-III	3	3	1
4.2	Hospital Pharmacy	2	3	1
4.3	Clinical Pharmacy	3	3	1
4.4	Biostatistics & Research Methodology	2	-	1
4.5	Biopharmaceutics & Pharmacokinetics	3	3	1
4.6	Clinical Toxicology	2	-	1
	Total hours	**15**	**12**	**6 = 33**

Fifth Year:

S.No.	Name of Subject	No. of hours of Theory	No. of hours of Hospital posting*	No. of hours of Seminar
(1)	(2)	(3)	(4)	(5)
5.1	Clinical Research	3	-	1
5.2	Pharmacoepidemiology and Pharmacoeconomics	3	-	1
5.3	Clinical Pharmacokinetics & Pharmacotherapeutic Drug Monitoring	2	-	1
5.4	Clerkship *	-	-	1
5.5	Project work (Six Months)	-	20	-
	Total hours	**8**	**20**	**4 = 32**

***** Attending ward rounds on daily basis.

Sixth Year:

Internship or residency training including postings in speciality units. Student should independently provide the clinical pharmacy services to the allotted wards.

(i) Six months in General Medicine department, and
(ii) Two months each in three other speciality departments

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 for the purpose of obtaining 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:

Provided that the Pharmacy Council of India shall not approve any institution under these regulations unless it provides adequate arrangements for teaching in regard to building, accommodation, labs., equipments, 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 Practicals		
		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.

Second Year examination :

S.No.	Name of Subject	Maximum marks for Theory			Maximum marks for Practicals		
		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	-	-	-
2.5	Community Pharmacy	70	30	100	-	-	-
2.6	Pharmacotherapeutics-I	70	30	100	70	30	100
				600			300 = 900

Third Year examination :

S.No.	Name of Subject	Maximum marks for Theory			Maximum marks for Practicals		
		Examination	Sessional	Total	Examination	Sessional	Total
3.1	Pharmacology-II	70	30	100	70	30	100
3.2	Pharmaceutical Analysis	70	30	100	70	30	100
3.3	Pharmacotherapeutics-II	70	30	100	70	30	100
3.4	Pharmaceutical Jurisprudence	70	30	100	-	-	-
3.5	Medicinal Chemistry	70	30	100	70	30	100
3.6	Pharmaceutical Formulations	70	30	100	70	30	100
				600			500 = 1100

Fourth Year examination :

S.No.	Name of Subject	Maximum marks for Theory			Maximum marks for Practicals		
		Examination	Sessional	Total	Examination	Sessional	Total
4.1	Pharmacotherapeutics-III	70	30	100	70	30	100
4.2	Hospital Pharmacy	70	30	100	70	30	100
4.3	Clinical Pharmacy	70	30	100	70	30	100
4.4	Biostatistics & Research Methodology	70	30	100	-	-	-
4.5	Biopharmaceutics & Pharmacokinetics	70	30	100	70	30	100
4.6	Clinical Toxicology	70	30	100	-	-	-
				600			400 = 1000

Fifth Year examination :

S.No.	Name of Subject	Maximum marks for Theory			Maximum marks for Practicals		
		Examination	Sessional	Total	Examination	Sessional	Total
5.1	Clinical Research	70	30	100	-	-	-
5.2	Pharmacoepidemiology and Pharmacoeconomics	70	30	100	-	-	-
5.3	Clinical Pharmacokinetics & Pharmacotherapeutic Drug Monitoring	70	30	100	-	-	-
5.4	Clerkship *	-	-	-	70	30	100
5.5	Project work (Six Months)	-	-	-	100**	-	100
				300			200 = 500

***** Attending ward rounds on daily basis.

****** 30 marks – viva-voce (oral)
70 marks – Thesis work

11. Eligibility for appearing Examination.— Only such students who produce 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 examination.

12. Mode of examinations.— (1) Theory examination shall be of three hours and practical examination shall be of four hours duration.

    (2) A Student who fails in theory or practical examination of a subject shall re-appear both in theory and practical of the same subject.

    (3) Practical examination shall also consist of a viva –voce (Oral) examination.

    (4) 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 shall be allotted on the following basis:-

        (i) Actual performance in the sessional examination (20 marks);
        (ii) Day to day assessment in the practical class work, promptness, viva-voce record maintenance, etc. (10 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 least 50% 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.

15. Eligibility for promotion to next year.— All students who have appeared for all the subjects and passed the first year annual examination are eligible for promotion to the second year and, so on. However, failure in more than two subjects shall debar him or her from promotion to the next year classes.

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 hereinafter 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.

CHAPTER-III
Practical training

19. Hospital posting.— Every student shall be posted in constituent hospital for a period of not less than fifty hours to be covered in not less than 200 working days in each of second, third & fourth year course. Each student shall submit report duly certified by the preceptor and duly attested by the Head of the Department or Institution as prescribed. In the fifth year, every student shall spend half a day in the morning hours attending ward rounds on daily basis as a part of clerkship. Theory teaching may be scheduled in the afternoon.

20. Project work.— (1) To allow the student to develop data collection and reporting skills in the area of community, hospital and clinical pharmacy, a project work shall be carried out under the supervision of a teacher. The project topic must be approved by the Head of the Department or Head of the Institution. The same shall be announced to students within one month of commencement of the fifth year classes. Project work shall be presented in a written report and as a seminar at the end of the year. External and the internal examiners shall do the assessment of the project work.

    (2) Project work shall comprise of objectives of the work, methodology, results, discussions and conclusions.

21. Objectives of project work.— The main objectives of the project work is to—

    (i) show the evidence of having made accurate description of published work of others and of having recorded the findings in an impartial manner; and

    (ii) develop the students in data collection, analysis and reporting and interpretation skills.

22. Methodology.— To complete the project work following methodology shall be adopted, namely:—

    (i) students shall work in groups of not less than *two* and not more than *four* under an authorised teacher;

    (ii) project topic shall be approved by the Head of the Department or Head of the Institution;

    (iii) project work chosen shall be related to the pharmacy practice in community, hospital and clinical setup. It shall be patient and treatment (Medicine) oriented, like drug utilisation reviews, pharmacoepidemiology, pharmacovigilance or pharmacoeconomics;

    (iv) project work shall be approved by the institutional ethics committee;

    (v) student shall present at least three seminars, one in the beginning, one at middle and one at the end of the project work; and

    (vi) two-page write-up of the project indicating title, objectives, methodology anticipated benefits and references shall be submitted to the Head of the Department or Head of the Institution.

23. Reporting .— (1) Student working on the project shall submit jointly to the Head of the Department or Head of the Institution a project report of about 40-50 pages. Project report should include a certificate issued by the authorised teacher, Head of the Department as well as by the Head of the Institution

(2) Project report shall be computer typed in double space using Times Roman font on A4 paper. The title shall be in bold with font size 18, sub-tiles in bold with font size 14 and the text with font size 12. The cover page of the project report shall contain details about the name of the student and the name of the authorised teacher with font size 14.

(3) Submission of the project report shall be done at least one month prior to the commencement of annual or supplementary examination.

24. Evaluation.— The following methodology shall be adopted for evaluating the project work—

(i) Project work shall be evaluated by internal and external examiners.

(ii) Students shall be evaluated in groups for four hours (i.e., about half an hour for a group of four students).

(iii) Three seminars presented by students shall be evaluated for twenty marks each and the average of best two shall be forwarded to the university with marks of other subjects.

(iv) Evaluation shall be done on the following items:

	Marks
a) Write up of the seminar	(7.5)
b) Presentation of work	(7.5)
c) Communication skills	(7.5)
d) Question and answer skills	(7.5)
Total	(30 marks)

(v) Final evaluation of project work shall be done on the following items:

	Marks
a) Write up of the seminar	(17.5)
b) Presentation of work	(17.5)
c) Communication skills	(17.5)
d) Question and answer skills	(17.5)
Total	(70 marks)

Explanation.— For the purposes of differentiation in the evaluation in case of topic being the same for the group of students, the same shall be done based on item numbers b, c and d mentioned above.

SULTAN-UL-ULOOM COLLEGE OF PHARMACY, HYDERABAD

SUBJECT: 1.1 T HUMAN ANATOMY & PHYSIOLOGY

(THEORY 90 HOURS)

Teaching Scheme
Lectures: 03 Hr/Week

Examination Scheme:
Internal Exam: 30 Marks
External Exam: 70 Marks
Total Marks: 100 Marks

Scope: This course lays the foundation for understanding human body structure and physiological functions essential for pharmacological and therapeutic applications. It emphasizes integration of modern technologies (e.g., bio-printing, wearable sensors, IVF, IUI) with physiological knowledge.

Course Objectives:

- To introduce the structural organization and physiological mechanisms of major human body systems.
- To relate anatomical structures to their physiological roles.
- To provide insight into homeostasis and systemic interrelationships.
- To introduce modern diagnostic and biomedical technologies linked with physiology.

Course Outcomes: Upon completion of the course a learner shall be able to

CO 1. Explain the scope of anatomy and physiology, basic terminologies, cell structure, components and transport mechanisms across cell membranes.

CO 2. Describe the types body tissues and the structure, function and disorders of bones and joints, including applications like artificial bone transplantation and 3D bioprinting.

CO 3. Understand the composition, functions and disorders of blood and lymph, including haemopoiesis, clotting mechanisms and lymphatic circulation.

CO 4. Illustrate the anatomy and physiology of the cardiovascular and respiratory systems, mechanisms of blood circulation, gas exchange, regulation and their clinical implications.

CO 5. Discuss the structure and physiology of the digestive and nervous systems, including neuronal control, reflexes and EEG.

CO 6. Explain the structure and function of the urinary and endocrine systems, emphasizing acid-base balance, hormone regulation and associated endocrine disorders.

CO 7. Summarize the anatomy and physiology of the reproductive and sensory systems, pregnancy and sensory perception, including modern applications like IVF and IUI.

CO 8. Describe muscle structure, contraction, exercise physiology, and adaptations to training and wearable technologies.

COURSE CONTENTS

Unit	Topics	Duration (Hrs)
1	**Scope of anatomy and physiology** Basic terminologies used in this subject (Description of the body as such planes and terminologies). **Structure of cell** Its components and their functions. General principles of cell communication. Transport across the cell membrane.	09
2	**Elementary tissues of the human body** Epithelial, connective, Muscular and nervous tissues-their sub-types and characteristics. Cell junctions and their physiological significance. **a) Osseous system** Structure, composition and functions of the Skeleton. (done in practical classes - 6hrs) **b) Joints** Classification of joints, Types of movements of joints and disorders of joints (Definitions only) Definitions and applications of artificial bone transplantation, 3D Bioprinting.	10
3	**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 **Lymph** a) Lymph and lymphatic system, composition, formation, and circulation. b) Spleen: structure and functions, Disorders c) Disorders of the lymphatic system (definition only).	11
4	**Cardiovascular system** a) Anatomy and functions of heart b) Blood vessels and circulation (Pulmonary, coronary, and systemic circulation) c) Electrocardiogram (ECG) d) Cardiac cycle and heart sounds e) Blood pressure – its maintenance and regulation f) Definition of the following diseases as per the global Guidelines (ESC, AHA, ACC) - Hypertension, Hypotension, Arteriosclerosis, Atherosclerosis, Angina, Myocardial infarction, Congestive heart failure, Cardiac arrhythmias. Definition and applications of Artificial Pace Maker. **Respiratory system** a) Anatomy of respiratory organs and functions b) Mechanism / physiology of respiration and regulation of respiration	12

	c) Transport of respiratory gases d) Respiratory volumes and capacities, and Definition of: Hypoxia, Asphyxia, Dybarism, Oxygen therapy and resuscitation. Importance of Exercise, Yoga and breathing exercises for maintaining respiratory health.	
5	**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) Concept of gut microbiota and Probiotics prebiotics. Applications of Endoscopy and colonoscopy as diagnostic tools. **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 – mono-poly-planter g) Cranial nerves – names and functions h) ANS – Anatomy & functions of sympathetic & parasympathetic N.S. Introduction to EEG	12
6	**Urinary system** a) Anatomy and physiology of urinary system b) Formation of urine c) Renin Angiotensin system – Juxtaglomerular apparatus - acid base Balance d) Clearance tests and micturition Types of Dialysis, its advantages and disadvantages **Endocrine system** a) Pituitary gland b) Adrenal gland c) Thyroid and Parathyroid glands d) Pancreas and gonads Disorders of pituitary gland, adrenal gland, thyroid gland, parathyroid gland, pancreas and gonads.	12
7	**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 Definition and Applications of IVF and IUI.	12

	Sense organs a) Eye b) Ear c) Skin d) Tongue and Nose	
8	**Skeletal muscles** a) Histology b) Physiology of Muscle contraction c) Physiological properties of skeletal muscle and their disorders (definitions) **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 Mechanism of wearable devices to measure muscle activity, its issues.	10

Text Books: (Latest Editions)

- Textbook of Human Anatomy and Physiology — K. Sembulingam & Prema Sembulingam, Jaypee Brothers Medical Publishers, 10th Edition, 2024
- Ross & Wilson Anatomy and Physiology in Health and Illness — Anne Waugh & Allison Grant, Elsevier, 15th Edition, 2024
- Principles of Anatomy and Physiology — Gerard J. Tortora & Bryan H. Derrickson, Wiley, 16th Edition, 2023

Reference Books: (Latest Editions):

- Human Physiology: From Cells to Systems — Lauralee Sherwood, Cengage Learning, 11th Edition, 2024
- Guyton and Hall Textbook of Medical Physiology — John E. Hall, Elsevier, 15th Edition, 2024

SULTAN-UL-ULOOM COLLEGE OF PHARMACY, HYDERABAD

SUBJECT: 1.1 HUMAN ANATOMY & PHYSIOLOGY

(PRACTICAL 90 HOURS)

Teaching Scheme
Practical: 03 hrs / Week

Examination Scheme:
Internal Exam: 20 Marks
External Exam: 70 Marks
Continuous Assessment: 10 Marks
Total Marks: 100 Marks

Scope: The practical course in Human Anatomy and Physiology–I provide hands-on understanding of body structure, functions, blood parameters and organ systems, linking theoretical knowledge with clinical and experimental applications in pharmacy and biomedical sciences.

Course Objectives:

- To provide hands-on experience in studying the structure and function of the human body.
- To develop skills in handling laboratory instruments and preparing biological specimens.
- To perform and analyze experiments related to tissues, blood, organ systems, and muscle physiology.
- To correlate practical findings with theoretical concepts of anatomy and physiology.
- To interpret normal physiological parameters and identify deviations from normal values.
- To enhance observation, analytical, and recording skills through systematic experimentation.
- To build a foundation for understanding diagnostic techniques and clinical applications in physiology.

Course Outcomes: Upon completion of the course a learner shall be able to-

CO 1. Demonstrate the use of the compound microscope and identify various human tissues including epithelial, muscular, connective, and nervous tissues.

CO 2. Describe and operate hematological appliances for blood analysis.

CO 3. Determine WBC, RBC, and differential counts, and interpret Complete Blood Count (CBC) reports.

CO 4. Measure erythrocyte sedimentation rate, hemoglobin content, bleeding time, and clotting time accurately.

CO 5. Assess vital physiological parameters including blood pressure, blood group, and understand blood donation and transfusion guidelines.

CO 6. Explain the structure and function of human organ systems using charts, models, specimens, and perform basic physiological assessments like BMI calculation and reflex testing.

CO 7. Identify and demonstrate the use of reproductive health tools including family planning devices and home pregnancy diagnostic kits.

CO 8. Record and analyze muscle physiology experiments using gastrocnemius-sciatic nerve preparations, studying muscle contraction, summation, fatigue, and effects of temperature and load.

COURSE CONTENTS

Expt. No.	Title of the Experiment	Duration (Hrs)
1.	To study the compound microscope.	03
2.	Study of tissues of human body (a) Epithelial tissue. (b) Muscular tissue.	03
3.	Study of tissues of human body (a) Connective tissue. (b) Nervous tissue.	03
4.	Study of appliances used in hematological experiments.	03
5.	Determination of W.B.C. count of blood. (2 Labs)	06
6.	Determination of R.B.C. count of blood. (2 Labs)	06
7.	Determination of differential count of blood. (2 Labs)	06
8.	To study the CBC report with its significance.	03
9.	Determination of (a) Erythrocyte Sedimentation Rate. (b) Hemoglobin content of Blood. (c) Bleeding time (d) Clotting time.	12
10.	Determination of (a) Blood Pressure. (b) Blood group. Guidelines for Blood donation, blood transfusion, and Blood bank	06
11.	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.	06
12.	Study of various systems with the help of charts, models & specimens (a) Cardiovascular system. Techniques of CPR (b) Respiratory system.	06
13.	Study of various systems with the help of charts, models & specimens (a) Digestive system. To calculate BMI (b) Nervous system. Reflex activity assessment	06
14.	Study of various systems with the help of charts, models & specimens (a) Urinary system. (b) Endocrine System- Pituitary gland, Adrenal gland, Thyroid and Parathyroid glands, Pancreas and gonads	06
15.	Study of various systems with the help of charts, models & specimens (a) Reproductive system. (b) Special senses. Visual acuity testing	06
16.	Study of different family planning methods and devices. Demo on confirmation of pregnancy diagnosis test.	06
17.	Study of appliances used in experimental physiology.	03
18.	To record simple muscle curve using gastrocnemius sciatic nerve preparation.	03

Text Books: (Latest Editions)

1. Singh I. Textbook of human histology. 11th edition. JP Medical Ltd., New Delhi, 2025.
2. Ghai CL. A textbook of practical physiology. 10th edition JP Medical Ltd., New Delhi: 2023.

Reference Books: (Latest Editions)

1. Chatterjee CC. Human physiology. 15th edition. Vol. 1 & 2. CBS Publication, New Delhi, 2025.
2. Tortora GJ, Derrickson BH. Principles of anatomy and physiology. 16th edition. John Wiley & Sons; 2023.
3. Guyton AC, Hall JE. Textbook of Medical Physiology. 14th edition. Elsevier 2020.
4. Standing S, Tubbs SR, editors. *Gray's Anatomy: The Anatomical Basis of Clinical Practice.* 43rd ed. London: Elsevier; 2025.

SULTAN-UL-ULOOM COLLEGE OF PHARMACY, HYDERABAD

SUBJECT: 1.2 PHARMACEUTICS

(THEORY 60 HOURS)

Teaching Scheme
Lectures: 02 Hr/Week

Examination Scheme:
Internal Exam: 30 Marks
External Exam: 70 Marks
Total Marks: 100 Marks

Scope:
This subject provides a foundational understanding of pharmaceutics, emphasizing the formulation and preparation of various dosage forms. It covers prescriptions, pharmaceutical calculations, pharmacopoeias, incompatibilities, and formulation of monophasic, biphasic, solid, and semisolid systems. The course also introduces recent advancements and regulatory aspects essential for professional pharmacy practice.

Course Objectives:
- Explain the classification, principles, and formulation of different pharmaceutical dosage forms.
- Understand the significance of pharmacopoeias and regulatory standards in ensuring product quality.
- Accurately interpret and handle prescriptions, including dose calculations and error identification.
- Perform basic pharmaceutical calculations related to weights, volumes, and solutions.
- Demonstrate knowledge of formulation, packaging, and evaluation of various dosage forms.

Course Outcomes: Upon completion of the course a learner shall be able to-

CO 1. Explain the classification, definitions, and importance of various pharmaceutical dosage forms, prescriptions, and dose calculations.

CO 2. Describe the historical development of pharmacy, pharmaceutical industry, and major pharmacopoeias.

CO 3. Perform pharmaceutical calculations involving percentage solutions, proof spirit, isotonic solutions, and related concepts.

CO 4. Classify and prepare powders and granules, and discuss their advantages, disadvantages, and packaging methods.

CO 5. Explain the formulation and evaluation of monophasic dosage forms such as solutions, liniments, and lotions.

CO 6. Describe the formulation, classification, and evaluation of biphasic dosage forms like suspensions and emulsions.

CO 7. Discuss the preparation, evaluation, and types of suppositories, pessaries, and galenical preparations.

CO 8. Explain the types and uses of surgical aids and identify various pharmaceutical incompatibilities and their remedies.

COURSE CONTENTS

Unit	Topics	Duration (Hrs)
1	a. **Introduction to dosage forms:** Classification and definitions b. **Prescription**: Definition, parts and handling. c. Posology: Definition, Factors affecting dose selection. Calculation of children and infant doses. Errors and their prevention in Prescription., Study of atleast 5 Sample Prescriptions.	7
2	Historical back ground and development of profession of pharmacy and pharmaceutical industry in brief. Development of Indian Pharmacopoeia and introduction to DCGI guidelines and other Pharmacopoeias such as BP, USP, European Pharmacopoeia, Extra pharmacopoeia, Indian National Formulary.	7
3	**Pharmaceutical calculations:** Weights and measures, Calculations involving percentage solutions, allegations, proof spirit, isotonic solutions etc. Enlarging and reducing formulae	7
4	**Powders and Granules:** Classification advantages and disadvantages, Preparation of simple, compound powders, Insufflations, Dusting powders, Eutectic and Explosive powders, Tooth powder and effervescent powders and granules. Packaging of powders, Geometric dilutions.	8
5	**Monophasic Dosage forms:** Theoretical aspects of formulation including all adjuvants with examples. Study of Monophasic liquid dosage forms like syrups, elixirs, gargles, mouth washes, Throat paint, Ear drops, Nasal drops, Liniments and lotions, Enemas and collodions.	7
6	**Biphasic dosage forms:** Suspensions and emulsions, Definition, advantages and disadvantages, classification, test for the type of emulsion, formulation, stability and evaluation.	7
7	**Suppositories and pessaries:** Definition, advantages and disadvantages, types of base, method of preparation, Displacement value and evaluation. **Galenicals:** Definition, equipment for different extraction processes like infusion, Decoction, Maceration and Percolation, methods of preparation of spirits, tinctures and extracts.	8
8	**Surgical aids:** Surgical dressings, absorbable gelatin sponge, sutures, ligatures and medicated bandages. **Incompatibilities:** Introduction, classification and methods to overcome the incompatibilities.	9

TEXT BOOKS: (Latest Editions)

1. H.C. Ansel et al., Pharmaceutical Dosage Form and Drug Delivery System, Lippincott Williams and Walkins, New Delhi.
2. Carter S.J., Cooper and Gunn's-Dispensing for Pharmaceutical Students, CBS publishers, New Delhi.
3. M.E. Aulton, Pharmaceutics, The Science& Dosage Form Design, Churchill Livingstone, Edinburgh.
4. E.A. Rawlins, Bentley's Text Book of Pharmaceutics, English Language Book Society, Elsevier Health Sciences, USA.

REFERENCE BOOKS: (Latest Editions)

1. Alfonso R. Gennaro Remington. The Science and Practice of Pharmacy, Lippincott Williams, New Delhi.
2. Indian Pharmacopoeia.
3. Lachmann. Theory and Practice of Industrial Pharmacy, Lea & Febiger Publisher, The University of Michigan.
4. Brayfield A, editor. Martindale: The Complete Drug Reference. Pharmaceutical Press, London.
5. World Health Organization. The International Pharmacopoeia. WHO, Geneva.

SULTAN-UL-ULOOM COLLEGE OF PHARMACY, HYDERABAD

SUBJECT: 1.2 PHARMACEUTICS

(PRACTICAL 90 HOURS)

Teaching Scheme
Practical: 03 hrs / Week

Examination Scheme:
Internal Exam: 20 Marks
External Exam: 70 Marks
Continuous Assessment: 10 Marks
Total Marks: 100 Marks

Scope:

This subject provides basic knowledge of pharmaceutics, focusing on the formulation and preparation of various dosage forms. It covers prescriptions, pharmaceutical calculations, pharmacopoeias, incompatibilities, and dosage systems like monophasic, biphasic, powders, suppositories, surgical aids, and galenicals. It also introduces recent advancements and regulatory aspects essential for pharmacy practice.

Course Objectives:

- Explain the classification and formulation principles of different dosage forms.
- Understand the role of pharmacopoeias and regulatory standards in ensuring product quality.
- Accurately interpret prescriptions and perform dose calculations for all age groups.
- Carry out essential pharmaceutical calculations with accuracy.
- Demonstrate understanding of preparation, packaging, and evaluation of various dosage forms.

Course Outcomes: Upon completion of the course a learner shall be able to-

CO 1. Explain the principles and methods involved in the preparation of various pharmaceutical liquid dosage forms.
CO 2. Formulate and evaluate different types of syrups and elixirs as per official standards.
CO 3. Prepare linctuses and solutions with proper selection of solvents and excipients.
CO 4. Demonstrate the preparation and evaluation of liniments, suspensions, and emulsions.
CO 5. Formulate and standardize different types of powders, including oral rehydration salts.
CO 6. Prepare and evaluate suppositories using suitable bases and methods.
CO 7. Identify and handle physical, chemical, and therapeutic incompatibilities in formulations.
CO 8. Formulate and assess gargles and mouthwashes for therapeutic and hygienic applications.

COURSE CONTENTS

Expt. No.	Title of the Experiment	Duration (Hrs)
1.	**Syrups** a. Simple Syrup I.P b. Syrup of Ephedrine HCl NF c. Syrup Vasaka IP d. Syrup of ferrous Phosphate IP e. Orange Syrup	 3 3 3 3 3
2.	**Elixir** a. Piperizine citrate elixir BP b. Cascara elixir BPC c. Paracetamol elixir BPC	 3 3 3
3.	**Linctus** a. Simple Linctus BPC b. Pediatric simple Linctus BPC	 3 3
4.	**Solutions** a. Solution of cresol with soap IP b. Strong solution of ferric chloride BPC c. Aqueous Iodine Solution IP d. Strong solution of Iodine IP e. Strong solution of ammonium acetate IP	 3 3 3 3 3
5.	**Liniments** a. Liniment of turpentine IP b. Liniment of camphor IP	 3 3
6.	**Suspensions** a. Calamine lotion b. Magnesium Hydroxide mixture BP	 3 3
7.	**Emulsions** a. Cod liver oil emulsion b. Liquid paraffin emulsion	 3 3
8.	**Powders** a. Eutectic powder b. Dusting powder c. Insufflations d. Effervescent powders e. Formulation of Oral Rehydration Salts (ORS) Powder as per guidelines	 3 3 3
9.	**Suppositories** a. Boric acid suppositories b. Chloral suppositories	 3 3
10.	**Incompatibilities** a. Mixtures with Physical b. Chemical & Therapeutic incompatibilities	 3 3
11.	**Gargles and Mouthwashes** a. Iodine gargle b. Chlorhexidine mouthwash	 3 3

TEXT BOOKS: (Latest Editions)

1. Pharmaceutics-I (General Pharmacy) A Practical Manual by Mishra Vijay, Pharmamed Press
2. Pharmaceutics: A Practical Manual for B PHARM & PHARM D Courses, Abraham Sindhu by Pharmamed Press.
3. Goyal RK. Pharmaceutics-I Practical Manual. Pune: Nirali Prakashan.
4. Sethi PD. Dispensing and Pharmaceutics Laboratory Manual. New Delhi: CBS Publishers & Distributors.
5. Ali J. Practical Manual of Pharmaceutics. New Delhi: CBS Publishers & Distributors.
6. Carter SJ. Cooper and Gunn's Dispensing for Pharmaceutical Students. New Delhi: CBS Publishers & Distributors.

REFERENCE BOOKS: (Latest Editions)

1. Troy DB, editor. Remington: The Science and Practice of Pharmacy. London: Pharmaceutical Press.
2. Indian Pharmacopoeia Commission. Indian Pharmacopoeia. Vol. I–IV. Ghaziabad: IPC, Govt. of India.
3. Brayfield A, editor. Martindale: The Complete Drug Reference. London: Pharmaceutical Press.
4. Indian Pharmacopoeia Commission. Pharmacopoeial Laboratory Procedures and Guidelines. Ghaziabad: IPC.
5. Allen LV, Popovich NG, Ansel HC. Ansel's Pharmaceutical Dosage Forms and Drug Delivery Systems. Philadelphia: Lippincott Williams & Wilkins.
6. Aulton ME, Taylor KMG, editors. Aulton's Pharmaceutics: The Science of Dosage Form Design. Edinburgh: Churchill Livingstone (Elsevier).
7. Rawlins EA, editor. Bentley's Textbook of Pharmaceutics. New Delhi: Elsevier India.

SULTAN-UL-ULOOM COLLEGE OF PHARMACY, HYDERABAD

SUBJECT: 1.3 MEDICINAL BIOCHEMISTRY

(THEORY 90HOURS)

Teaching Scheme
Lectures: 03 Hr/Week

Examination Scheme:
Internal Exam: 30 Marks
External Exam: 70 Marks
Total Marks: 100 Marks

Scope:
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

Course Objectives:

- To understand the structure and function of cells and the biomolecules involved in cellular organization.
- To introduce enzymes, highlighting their fundamental role as biological catalysts, importance of isoenzymes in diagnosis of diseases
- Understanding of Major Pathways in Carbohydrate Metabolism
- Understand the Pathways of Lipid Catabolism and Anabolism.
- Understand Protein Turnover, describe Key Amino Acid Metabolism Reactions, associated metabolic disorders.
- Understand the genetic organization of mammalian genome; replication; mutation and repair mechanism;
- Know the biochemical principles of organ function tests of kidney, liver and endocrine gland;
- Understand the Principles of Immunochemical Techniques; Describe Hormone and Protein Level Determination in Serum.

Course Outcomes: Upon completion of the course a learner shall be able to

CO 1. Describe the basic structure and function of cells and understand how biochemical pathways are organized within cells.
CO 2. Understand the catalytic activity of enzymes and importance of isoenzymes in diagnosis of diseases.
CO 3. Describe and Understand Key Pathways in Carbohydrate Metabolism.
CO 4. Explain all major lipid metabolic pathways and their enzymes, role of lipids in energy metabolism and cellular functions.
CO 5. Explain the importance of protein turnover in maintaining cellular function; Identify and explain the metabolic basis of key amino acid disorders.
CO 6. Understand the genetic organization of mammalian genome; replication; mutation and repair mechanism
CO 7. Know the biochemical principles of organ function tests of kidney, liver and endocrine gland.
CO 8. Explain the principles of immunoassays and their reliance on antigen-antibody specificity

COURSE CONTENTS

Unit	Topics	Duration (Hrs)
1	**Introduction to biochemistry:** Cell and its biochemical organization. Introduction to bioenergetics and energy rich compounds – ATP, Cyclic AMP and their biological significance.	10
2	**Enzymes:** Definition and Nomenclature, IUB classification, factors affecting enzyme activity, enzyme action, enzyme inhibition and enzyme induction. Isoenzymes their therapeutic and diagnostic applications, Coenzymes and their biochemical role and deficiency diseases.	12
3	**Carbohydrate metabolism:** Glycolysis, Citric acid cycle (TCA cycle), 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.	12
4	**Lipid metabolism**: β-oxidation, Ketogenesis and ketolysis, biosynthesis of fatty acids, lipids. Metabolism of cholesterol. Hormonal regulation of lipid metabolism. Defective metabolism of lipids (atheroslerosis, fatty liver, hypercholesterolemia). **Biological Oxidation:** Coenzyme systems, Electron transport chain (ETC), energy capture, regulation, inhibition. Uncouplers of ETC. Oxidative phosphorylation.	12
5	**Protein & Amino Acid Metabolism:** Protein turnover, nitrogen balance, transamination, deamination, decarboxylation. Urea cycle and disorders. Bile pigments, jaundice, porphyria. Amino acid metabolic disorders.	10
6	**Nucleic Acid Metabolism:** Purine/pyrimidine metabolism, protein synthesis, genetic code, inhibition of protein synthesis, mutation and repair. Types of DNA, DNA transcription, translation and replication (onion peel/semiconservative models). Types of RNA (mRNA, tRNA, rRNA) and their roles.	12
7	**Introduction to Clinical Chemistry:** Cell composition and malfunction, Role of clinical chemistry laboratory in diagnosis. **Kidney Function Tests:** Role of kidneys, urine analysis (macro/micro), NPN tests (creatinine/urea), clearance tests, urine concentration, urinary calculi. **Liver Function Tests:** Liver's physiological/metabolic roles, bile pigment metabolism, serum/urine bilirubin, urobilinogen, dye tests, enzyme tests. **Lipid Profile Tests:** Lipoproteins, serum lipids (TC, HDL, LDL, TG), methods, interpretation and their significance.	12
8	**Immunochemical Techniques:** Hormone and protein level determination in serum; RIA, ELISA; applications in endocrine and infectious diseases. **Electrolytes:** Body fluid compartments, water/electrolyte balance, sodium, potassium, calcium, chloride, bicarbonate estimation. Brief note on Acid-base imbalance.	10

TEXTBOOKS: (Latest Editions)

1. Satyanarayana U, Chakrapani U. Biochemistry. New Delhi: Elsevier.
2. Text Book of Biochemistry by Dr.A V S S Rama Rao,Ubs Publishers' distributorz Pvt Ltd.
3. Harper's Illustarted Biochemistry by Robert K. Murray,Daryl K.Granner, Victor W.Rodwell, Mcgraw Hill.
4. Textbook of Biochemistry Anil potnis Himalaya.
5. Gereral Biochemistry by J.H.Weil.New Age International Publishers General Biochemistry J.H.Weil new age PBL.
6. Biochemistry by S.C.Rastogi, Tata Mc Graw Hill Education Private Limited

REFERENCES: (Latest Editions)

1. Kennelly PJ, Botham KM, McGuinness OP, Rodwell VW, Weil PA, editors. Harper's Illustrated Biochemistry. New York: McGraw Hill.
2. Nelson DL, Cox MM. Lehninger Principles of Biochemistry.. New York: W.H. Freeman and Company.
3. Crook MA. Clinical Biochemistry and Metabolic Medicine.. Boca Raton: CRC Press.

SULTAN-UL-ULOOM COLLEGE OF PHARMACY, HYDERABAD

SUBJECT: 1.3 MEDICINAL BIOCHEMISTRY

(PRACTICAL 90 HOURS)

Teaching Scheme
Practical: 03 hrs / Week

Examination Scheme:
Internal Exam: 20 Marks
External Exam: 70 Marks
Continuous Assessment: 10 Marks
Total Marks: 100 Marks

Scope: This practical course in Medical Biochemistry provides hands-on training in analyzing biological fluids, including urine and blood. Students learn qualitative and quantitative techniques to study metabolites, enzymes, proteins, lipids, and electrolytes, linking biochemical principles with clinical and diagnostic applications.

Course Objectives:

- Develop practical skills in qualitative and quantitative analysis of urine and blood constituents.
- Perform estimations of sugars, proteins, enzymes, lipids, and electrolytes using standard biochemical methods.
- Understand and apply techniques for preparing reagents, buffers, and biological filtrates.
- Study enzyme activity and factors affecting biochemical reactions.
- Correlate experimental results with physiological and pathological conditions.
- Enhance analytical, observational, and recording skills in biochemical experiments.
- Build a foundation for clinical diagnostics and interpretation of biochemical data.

Course Outcomes: Upon completion of the course a learner shall be able to

CO 1. Demonstrate safe and effective laboratory techniques, including pipetting, titration, centrifugation, and spectrophotometry

CO 2. Perform qualitative analysis and determination of biomolecules in the body fluids.

CO 3. Analyse and interpret biochemical test results for diagnostic and clinical correlation.

CO 4. Understand the biochemical basis of diseases through practical investigation of metabolites and enzymes.

CO 5. Perform quantitative analysis and determination of electrolytes.

CO 6. Estimate SGOT, SGPT, Urea & protein in serum

CO 7. Study factors affecting enzyme activity and preparation, pH measurement of standard buffer solution functional groups

CO 8. Maintain proper lab records, follow safety guidelines, and apply scientific reasoning to solve biochemical problems.

COURSE CONTENTS

Exp.No	Title of the Experiment	Hrs
1.	Qualitative analysis of normal constituents of urine.	3
2.	Qualitative analysis of abnormal constituents of urine.	3
3.	Quantitative estimation of urine sugar by Benedict's reagent method.	3
4.	Quantitative estimation of urine chlorides by Volhard's method.	3
5.	Quantitative estimation of urine creatinine by Jaffe's method.	3
6.	Quantitative estimation of urine calcium by precipitation method.	3
7.	Quantitative estimation of serum cholesterol by Libermann Burchard's method.	3
8.	Quantitative estimation of blood creatinine.	3
9.	Quantitative estimation of blood sugar by glucometer and continuous glucose monitor system(CGMS).	3
10.	Estimation of SGOT in serum.	3
11.	Estimation of SGPT in serum.	3
12.	Estimation of Urea in Serum.	3
13.	Estimation of Proteins in Serum.	3
14.	Determination of serum bilirubin	3
15.	Determination of Glucose by means of Glucoseoxidase.	3
16.	Enzymatic hydrolysis of Glycogen/Starch by Amylases.	6
17.	Introduction to Estimation of Enzyme activity.	3
18.	Study of factors affecting Enzyme activity. (pH & Temp.)	3
19.	Preparation of standard buffer solutions and its pH measurements	3
20.	Experiment on lipid profile tests	3
21.	Determination of sodium, calcium and potassium in serum.	3
22.	Qualitative analysis of carbohydrates (minimum three)	9
23.	Qualitative analysis of Proteins (minimum three)	9

TEXTBOOKS: (Latest Editions)

1. Laboratory Manual in biochemistry J. Jayaraman New Age Publishers .
2. Biochemistry A Practical Manual Sharad Chandra Bose PharmaMed Press.
3. Practical Biochemistry and Clinical Pathology S. R. Kale R.R.Kale.
4. Manual of Practical Biochemistry for medical students University press.
5. Practical Biochemistry R C Gupta S Bhargava CBS Publishers & Distributors.

REFERENCES: (Latest Editions)

1. Plummer DT. An Introduction to Practical Biochemistry. New Delhi: Tata McGraw-Hill;
2. Jayaraman J. Laboratory Manual of Biochemistry. New Delhi: New Age International Publishers.
3. Sadasivam S, Manickam A. Biochemical Methods. New Delhi: New Age International Publishers.
4. Wilson K, Walker J. Principles and Techniques of Biochemistry and Molecular Biology. Cambridge: Cambridge University Press.

SULTAN-UL-ULOOM COLLEGE OF PHARMACY, HYDERABAD

SUBJECT: 1.4 PHARMACEUTICAL ORGANIC CHEMISTRY

(THEORY 90 HOURS)

Teaching Scheme
Lectures: 03 Hr/Week

Examination Scheme:
Internal Exam: 30 Marks
External Exam: 70 Marks
Total Marks: 100 Marks

Scope: This subject covers the fundamental principles of organic chemistry, including structures, properties, nomenclature, and reactivity of organic compounds. It emphasizes key reaction mechanisms such as substitution, elimination, addition, oxidation, and reduction. Special focus is given to named reactions, preparation and purification of organic compounds, and the medicinal importance of various organic compounds relevant to pharmacy.

Course Objectives:

- Apply IUPAC and common naming systems to organic compounds.
- Describe the physical and chemical properties of organic molecules.
- Explain mechanisms of key organic reactions and intermediate stability.
- Identify and apply important named reactions in organic synthesis.
- Demonstrate preparation and purification techniques for organic compounds.
- Evaluate the medicinal and pharmaceutical importance of organic compounds.

Course Outcomes: Upon completion of the course a learner shall be able to

CO 1. Explain the structure, bonding, and nomenclature of organic compounds.
CO 2. Analyze mechanisms and stability of free radical reactions.
CO 3. Apply nucleophilic substitution principles to predict reactivity.
CO 4. Compare elimination and addition mechanisms in organic reactions.
CO 5. Predict products of electrophilic aromatic substitution reactions.
CO 6. Illustrate key carbonyl and condensation reactions in synthesis.
CO 7. Apply functional group transformations in amines and phenols.
CO 8. Evaluate the pharmaceutical significance of organic compounds.

COURSE CONTENTS

Unit	Topics	Duration (Hrs)
1	**Fundamentals of Organic Chemistry** • Structures and physical properties: Polarity of bonds, polarity of molecules, M.P, intermolecular forces, solubility (ionic & non-ionic solutes), protic and aprotic solvents, ion pairs. • Acids and bases: Bronsted-Lowry and Lewis Theory • Isomerism. • Hybridization of atomic orbitals of carbon, nitrogen & oxygen to form molecular orbitals. • Nomenclature of organic compounds (up to 10 carbons open chain) • Introduction to basic heterocyclic rings.	11
2	**Hydrocarbons and Free Radicals** • Free radical chain reactions of alkanes: Mechanism, relative reactivity and stability, applications. • Alicyclic compounds: Baeyer strain theory and orbital picture of angle strain, preparation methods. • Free radical halogenations of alkenes, comparison of free radical substitution & addition, allylic rearrangements. • Resonance theory: Allyl radical/cation as resonance hybrids, orbital picture, resonance stabilization, hyper conjugation.	12
3	**Substitution Reactions** • Nucleophilic aliphatic substitution: Nucleophiles & leaving groups, kinetics and mechanisms of SN1 & SN2 reactions, stereochemistry, steric hindrance, carbocation stability, rearrangements, role of solvents, phase transfer catalysis, SN1 vs SN2 comparison. • Nucleophilic aromatic substitution: Bimolecular displacement mechanisms, orientation and reactivity, comparison with aliphatic substitution.	12
4	**Elimination and Addition Reactions** • Elimination reactions: Dehydrohalogenation of alkyl halides (E1 & E2 mechanisms, kinetics, orientation, reactivity). • Dehydration of alcohols: Acid catalysis, ease of dehydration, reversibility, orientation. • Elimination vs substitution. • Addition reactions: Electrophilic & free radical addition to alkenes, Markownikoff's rule and peroxide effect, hydrogenation, heat of hydrogenation and stability of alkenes, addition of halogens, halohydrin formation, free radical addition of HBr, carbene additions, cycloadditions. • Conjugated dienes: Ease of formation, orientation of elimination, electrophilic addition, 1,2 vs 1,4-addition, rate vs equilibrium, free radical addition to conjugated dienes.	11

5	**Aromatic compounds** • Electrophilic aromatic substitution: Mechanisms of nitration, sulphonation, halogenation, Friedel-Crafts alkylation & acylation. • Effect of substituents, orientation, relative reactivity, classification of substituents into activating/deactivating groups. • Resonance effects, halogen influence. • Side-chain reactions: Halogenation of alkyl benzenes, resonance stabilization of benzyl radical.	11
6	**Carbonyl Compounds and Related Reactions** • Nucleophilic addition and acyl substitution: Ionization and acidity of carboxylic acids, structure and stability of carboxylate ions, effects of substituents on acidity, conversion of acids to acid chlorides, esters, amides, anhydrides, comparison of alkyl vs acyl nucleophilic substitution. • Condensation reactions: Aldol condensation, Claisen condensations, Cannizzaro and cross Cannizzaro reaction reactions, Perkin condensation, Knoevenagel reaction, Reformatsky reaction, Benzoin condensation, Wittig reaction, Michael addition.	13
7	**Substituted Aromatic Compounds and their reactions** • Reactions of amines and phenols: Hoffmann rearrangement, Sandmeyer reaction, basicity of amines, diazotization and coupling, acidity of phenols, Williamson synthesis, Fries rearrangement, Kolbe reaction, Reimer–Tiemann reaction. • Oxidation–reduction reactions.	10
8	**Pharmaceutical Importance of Organic Compounds** • Preparation, IUPAC nomenclature, and medicinal uses of official compounds: Chlorbutol, Dimercaprol, Glyceryl trinitrate, Lactic acid, Tartaric acid, Citric acid, Salicylic acid, Aspirin, Methyl salicylate, Sodium lauryl sulfate, Saccharin sodium, Mephenesin.	10

TEXT BOOKS: (Latest Editions)

1. Advanced Organic Chemistry Arun Bahl & B.S. Bahl S. Chand Publishing.
2. Organic Chemistry Robert Thornton Morrison Robert Neilson Boyd Saibal Kanti Bhattacharjee Pearson Education.

REFERENCE BOOKS: (Latest Editions)

1. Morrison, R.T. & Boyd, R.N. *Organic Chemistry*, Pearson Education.
2. Finar, I.L. *Organic Chemistry, Volume 1: The Fundamental Principles*, Pearson Education.
3. Solomons, T.W. Graham, Fryhle, C.B., & Snyder, S.A. *Organic Chemistry*, Wiley India.
4. Vollhardt, K.P.C. & Schore, N.E. *Organic Chemistry: Structure and Function*, W.H. Freeman & Company.

SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD

SUBJECT: 1.4 P PHARMACEUTICAL ORGANIC CHEMISTRY

(PRACTICAL 90 HOURS)

Teaching Scheme
Practical: 03Hr/Week

Examination Scheme:
Internal Exam: 20 Marks
External Exam: 70 Marks
Continuous Assessment:10 Marks
Total Marks: 100 Marks

Scope:
This subject is designed to impart the knowledge on the synthesis and qualitative analysis of organic compounds. It aims to provide hands-on experience in preparing pharmaceutical intermediates and identifying functional groups through classical chemical tests. The practicals enhance understanding of reaction mechanisms and basic organic laboratory techniques relevant to pharmaceutical sciences.

Course Objectives:
Upon completion of the course a student shall be able to-

- Synthesize selected organic compounds relevant to pharmaceutical applications.
- Understand basic reaction mechanisms in organic synthesis.
- Perform qualitative analysis of organic compounds by identifying functional groups.
- Apply purification techniques such as recrystallization and determine melting points.
- Correlate experimental observations with theoretical concepts in pharmaceutical organic chemistry.

Course Outcomes: Upon completion of the course a learner shall be able to

CO 1. Explain and follow essential safety guidelines and practices in an organic chemistry laboratory.
CO 2. Determine the melting and boiling points of organic compounds accurately.
CO 3. Demonstrate basic laboratory techniques involved in organic compound synthesis.
CO 4. Synthesize a variety of simple organic compounds using reactions such as acetylation, nitration and oxidation.
CO 5. Perform purification and characterization of synthesized organic compounds.
CO 6. Identify unknown organic compounds through systematic qualitative analysis.
CO 7. Interpret functional groups and chemical behavior of organic compounds based on experimental results.
CO 8. Illustrate molecular structures and stereochemistry using molecular models for better understanding of spatial arrangements.

COURSE CONTENTS

S. No.	Title of the Experiment	Duration (Hrs)
1	Safety measures / guidelines in an organic laboratory	**6**
2	Determination of melting point and boiling point of organic compounds	**6**
3	Introduction to the various laboratory techniques through demonstration involving 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. Benzoic acid / salicylic acid (Hydrolysis of ester) 7. M-dinitro benzene (Nitration) 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	**8×3= 24**
4	Identification of organic compounds belonging to the following classes by Systematic qualitative organic analysis: carboxylic acids, phenols, alcohols, esters, aldehyde and ketones, amides, carbohydrates, amines, hydrocarbons, anilides, nitrocompounds.	**13×3=39**
5	Introduction to the use of stereo models: Methane, Ethane, Ethylene, Acetylene, Cis alkene, Trans alkene, inversion of configuration.	**9**

TEXTBOOKS: (Latest Editions)

1. A. I. Vogel, Elementary Practical Organic Chemistry: Small Scale Preparations, Pearson Publication.

2. K. S. Jain, P. B. Miniyar, T. S. Chitre, Experimental Pharmaceutical Organic Chemistry- a benchtop manual, Career Publication.

REFERENCE BOOKS: (Latest Editions)

1. B. S. Furniss, A. J. Hannaford, P. W.G. Smith, A. R. Tatchell, Vogel's Textbook of Practical Organic Chemistry, Pearson Publication.
2. Indian Pharmacopoeia Volume I, II, III & IV; Government of India, Ministry of Health and Family Welfare; the Indian Pharmacopoeia Commission, Ghaziabad.

SULTAN-UL-ULOOM COLLEGE OF PHARMACY HYDERABAD

SUBJECT: 1.5 PHARMACEUTICAL INORGANIC CHEMISTRY

(THEORY 60 HOURS)

Teaching Scheme
Lectures: 02 hrs/Week

Examination Scheme:
Internal Exam: 30 Marks
External Exam: 70 Marks
Total Marks: 100 Marks

Scope: This course provides fundamental knowledge of pharmaceutical inorganic chemistry, emphasizing analytical techniques, chemical principles, and the medicinal and pharmaceutical importance of inorganic compounds. It helps students understand analytical methods, purity tests, and therapeutic uses of inorganic substances in pharmacy.

Course Objectives:

- To understand the principles and methods involved in volumetric and gravimetric analysis.
- To learn the concepts of various titrimetric methods and their pharmaceutical applications.
- To gain knowledge about the purity testing of pharmaceutical substances through limit tests.
- To study the preparation, properties, and uses of inorganic medicinal agents and pharmaceutical aids.
- To understand the therapeutic role of electrolytes, trace elements, and essential inorganic compounds in healthcare.

Course Outcomes: Upon completion of the course a learner shall be able to

CO 1. Explain sources and types of errors, and apply volumetric principles for accurate analytical measurements.
CO 2. Perform acid-base and non-aqueous titrations using suitable indicators and buffer systems.
CO 3. Demonstrate precipitation, gravimetric, and diazotisation titrations for quantitative analysis of substances.
CO 4. Analyze substances using complexometric and redox titration principles involving oxidation-reduction reactions.
CO 5. Conduct limit tests to identify impurities and describe preparation and uses of common medicinal gases.
CO 6. Classify and evaluate inorganic compounds used as acidifiers, antacids, and cathartics in pharmacy.
CO 7. Describe the pharmaceutical importance of electrolytes, trace elements, antimicrobials, and pharmaceutical aids.
CO 8. Explain the composition, uses, and safety aspects of dental products, radiopharmaceuticals, and miscellaneous inorganic agents.

COURSE CONTENTS

Unit	Description	Duration (Hrs)
1.	**Volumetric analysis /*Titrimetric Analysis*:** Principle of volumetric analysis, different methods of analysis, different methods for expressing concentrations of solutions, (Normality, Molarity, Molality, primary and secondary standards.	06
2.	• **Acid-base titrations:** Acid- base concepts, relative strength of acids and bases, law of mass action, common ion effect, ionic product of water, Henderson-Hasselbalch equation, buffer solutions, theory of indicators, classification of acid base titrations and theory involved in titrations neutralization curves, choice of indicators, mixed and universal indicators. • **Non aqueous titrations:** Theoretical basis, types of solvents, preparations and standardization of titrant solutions, titration of weak acid, weak bases and indicators. Standardisation of perchloric acid, lithium and sodium methoxide, tetra butyl ammonium hydroxide. Estimation of Sodium benzoate and Ephedrine HCl by non-aqueous titrations	08
3.	• **Precipitation titrations:** Introduction, *concept of Solubility product and precipitation,* Mohr's, Volhard's, Modified Volhard's, Fajans method for detection of end point. Assay of sodium chloride • **Gravimetry:** Principle and steps involved in gravimetric analysis. Purity of the precipitate: co-precipitation and post precipitation, Estimation of barium sulphate. • Basic Principles, methods and application of diazotisation titration	06
4.	• **Complexometric titrations:** Concept of ligand and metal ion, principle, types of titrations, endpoint detection, metal ion indicators, masking and demasking reagents. Estimation of Magnesium sulphate, and calcium gluconate. • **Redox titrations:** (a) Concepts of oxidation and reduction (b) Types of redox titrations (Principles and applications) Cerimetry, Iodimetry, Iodometry, Bromatometry, Dichrometry, Titration with potassium iodate	08
5.	• **Errors in Analysis**: Sources of errors, types of errors (determinate and indeterminate), methods of minimizing errors, accuracy, precision and significant figures. • **Limit tests:** Sources of impurities in medicinal agents, limit tests. Definition, importance, general procedure for limit test for chlorides, sulphates, iron, arsenic, lead and heavy metals. • **Medicinal Gases:** Preparation and uses of the following Oxygen, Carbon dioxide, Helium, Nitrogen and Nitrous Oxide	06

6.	• **Acidifiers:** Dilute hydrochloric acid, Sodium phosphate, Ammonium chloride. • **Antacids:** Classification, Qualities of an ideal antacid, side effects, advantages, combination therapy, acid neutralizing capacity, Sodium bicarbonate, Potassium citrate, Aluminium hydroxide gel, Dried aluminium hydroxide gel, Magnesium hydroxide, Light and heavy magnesium trisilicate, light and heavy magnesium carbonate, Calcium carbonate, Magaldrate and Bismuth carbonate. • **Cathartics:** Magnesium hydroxide, Magnesium sulphate, Magnesium carbonate and Sodium phosphate.	06
7.	• **Electrolyte replenishers:** *Electrolytes used for replacement therapy:* Sodium chloride, Potassium chloride, Calcium chloride, Calcium gluconate, *Electrolytes used in the acid-base therapy:* Sodium acetate, Potassium acetate, Sodium bicarbonate, Potassium bicarbonate, Sodium citrate, Sodium lactate, Ammonium chloride. *Electrolyte combination therapy:* Compound sodium chloride solution, Sodium chloride injection and Oral rehydration salt. • **Essential and Trace elements:** Definition, Physiological role of Iron, Copper, Zinc, Chromium, Manganese, Molybdenum, Selenium, Sulphur and Iodine • **Antimicrobials:** Hydrogen Peroxide, Potassium Permanganate, Chlorinated Lime, Iodine, Boric Acid, Silver Nitrate, Selenium Sulphide. • **Pharmaceutical Aids:** Sodium bisulphite, sodium metabisulphite, bentonite, magnesium stearate, zinc stearate, aluminium sulphate, sodium carboxy methyl cellulose, purified water, water for injection and sterile water for injection.	12
8.	• **Dental products:** Anti-caries Agents: Role of Fluorides as anti-caries agents, Sodium fluoride Dentifrices: Calcium carbonate, dibasic calcium phosphate, Zinc chloride. • **Radiopharmaceuticals:** Introduction, measurement of radioactivity, clinical applications and dosage, hazards and precautions. • **Miscellaneous compounds:** *Sclerosing agents:* Hypertonic saline, Sodium tetra decyl sulphate. *Expectorants:* Potassium citrate and Potassium iodide. *Sedative:* Potassium bromide. Antidotes: Sodium nitrite, Sodium thiosulphate and Charcoal *Respiratory stimulant:* Ammonium carbonate.	08

TEXT BOOKS: (Latest Editions)

1. Beckett AH, Stenlake JB. Practical Pharmaceutical Chemistry. Vol I & II. London: Athlone Press.
2. Kasture AV, Mahadik KR, Wadodkar SG, More HN. Pharmaceutical Analysis. Pune: Nirali Prakashan.
3. Tipnis HP, et al. Pharmaceutical Chemistry – Inorganic Vol I. Mumbai: Himalaya Publishing House.
4. Bari SK. Textbook of Pharmaceutical Analysis I. New Delhi.

REFERENCE BOOKS: (Latest Editions)

1. Kar A. Pharmaceutical Analysis Vol 1. 1st ed. New Delhi: CBS Publishers.
2. Connors KA. A Textbook of Pharmaceutical Analysis. 3rd ed. Hoboken: Wiley.
3. Gandhi NC. A Textbook of Pharmaceutical Inorganic Chemistry. 1st ed. New Delhi: IP Innovative.
4. Ali M. Textbook Of Pharmaceutical Chemistry I (Inorganic). 1st ed. New Delhi: CBS Publisher.
5. Gunasekaran V, et al. A Textbook of Pharmaceutical Inorganic Chemistry. 1st ed. Chennai: Shashwat Publication.
6. Rai AB, Sharma M, Kumar P. B. Pharm Semester Combo Set: Textbook of Pharm Analysis & Inorganic Chem.
7. Indian Pharmacopoeia Commission. Indian Pharmacopoeia. Ghaziabad: Indian Pharmacopoeia Commission.
8. Medicines and Healthcare products Regulatory Agency. British Pharmacopoeia. London: TSO (The Stationery Office).
9. United States Pharmacopeial Convention. United States Pharmacopeia (USP 48–NF 43). Rockville: United States Pharmacopeial Convention.

SULTAN-UL-ULOOM COLLEGE OF PHARMACY, HYDERABAD

SUBJECT: 1.5 PHARMACEUTICAL INORGANIC CHEMISTRY (PRACTICALS 90 HOURS)

Teaching Scheme
Practical: 03 hrs/ Week

Examination Scheme:
Internal Exam: 20 Marks
External Exam: 70 Marks
Continuous Assessment: 10 Marks
Total Marks: 100 Marks

Scope: This course mainly deals with fundamentals of Analytical chemistry and also the study of inorganic pharmaceuticals regarding their monographs and also the course deals with basic knowledge of analysis of various pharmaceuticals.

Course Objectives:

- To develop practical skills in performing limit tests for various pharmaceutical substances.
- To carry out quantitative assays using volumetric, gravimetric, and complexometric methods.
- To estimate components in mixtures accurately using analytical techniques.
- To test the identity and purity of inorganic pharmaceutical compounds.
- To prepare standard inorganic pharmaceutical compounds in the laboratory.

Course Outcomes: Upon completion of the course a learner shall be able to

CO 1. Perform limit tests for chlorides, sulphates, iron, heavy metals, arsenic, and modified methods.
CO 2. Conduct quantitative assays including acid-base, redox, complexometric, non-aqueous, and gravimetric titrations.
CO 3. Estimate components in binary mixtures such as sodium hydroxide & sodium carbonate, boric acid & borax, oxalic acid & sodium oxalate.
CO 4. Test the identity of compounds like sodium bicarbonate, barium sulphate, ferrous sulphate, and potassium chloride.
CO 5. Determine the purity of pharmaceutical agents through tests like swelling power, acid neutralizing capacity, ammonium salts, adsorption power, and iodates.
CO 6. Prepare standard inorganic compounds including boric acid, potash alum, calcium lactate, and magnesium sulphate.
CO 7. Apply analytical principles for accurate calculation, reporting, and interpretation of experimental data.
CO 8. Develop competence in laboratory safety, documentation, and systematic experimental procedures.

COURSE CONTENTS

S. No.	Title of the Experiment	Duration (Hrs)
	Limit test (6 exercises):	
1	a. Limit test for chlorides	3
2	b. Limit test for sulphates	3
3	c. Limit test for iron	3
4	d. Limit test for heavy metals	3
5	e. Limit test for arsenic	3
6	f. Modified limit tests for chlorides and sulphates	
	Assays (10 exercises):	
7	a. Ammonium chloride- Acid-base titration	3
8	b. Ferrous sulphate- Cerimetry	3
9	c. Copper sulphate- Iodometry	3
10	d. Calcium gluconate- Complexometry	3
11	e. Hydrogen peroxide – Permanganometry	3
12	f. Sodium benzoate – Nonaqueous titration	3
13	g. Sodium chloride – Modified Volhard's method	3
14	h. Assay of KI – KIO_3 titration	3
15	i. Gravimetric estimation of barium as barium sulphate	3
16	j. Sodium antimony gluconate or antimony potassium tartarate	3
	Estimation of mixture (Any two exercises):	
17	a. Sodium hydroxide and sodium carbonate	3
18	b. Boric acid and Borax	3
19	c. Oxalic acid and sodium oxalate	3
	Test for identity (Any three exercises) :	
20	a. Sodium bicarbonate	3
21	b. Barium sulphate	3
22	c. Ferrous sulphate	3
23	d. Potassium chloride	3
	Test for purity:	
24	a. Swelling power in Bentonite	3
25	b. Acid neutralising capacity in aluminium hydroxide gel	3
26	c. Ammonium salts in potash alum	3
27	d. Adsorption power heavy Kaolin	3
28	e. Presence of Iodates in KI	3
	Synthesis of following Inorganic Compounds :	
29	a. Boric acid	3
30	b. Potash alum	3
31	c. Calcium lactate	3
32	d. Magnesium sulphate	3

TEXT BOOKS: (Latest Editions)

1. Laboratory Handbook of Instrumental Drug Analysis (also appears as Laboratory Instrumental Drug Analysis) by B. G. Nagavi ,Publisher: Vallabh Prakashan.

2. Bayya Subba Rao, Alagarsamy V. Practical Pharmaceutical Inorganic Chemistry. Hyderabad: Pharma Med Press.
3. Dash AK. The Theory and Practical Book of Pharmaceutical Inorganic Chemistry for B.Pharm 1st Semester Students. New Delhi: IP Innovative Publications.
4. Dash B, Debnath B, Lalhriatpuii TC, Dkhar P, Kalita R, Yadav P. A Practical Book of Pharmaceutical Inorganic Chemistry (As per PCI Syllabus, B.Pharm 1st Semester). Odisha: Booksclinic Publishing.

REFERENCE BOOKS: (Latest Editions)

1. Beckett AH, Stenlake JB. Practical pharmaceutical chemistry. 4th ed. (Parts I & II, revised, reprint). New Delhi: CBS Publishers & Distributors.
2. Mendham J, Denney RC, Barnes JD, Thomas M. Vogel's Textbook of Quantitative Chemical Analysis. Pearson Education.
3. Indian Pharmacopoeia (IP). Indian Pharmacopoeia Commission, Ghaziabad.
4. British Pharmacopoeia (BP). The Stationery Office, London; effective.
5. United States Pharmacopeia – National Formulary Issue 1. United States Pharmacopeial Convention, Rockville.
6. Alexeyev, V. N. Quantitative Analysis. New Delhi: CBS Publishers & Distributors.

SULTAN-UL-ULOOM COLLEGE OF PHARMACY, HYDERABAD

SUBJECT: 1.6 REMEDIAL MATHEMATICS

(THEORY 90 HOURS)

Teaching Scheme
Lectures: 03 Hr/Week

Examination Scheme:
Internal Exam: 30 Marks
External Exam: 70 Marks
Total Marks: 100 Marks

Scope:
This introductory mathematics course provides fundamental quantitative tools essential for understanding and applying scientific concepts in pharmacy and clinical practice

Course Objectives:

- To develop a basic understanding of mathematical concepts used in pharmaceutical calculations.
- To introduce logarithms and their applications in pharmaceutical concentration and pH-related calculations.
- To build foundational skills in differentiation and integration for use in pharmacokinetic modelling and clinical trials.
- To strengthen analytical thinking, quantitative reasoning, and data organization in clinical trials and hospital management.

Course Outcomes: Upon completion of the course, a learner shall be able to

CO 1. Understand and apply fundamental concepts of numbers, arithmetic operations, fractions, decimals, HCF, and LCM to solve quantitative problems in pharmaceutical calculations.
CO 2. Understand and apply the fundamentals of trigonometry, including measurement of angles and trigonometric identities, to solve problems in pharmaceutical sciences.
CO 3. Identify types of matrices and perform basic matrix operations useful in data organization, apply determinant and matrix inverse methods to solve linear equations.
CO 4. Use logarithmic properties for simplifying complex pharmaceutical data and concentration calculations.
CO 5. Apply logarithmic and antilogarithmic principles to compute pH values and related biochemical parameters in drug formulations.
CO 6. Evaluate derivatives using standard rules to understand rate-based changes in pharmacokinetic and pharmacodynamics models.
CO 7. Perform derivative operations (sum, difference, product) for interpreting dose-response and rate equations in clinical settings.
CO 8. Apply basic integration techniques to determine cumulative quantities such as total drug absorption or concentration over time.

COURSE CONTENTS

Unit	Topics	Duration (Hrs.)
1	**Numbers & Arithmetic:** Integer numbers and whole numbers, Fractions and Decimals. Arithmetic Operations: Addition, Subtraction, Multiplication, and Division, Highest Common Factor(HCF), and Least Common Multiple(LCM).	11
2	**Trigonometry:** Measurement of angles, Trigonometric identities.	12
3	**Matrices:** Introduction to matrices, Types of matrices, Operations on matrices, Transpose of a matrix, Matrix multiplication, Singular and Non-Singular matrices. Inverse method of a matrix for solving simultaneous Equations.	12
4	**Logarithms:** Introduction, Definition, Theorems/Properties of Logarithms, Common Logarithms, Characteristic and Mantissa, Worked Examples.	11
5	**Applications of Logarithms:** Simple Applications of pH value-related problems in Pharmaceutical Sciences and Antilogarithms.	11
6	**Differentiation:** Introduction, properties of derivatives, finding the derivative of a function using Standard Derivatives.	11
7	**Operations on Derivatives:** Derivative of the sum or difference of two functions, Derivative of the product of two functions (Addition, Subtraction, and Multiplication by using Standard formulae).	11
8	**Integration:** Introduction, Definition, Standard formulae, Simple problems.	11

TEXT BOOKS: (Latest Editions)

1. Intermediate Telugu Academy Mathematics Textbooks.
2. A Text Book of Remedial Mathematics by P Seshagiri Rao, Pharmamed Press.

REFERENCE BOOKS: (Latest Editions)

1. Integral Calculus by Shanthinarayan
2. Higher Engineering Mathematics by Dr.B.S. Grewal.
3. Differential Calculus by Shantinarayan
4. Textbook of Mathematics by Prof.B.M. Srinivas.
5. Quantitative Aptitude by RS Aggarwal

SULTAN-UL-ULOOM COLLEGE OF PHARMACY, HYDERABAD

SUBJECT: 1.6 REMEDIAL BIOLOGY

(THEORY 90 HOURS)

Teaching Scheme
Lectures: 03 hrs/Week

Examination Scheme:
Internal Exam: 30 Marks
External Exam: 70 Marks
Total Marks: 100 Marks

Scope: To learn and understand the components of living world, structure and functional system of plant and animal kingdom.

Course Objectives: Upon completion of the course, the student shall be able to know the classification and salient features of five kingdoms of life understand the basic components of anatomy & physiology of plant understand the basic components of animal kingdom.

Course Outcomes: Upon completion of the course student shall be able to

CO 1. Describe the living world, classification, nomenclature and their salient features.
CO 2. Understand morphology of different parts of flowering plants and general anatomy of root, stem, leaf and their modifications. Taxonomy of Umbelliferae and Solanaceae
CO 3. Understand the role of mineral nutrition and nitrogen metabolism in plant growth and development.
CO 4. Describe the energy conversion process through photosynthesis and respiration.
CO 5. Understand the phases, conditions and regulators of plant growth.
CO 6. Deepen insight into cell division and animal tissues.
CO 7. Differentiate vertebrate classes and explain arthropods' roles as disease vectors and causative agents.
CO 8. Enhance comprehension on organization of mammals and poisonous animals.

COURSE CONTENTS

Unit	Topics	Duration (Hrs)
1	**Living world:** • Definition and characters of living organisms • Diversity in the living world • Binomial nomenclature • Five kingdoms of life on the basis of classification: Salient features of monera, protista, fungi, Animalia, plantae and virus.	12
2	**Morphology of Flowering plants:** • Morphology of different parts of flowering plants – Root, stem, inflorescence, flower, leaf, fruit, seed. • Modifications of root, stem and leaf. • General Anatomy of root, stem, leaf of monocotyledons and dicotyledons. • Taxonomy of Umbelliferae and Solanaceae.	12
3	**Plants and Mineral Nutrition:** • Essential minerals, macro and micronutrients • Nitrogen metabolism, nitrogen cycle, biological nitrogen fixation.	11
4	**Photosynthesis:** Autotrophic nutrition, photosynthesis, photosynthetic pigments, factors affecting photosynthesis. **Plant Respiration:** Respiration, glycolysis, fermentation (anaerobic).	11
5	**Plant Growth and Development:** Phases and rate of plant growth, conditions of growth, introduction to plant growth regulators.	11
6	**Animal Kingdom:** • Cell - The structural and functional unit of life: Structure and functions of cell and cell division • Tissues: Definition, types, location and functions of animal tissues.	11
7	**Study of types of:** Pisces, Reptiles & Aves. Study of Arthropods (characters and diseases transmitted through Mosquitoes and itch mite)	11
8	**General organization of mammals.** **Study of poisonous animals.**	11

TEXT BOOKS: (Latest Editions)

1. S. B. Gokhale, Dr.C.K.Kokate, Dr.D.S.Bidarkar, Pharmaceutical Biology, (Remedial Biology), Nirali Prakashan**.**
2. Dr. Thulajappa and Dr. Seetaram, A Text book of Biology, Excellent educational enterprise.

REFERENCE BOOKS: (Latest Editions)

1. Naidu and Murthy, A Text book of Biology, Prakasha Sahitya Publishers, Bangalore.
2. A.C. Dutta, Botany for Degree students, OUP India.
3. M. Ekambaranatha Ayyer and T. N. Anantha Krishnan, Outlines of Zoology, S.Viswanathan publishers.
4. Dr.O.P.Sharma and Rahul Sharma, A text book of Remedial Biology, Birla Publications Pvt. Ltd.

SULTAN-UL-ULOOM COLLEGE OF PHARMACY, HYDERABAD

SUBJECT: 1.6 REMEDIAL BIOLOGY

(PRACTICAL 90 HOURS)

Teaching Scheme
Practical: 03 hrs / Week

Examination Scheme:
Internal Exam: 20 Marks
External Exam: 70 Marks
Continuous Assessment: 10 Marks
Total Marks: 100 Marks

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 introduced 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 Outcomes: Upon completion of the course a learner shall be able to

CO 1. Get knowledge on instruments used in experimental biology and its operation.

CO 2. Students will acquire skills in microscopy and slide preparation.

CO 3. Grasp knowledge on different cellular compositions and its importance in living organisms (Plants & Animals).

CO 4. Understand the structure, modifications and functions of plant parts and identify them.

CO 5. Identify and study the tissues of selected medicinal plants microscopically.

CO 6. Observe and understand the stages of cell division using permanent slides.

CO 7. Gain practical insight into basic plant physiological processes.

CO 8. Identify animals, enhance understanding of biological concepts through computer-based tutorials.

COURSE CONTENTS

Expt. No.	Title of the Experiment	Duration (Hrs)
1.	Introduction to experiments in biology a. Study of microscope b. Section cutting techniques c. Mounting and staining d. Permanent slide preparation	15
2.	Study of plant cell and its inclusions	9
3.	Study of stem modifications	3
4.	Study of root modifications	3
5.	Study of leaf modification	3
6.	Study of flowers	3
7.	Identification of fruits and seeds	6
8.	Microscopic study and identification of tissues: T.S of Senna, Cassia, Ephedra, Podophyllum	15
9.	Microscopic study of cell division through permanent slides	6
10.	Simple plant physiology experiments	9
11.	Identification of animals	6
12.	Computer based tutorials	12

TEXT BOOKS: (Latest Editions)

1. A Manual of pharmaceutical biology practical, S.B. Gokhale, C.K. Kokate and S.P. Shrivastava, Nirali Prakashan.

REFERENCE BOOKS: (Latest Editions)

1. Biology practical manual according to national core curriculum. Biology forum of Karnataka, Prof. M. J. H. Shafi.
2. Practical Botany manual, S.R.K. Prasad, N.Sarath Chandra Naidu and Ch.Anjaneyulu, Vikram modern series, Vijayawada.

APPENDIX-C
(See regulation 16)
INTERNSHIP

1) **SPECIFIC OBJECTIVES :**

i) to provide patient care in cooperation with patients, prescribers, and other members of an interprofessional health care team based upon sound therapeutic principles and evidence-based data, taking into account relevant legal, ethical, social cultural, economic, and professional issues, emerging technologies, and evolving biomedical, pharmaceutical, social or behavioral or administrative, and clinical sciences that may impact therapeutic outcomes.

ii) to manage and use resources of the health care system, in cooperation with patients, prescribers, other health care providers, and administrative and supportive personnel, to promote health; to provide, assess, and coordinate safe, accurate, and time-sensitive medication distribution; and to improve therapeutic outcomes of medication use.

iii) to promote health improvement, wellness, and disease prevention in co-operation with patients, communities, at-risk population, and other members of an interprofessional team of health care providers.

iv) to demonstrate skills in monitoring of the National Health Programmes and schemes, oriented to provide preventive and promotive health care services to the community.

v) to develop leadership qualities to function effectively as a member of the health care team organised to deliver the health and family welfare services in existing socio-economic, political and cultural environment.

vi) to communicate effectively with patients and the community.

2) **OTHER DETAILS :**

i) All parts of the internship shall be done, as far as possible, in institutions in India. In case of any difficulties, the matter may be referred to the Pharmacy Council of India to be considered on merits.

ii) Where an intern is posted to district hospital for training, there shall be a committee consisting of representatives of the college or university, and the district hospital administration, who shall regulate the training of such trainee. For such trainee a certificate of satisfactory completion of training shall be obtained from the relevant administrative authorities which shall be countersigned by the Principal or Dean of College.

iii) Every candidate shall be required, after passing the final Pharm.D. or Pharm.D. (Post Baccalaureate) examination as the case may be to undergo compulsory rotational internship to the satisfaction of the College authorities and University concerned for a period of twelve months so as to be eligible for the award of the degree of Pharm.D. or Pharm.D. (Post Baccalaureate) as the case may be.

3. ASSESSMENT OF INTERNSHIP :

i) The intern shall maintain a record of work which is to be verified and certified by the preceptor (teacher practioner) under whom he works. Apart from scrutiny of the record of work, assessment and evaluation of training shall be undertaken by an objective approach using situation tests in knowledge, skills and attitude during and at the end of the training. Based on the record of work and date of evaluation, the Dean or Principal shall issue certificate of satisfactory completion of training, following which the university shall award the degree or declare him eligible for it.

ii) Satisfactory completion of internship shall be determined on the basis of the following:-

(1) Proficiency of knowledge required for each case management SCORE 0-5

(2) The competency in skills expected for providing Clinical Pharmacy Services SCORE 0-5

(3) Responsibility, punctuality, work up of case, involvement in patient care SCORE 0-5

(4) Ability to work in a team (Behavior with other healthcare professionals including medical doctors, nursing staff and colleagues). SCORE 0-5

(5) Initiative, participation in discussions, research aptitude. SCORE 0-5

Poor	Fair	Below Average	Average	Above Average	Excellent
0	1	2	3	4	5

A Score of less than 3 in any of above items will represent unsatisfactory completion of internship.

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.

(ARCHNA MUDGAL)
Registrar-cum-Secretary
Pharmacy Council of India
New Delhi – 110002